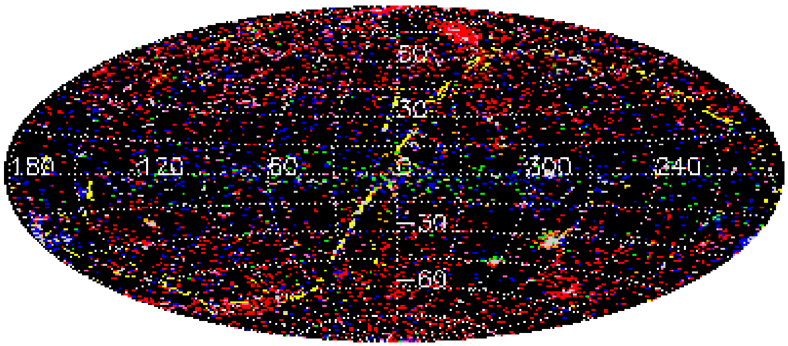
HST Hubble Space Telescope

Hubble Space Telescope (HST) is an orbiting astronomical observatory operating from the near-infrared into the ultraviolet. Launched in 1990 and scheduled to operate through 2010, HST carries and has carried a wide variety of instruments producing imaging, spectrographic, astrometric, and photometric data through both pointed and parallel observing programs. MAST is the primary archive and distribution center for HST data, distributing science, calibration, and engineering data to HST users and the astronomical community at large. Over 100 000 observations of more than 20 000 targets are available for retrieval from the Archive.



Map of HST Observations

archive@stsci.edu

Modified: Jan 29, 2002
9:29

MAST Multimission Archive at Space Telescope

The Multimission Archive at STScI supports a variety of astronomical data archives, with the primary focus on scientifically related data sets in the optical, ultraviolet, and near-infrared parts of the spectrum. MAST provides search tools and retrieval support for the following missions:

Missions				Catalogs & Surveys
HST	ASTRO	ORFEUS	Copernicus	SDSS
FUSE	HUT	BEFS	ROSAT	GSC
IUE	UIT	IMAPS		DSS
EUVE	WUPPE	TUES		VLA-FIRST

Cross-correlation Target Search and/or Mission Search

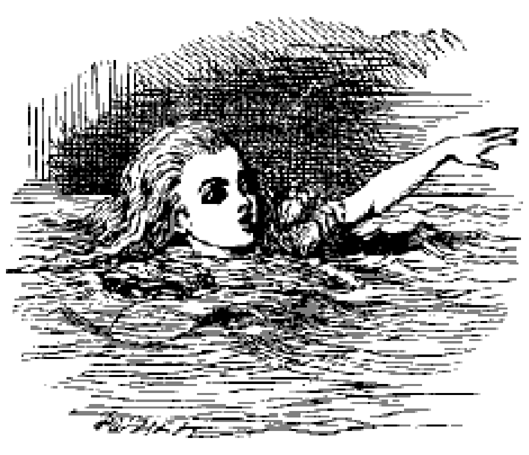
Enter Target name (or Coordinates):
Resolver: SIMBAD NED

and/or Data Type(s):

	X-Ray	Extreme UV	Far UV	Near UV	Optical	Near IR	Radio
Images	☐	☐	☐	☐	☐	☐	☐
Spectra	☐	☐	☐	☐	☐	☐	
Other			☐	☐	☐	☐	

Search Reset Help

MAST Contacts for Help



The Archive Hotseat is available Monday through Friday, 9:00 AM to 5:00 PM Eastern to answer questions about the Archive.

For assistance with the archive, send E-mail to: ***archive@stsci.edu***

For questions about HST data analysis, send E-Mail to: ***help@stsci.edu***

For questions about IUE, Copernicus and EUVE data analysis, send E-Mail to: ***archive@stsci.edu***

E-mail may also be sent to individual ***staff members***.

Archive, Catalog, & Data Services Division
Space Telescope Science Institute,
3700 San Martin Drive
Baltimore MD 21218
410-338-4547

Links to Mission Pages

Active Missions / Projects

HST	**FUSE**

Legacy Missions

IUE	**EUVE**	**Copernicus**	**ROSAT**
ASTRO -->	**HUT**	**UIT**	**WUPPE**
ORFEUS -->	**BEFS**	**IMAPS**	**TUES**

Catalogs & Surveys

DSS	**VLA-FIRST**	**GSC**	**SDSS**

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IRSA
NED
NSSDC
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Links to Mission Search Pages

Active Missions / Projects

HST Web Search	**FUSE (Science)**
STARVIEW	**FUSE (Exposures)**

Legacy Missions

IUE	**EUVE**	**Copernicus Raw** **Copernicus Co-add**	**ROSAT**
ASTRO -->	**HUT**	**UIT**	**WUPPE**
ORFEUS -->	**BEFS**	**IMAPS**	**TUES**

Catalogs & Surveys

DSS	**VLA-FIRST**	**GSC II**	**SDSS MAST Simple Form** **SDSS Query Tool/Advanced**

Cross Mission Searches

Search across missions for single target

List and display representative spectra/images from MAST archive for a single target. (Scrapbook)

Search across missions cross-correlated with catalogs

MAST Index Search Page

Search for: [ ] Submit Options

This page allows users to search for words or phrases in the on-line MAST WEB pages. Enter the desired search string above and either press return or click on "submit". Phrases should be enclosed in double quotes or hyphenated.

If you get too many hits, try:

- entering more keywords,
- changing the proximity control if your keywords should appear together, or
- excluding terms by preceeding them with a minus sign.

If you get too few hits, try fewer keywords, and check your spelling.

About MAST

The **M**ultimission **A**rchive at **ST**ScI supports a variety of astronomical data archives, with the primary focus on scientifically related data sets in the optical, ultraviolet, and near-infrared parts of the spectrum. MAST is a component of NASA's distributed Space Science Data Services (SSDS).

MAST provides a **Cross Correlation Search** tool, enabling users to search all the MAST missions for data with one of the catalogs provided by MAST or a customized catalog provided by the user. Users may also do a "**quick search**" of the MAST holdings for a single object. Search pages for each individual mission are also provided. You may also look at the **Image/Spectral Scrapbook** to see representative images or spectra for a single target.

Preview images/spectra are available for most of the images, allowing users to more easily select the most useful data for their project.

MAST distributes data in a variety of different ways. HST and FUSE data, stored on the DADS optical disk system, are requested and staged either to the users disk or to an anonymous ftp area on this server. (The latter option is available only for non-proprietary data). Other datasets held by MAST are stored on CD in a pair of jukeboxes. Users may select desired data from the search results page and download the data directly to disk via their browsers. Alternatively, some data are available via anonymous ftp on this server.

MAST currently holds or provides links to archival data for the following missions or projects:

- Hubble Space Telescope (HST)
- Far Ultraviolet Spectroscopic Explorer (FUSE)
- International Ultraviolet Explorer (IUE)
- Extreme Ultraviolet Explorer (EUVE)
- ASTRO Missions
  - Hopkins Ultraviolet Telescope (HUT)
  - Ultraviolet Imaging Telescope (UIT)
  - Wisconsin Ultraviolet Photo Polarimetry Experiment (WUPPE)
- Copernicus (OAO-3)
- Orbiting and Retrieval Far and Extreme Ultraviolet Spectrograph (ORFEUS) missions.
  - Berkeley Extreme and Far-UV Spectrometer (BEFS)
  - Interstellar Medium Absorption Profile Spectrograph(IMAPS) (first flight)
  - Tübingen Echelle Spectrograph (TUES)
- Digitized Sky Survey (DSS) & Guide Star Catalog II (GSCII)
- Sloan Digital Sky Survey (SDSS)
- FIRST (VLA radio data)
- Roentgen Satellite (ROSAT)

Although there is no cost involved in retrieving data from MAST, researchers are requested to include an acknowledgement (as shown below) in their publications.

> "Some/all of the data presented in this paper was obtained from the Multimission Archive at the Space Telescope Science Institute (MAST). STScI is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555. Support for MAST for non-HST data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contracts."

Cross-Mission Search Tools

The forms listed below offer a variety of cross-mission search options using either positions extracted from online catalogs, or user-specified target names or positions. Submitting any of the forms will return a table of entries listing the data available from the MAST archive for the target or targets of interest. The "MAST Scrapbook" form will return a table of representative data sets as well as a set of thumbnail images displaying either a plot of the spectrum or the image.

Form	Help	Description
MAST Scrapbook		Lists and displays representative spectra or images from the MAST archive based on user-specified target name or coordinates.
Single Target quick search		Cross-correlation search based on user-specified target name or coordinates.
Hipparcos Catalog		Make cuts on the Hipparcos Catalog and cross-correlate them with MAST's holdings.
SKY2000 Catalog		Query the SKY2000 Catalog (version 3) and cross-correlate results with MAST's holdings.
Active Galactic Nuclei		Make cuts on our catalog of AGN, derived from the Veron-Cetty and Veron (1996) catalog, and cross-correlate them with MAST's holdings.
Abell Galaxy Clusters		Make cuts on the Abell Galaxy Clusters catalog (including the supplementary southern catalog), and cross-correlate them with MAST's holdings.
User-Supplied Catalog		Upload your own list of equatorial sky positions to cross-correlate with MAST's holdings.

MAST Scrapbook

Search the MAST catalog of representative spectra or images for an astronomical object. Enter a target name or coordinates (see help for other options). Only fixed targets (i.e., no solar system objects) are available. A table of results will be displayed along with thumbnails of images or spectra.

Target: [ ] Data Type : (•) Spectra ( ) Images

Search Criteria: [Coordinates]

Name Resolver : (ignored for mission target name search) [SIMBAD]

Search Radius (arcmin): (coordinate search only) [3.0] Max thumbnails per mission: [10]

[Submit Query] [Reset] Help

What's New for MAST during last 6 months

WUPPE Added to MAST Scrapbook
2002 March 15
Representative spectra from the ASTRO WUPPE mission have been added to the MAST scrapbook available at http://archive.stsci.edu/scrapbook.html

New WUPPE Preview Files
2002 February 28
The WUPPE Preview files have been updated following the format adopted for the other MAST missions. Besides a plot showing flux, polarization, and polarization position angle as a function of wavelength, there are now links to display the FITS header, display the ASCII table file, display/customize a plot of flux versus wavelength, and download data in FITS format. Links to known literature references are also displayed.

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Larger Staging area for HST and FUSE data
2002 February 27
The staging area for HST and FUSE data retrieved with the HOST option has been significantly increased to around 500 GB from 27GB.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

Coplotting Option now available for IUE Spectra
2001 December 10
A new option is available on the search results page of the IUE search script which allows users to coplot up to 15 selected IUE spectra and interactively rescale the resulting plot.

New Interface for SDSS EDR Quasar Data
2001 December 3
A web-based search and spectra retrieval interface for the SDSS EDR Quasar catalog and spectra, is now available at http://archive.stsci.edu/sdss/quasars/. The interface is based on a generic MAST interface we are developing and comments and suggestions, as always, are welcome at archive@stsci.edu.

Magellanic Cloud Planetary Nebulae Data Sets now Available
2001 November 15
HST prepared datasets of the Magellanic Cloud Planetary Nebulae are now available.

HST Literature Links Update
2001 November 13
The HST reference database table entries (and ADS data links) are now complete through the first half of this year.

EUVE Previews Updated
2001 October 24
Preview files were made available for the last 83 EUVE observations obtained in 2000 and 2001.

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Exposure time searches offered for WFPC2 Pointings
2001 September 27
The WFPC2 Pointings search form now allows searches to be performed on total exposure times. See the pointings help page for more information.

OTFR Implemented for NICMOS Data
2001 September 26
As of today, all requests for archived NICMOS data will utilize the On-the-fly Reprocessing (OTFR) system.

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Frequently Asked Questions

Data

- ***What type of data are supported by MAST?***
  The Multimission Archive at STScI supports:
  - The Hubble Data Archive (HDA), which contains spectroscopic (1,100 - 11,000 Angstroms range; slitless spectroscopy up to 2.5 microns with NIC3) and imaging (1,150 - 25,000 Angstroms) data taken with Hubble Space Telescope. As of August 1998, the HDA contains over 5.2 Tbytes of science and engineering data, for a total of approximately 150,000 science exposures.
  - The Far Ultraviolet Exporer (FUSE) covers the 905-1187 Å spectral region. This active mission contains high resolution spectra of hot and cool stars, AGNs, supernova remnants, planetary nebulae, solar system objects and the interstellar medium.
  - The International Ultraviolet Explorer (IUE) Final Archive, which contains over 104,000 spectra of approximately 10,000 individual astronomical sources (covering the 1,200 - 3,350 Angstroms range).
  - The Extreme Ultraviolet Explorer (EUVE) Archive, which at present contains spectroscopic observations (in the 70 - 760 Angstroms range) of about 300 sources, mostly Galactic.
  - The Hopkins Ultraviolet Telescope (HUT) Archive, which contains 106 spectrophotometric observations of 77 targets were obtained in the far-UV (i.e., 912-1850 Å) at a resolution of ~3 Å. These were obtained during the first ASTRO mission. An additional 385 observations of 265 targets were obtained during the ASTRO-2 missions.
  - The Ultraviolet Imaging Telescope (UIT) Archive, which contains 1,579 images of 259 targets (covering the 1,200 - 3,300 Å range) obtained by UIT as part of the ASTRO-1 and ASTRO-2 missions.
  - The Wisconsin Ultraviolet Photopolarimeter Experiment (WUPPE) Archive, which contains 467 observations of 169 objects. WUPPE obtained simultaneous spectral and polarization measurements from 1400 to 3300 Å during the ASTRO-1 and ASTRO-2 missions.
  - The Copernicus Archive, which includes far- (900 - 1,560 Angstroms) and near- (1,650 - 3,150 Angstroms) ultraviolet spectra of 551 objects, primarily bright stars.
  - The Berkeley Extreme and Far-UV Spectrometer (BEFS), flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS I and II space shuttle missions in 1993 and 1996, returning high-resolution (/3000) FUV spectra (900-1200 Å) of 75 astrophysical objects from the first flight and more than 100 from the second. EUV spectra (400-900 Å) were obtained for a subset of these targets.
  - The The Interstellar Medium Absorption Profile Spectrograph (IMAPS) obtained high resolution (R=75,000 for IMAPS-1) objective-grating echelle spectra of hot stars, over the spectral region 950-1150 Å. The IMAPS archive currently contains roughly 600 spectral images of 10 hot stars from the first shuttle flight. Once the proprietary period ends for the second IMAPS mission, the archive will include an additional 3,900 spectral images of 29 stars
  - The Tübingen Ultraviolet Echelle Spectrometer (TUES) flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS II space shuttle mission in 1996, returning spectra in the 900 Å to 1400 Å wavelength range. The instrument was designed to achieve a spectral resolution of $\lambda/\Delta\lambda$=10000 when used with an entrance aperture of 10" diameter. During the 17.7 day flight, TUES returned 239 spectra of 62 targets.
  - The Digitized Sky Survey (DSS). The Catalogs and Surveys Branch of the STScI has been digitizing the photographic Sky Survey plates from the Palomar and UK Schmidt telescopes in order to support HST operations and provide a service to the astronomical community. Archive users can easily retrieve image data for any part of the sky.
  - The The Guide Star Catalog I (GSC I) is an all-sky optical catalog of positions and magnitudes of approximately 19 million stars and other objects in the 6th to 15th magnitude range. The GSC II is an all-sky catalog of approximately 2 billion stars and galaxies containing positions, magnitudes, colors and proper motions complete to a minimum of V =18.
  - The Sloan Digital Sky Survey (SDSS) is using a dedicated 2.5 m telescope and a large format CCD camera to obtain images of over 10,000 square degrees of high Galactic latitude sky in five broad bands (u', g', r', i' and z', centered at 3540, 4770, 6230, 7630, and 9130 Å, respectively). The first data release, planned for June 2001, includes: imaging data containing a searchable catalog, images in several formats (FITS and JPEG), and spectra in both FITS format and GIF spectra with line identifications. This first public data release will contain over 500 square degrees of sky.
  - The Faint Images of the Radio Sky at Twenty-centimeters (FIRST) Archive. The FIRST project is designed to produce a radio survey at 20 cm (1.4 GHz) of over 10,000 square degrees down to a flux of 1 mJy. MAST provides access to the radio images and the source catalog, which currently includes about 437,000 entries.
  - The ROSAT, the RÖntgen SATellite, was an X-ray observatory developed through a cooperative program between Germany, the United States, and the United Kingdom. ROSAT data is maintained and archived at HEASARC. Except for the search and acknowledgments pages, all images and linked pages are provided by HEASARC.

- ***How do I search MAST?***
  Every single archive can be searched using its search page. Links to the Web pages of the various archives included in MAST are available from the MAST main page. Moreover, for users wanting to search more than one archive at the same time, two interfaces are provided:
  - From the MAST main page one can conduct a quick search by typing the name of a target to see if any of the MAST supported archives have observations of this target.
  - The MAST Cross Correlation page provides a facility to allow the user to cross-correlate lists of positions with data in our archives. You can compile lists externally or use one of our online catalogs.

- ***How can I retrieve MAST data?***
  All MAST data can be retrieved from the appropriate Web pages. HST, FIRST, and DSS data can also be retrieved using StarView.

Documentation

- ***Are there manuals available for the MAST Archives?***
  Yes. You can get them here:
  - The HDA Manual
  - IUE Reduction/Analysis Documentation
  - IUE Instrumentation/Operations Documentation
  - IUE Project Publications
  - EUVE Project Publications
  - Copernicus Reduction/Analysis Documentation
  - Copernicus Instrumentation and Operations Documentation
  - UIT Publications
  - WUPPE Instrumentation and Operations Documentation
  - HUT Instrumentation and Operations Documentation

- ***Is there a MAST Newsletter?***
  Yes. It is sent out electronically to a distribution list. You can also read it on-line. If you would like to subscribe to the mailing list, please send e-mail to archive_news-request@stsci.edu and put the single word SUBSCRIBE in the BODY of the message.

More FAQ

- ***Can I find FAQ's for individual missions?***
  More FAQ for the single archives are available on the following pages:
  - HDA FAQ Page
  - IUE FAQ Page
  - Copernicus FAQ Page
  - EUVE FAQ Page
  - FUSE FAQ Page
  - BEFS FAQ Page
  - TUES FAQ Page
  - GSC FAQ Page
  - HUT FAQ Page
  - UIT FAQ Page
  - WUPPE FAQ Page
  - DSS FAQ Page

User Support

- ***What level of support is provided for the various missions?***
  Assistance is available for users of the various data included in MAST, although at different levels. Namely:
  - Full support for HST data analysis.
  - Full support for IUE data analysis (except for enhancement of post-pipeline data products).
  - Moderate support for EUVE data analysis.
  - Limited support for DSS, Copernicus, UIT, HUT, and WUPPE data analysis.

  Questions about HST data analysis should be sent to help@stsci.edu.

  Questions about IUE, EUVE, Copernicus, and UIT data analysis should be sent to archive@stsci.edu.

MAST Prepared Science Products

The following is a listing of sites of highly processed datasets from missions supported by MAST. These are datasets consisting of atlases, images, and/or the data themselves which have been placed on the web either as final data products or as appendices referenced in recent published papers. These data are in the public domain and/or will soon be published. The datasets are organized by type of observation (survey, individual objects, time series) and will include a growing number of catalogs with links to the data and in some cases spectra and/or images.

Deep Sky Surveys

- Hubble Deep Field
- Hubble Deep Field South
- Medium Deep Survey

Wide Field Survey Catalogs

- Magellanic Clouds Planetary Nebulae (HST)
- SDSS Quasar Catalog

Spectral Atlases: multi-object samples

- Ultraviolet Spectral Atlas of Standard Stars (IUE)
- Library of Copernicus Atlases of Selected Stars
- Far-Ultraviolet Spectral Atlas of Stars (EUVE)
- Library of IUE NEWSIPS SWP Echelle Spectra for White Dwarfs
- FOS Composite Quasar Spectrum (FOS)

Spectral Atlases: individual objects

- High S/N GHRS LSA G160M Observations of 10 Lacertae (HST)
- High S/N GHRS SSA Echelle Observations of chi Lupi (HST)
- High S/N GHRS SSA Observations of Chromospheric lines in Procyon (HST)
- High S/N GHRS LSA G270M Observations of alpha Ori (HST)

Time-Dependent Spectra

- Grayscale of Time Variations of gamma Cas near SiIV Doublet (HST)

Guidelines for authors of new prepared science products

For further information see: VizieR astronomical catalogs

Data Analysis Software

Some of the data analysis software packages used for the MAST archived data are:

- Space Telescope Science Data Analysis System (STSDAS)
- IUE Data Analysis Center software package (in IDL)
- IRAF/STSDAS tools for IUE data analysis
- EUVE IRAF software package available from STScI
- HUT IRAF data reduction package links

Information on these and other available astronomical data reduction and analysis software packages may be found at the Astronomical Software and Documentation Service.

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Flexible Image Transport System (FITS)

The astronomical community has adopted the **Flexible Image Transport System** (i.e. **FITS**) format as the default standard for the exchange of data between institutions. The FITS file format is platform independent, supported by many institutions, and endorsed by both NASA and the IAU. For these reasons FITS is the recommended file format for archiving data at STScI. A description of the MAST data format recommendations can be found in the **MAST Data Format Guidelines** document.

For the official description of the FITS format, see the **FITS Standard Document**.

The **FITS User's Guide** provides examples, infomation on the history of FITS as well as a thorough description of the format.

Related Sites

NASA Data Archive Centers

- High Energy Astrophysics Science Archive Research Center (HEASARC)
- Infrared Science Archive (IRSA)
- Astronomy & Astrophysics at the National Space Science Data Center (NSSDC)
- Astrophysics Data Facility (NASA/GSFC)

Other Data Archive Centers

- Canadian Astronomy Data Centre (CADC)
- Space Telescope European Coordinating Facility (ST-ECF)
- ST-ECF/ESO Science Archive Facility
- LEDAS - the Leicester Database and Archive Service
- NAOJ - National Astronomical Observatory of Japan

Integrating Services

- The NASA Astrophysics Data System
- Centre de Donnees astronomiques de Strasbourg (CDS)
- NASA/IPAC Extragalactic Database (NED)
- Astronomical Data Center (NASA/GSFC)
- Astronomical Software and Documentation Service

Mission Sites (past, present & related)

- Chandra X-ray Observatory (AXAF)
- Space Telescope Science Institute (STScI)
- Far Ultraviolet Spectroscopic Explorer (FUSE)
- OGLE (Princeton Site)
- GSFC Laboratory for Astronomy and Astrophysics (LASP)
- VILSPA (IUE)
- INES (IUE) STScI Server, software & data provided by VILSPA
- RAL Astrophysics STARLINK
- Ultraviolet Imaging Telescope (UIT)
- Hopkins Ultraviolet Telescope (HUT)
- Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE)
- Extreme Ultraviolet Explorer (EUVE)
- Infrared Space Observatory (ISO)
- BeppoSAX Mission
- Space Telescope European Coordination Facility
- Energetic Gamma Ray Experiment Telescope (EGRET)
- ORFEUS - BEFS (also known as Berkeley Spectrometer and EUV instrument)
- ORFEUS - FUV at Tübingen
- ORFEUS-SPAS II project page at GSFC

Future Missions

- Next Generation Space Telescope (NGST)
- Galaxy Evolution Explorer (GALEX)
- Cosmic Hot Interstellar Plasma Spectrometer (CHIPS)
- Kepler Mission

Organizations

- National Aeronautics and Space Adminstration (NASA)
- European Space Agency (ESA)
- Space Science Data System (SSDS)
- Astrophysics Data Centers Coordination Council (ADCCC)

Acknowledgments

The MAST staff wishes to acknowledge the work that other groups and projects have done and allowed us to use. Thank you to:

- Canadian Astronomy Data Centre (CADC) for the HST preview images
- NASA's Goddard Space Flight Center (GSFC) Astrophysics Data Facility (ADF) staff for access to the IUE and UIT browse images, and copies of the IUE, UIT, WUPPE, and HUT datasets. ADF staff members provided background information and documentation about these datasets. Special thanks to the WISARD group for a copy of their UIT databases.
- GSFC's Laboratory for Astronomy and Solar Physics (LASP) IUE Project for the IUE Documentation, the IUEDAC web pages, the IUEDAC software package, and the initial copy of the database.
- EUVE Project for initial copy of the EUVE database and various web pages.
- WUPPE , UIT , and HUT projects for additional information, documentation, and data.
- High Energy Astrophysics Science Archive Research Center (HEASARC) for access to the on-line copies of the EUVE data
- Dr. George Sonneborn and other members of the GSFC LASP for the Copernicus data, database, and associated web pages.

We would also like to request that users acknowledge the use of data obtained from MAST in their publications. An example acknowledgment is shown below.

> "Some/all of the data presented in this paper were obtained from the Multimission Archive at the Space Telescope Science Institute (MAST). STScI is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555. Support for MAST for non-HST data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contracts."

Users wishing to use documents obtained from the MAST web site for other than personal use, should first contact the MAST staff at archive@stsci.edu regarding neccessary permissions and acknowledgements.

MAST Index Search Page

Search for: [ ] Submit Options

This page allows users to search for words or phrases in the on-line MAST WEB pages. Enter the desired search string above and either press return or click on "submit". Phrases should be enclosed in double quotes or hyphenated.

If you get too many hits, try:

- entering more keywords,
- changing the proximity control if your keywords should appear together, or
- excluding terms by preceeding them with a minus sign.

If you get too few hits, try fewer keywords, and check your spelling.

FUSE Far Ultraviolet Spectroscopic Explorer

FUSE Target Search
FUSE Proposal Abstracts

FUSE Home
Getting Started
Data Search & Retrieval
- Search Form
- Exposure Search
- Daily Data Reports

What's New
FAQ
Data Reduction/Analysis
Instrumentation/Operations
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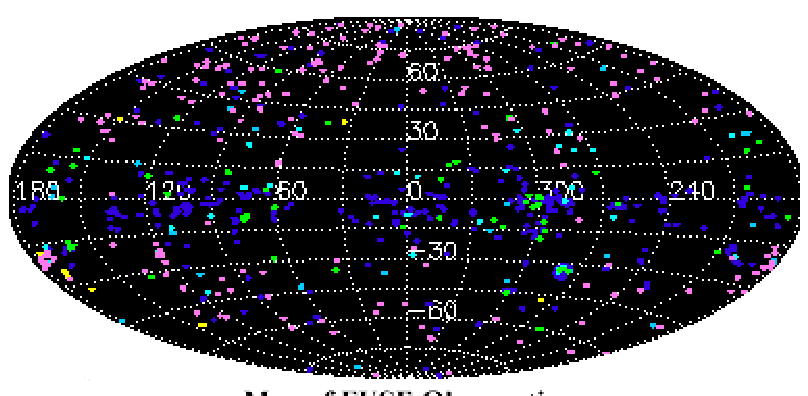
The Far Ultraviolet Spectroscopic Explorer (FUSE), launched on June 24, 1999, covers the 905-1187 Å spectral region and will obtain high resolution spectra of hot and cool stars, AGNs, supernova remnants, planetary nebulae, solar system objects as well as perform detailed studies of the interstellar medium. FUSE will be able to observe sources 10 000 times fainter than Copernicus, an early FUV mission, and has superior resolving power than the Hopkins Ultraviolet Telescope (HUT) and the Berkeley Spectrograph (BEFS) and the Tübingen Echelle Spectrograph (TUES) of the Orbiting Retrievable Far and Extreme Ultraviolet Spectrometers (ORFEUS). FUSE was planned for a 3 year lifetime with funding for an additional 2 years expected.

More information about the FUSE Guest Investigator program, including PI and Cycles 1 and 2 GI target lists, may be found at the FUSE Guest Investigator Program site at http://fusewww.gsfc.nasa.gov/.

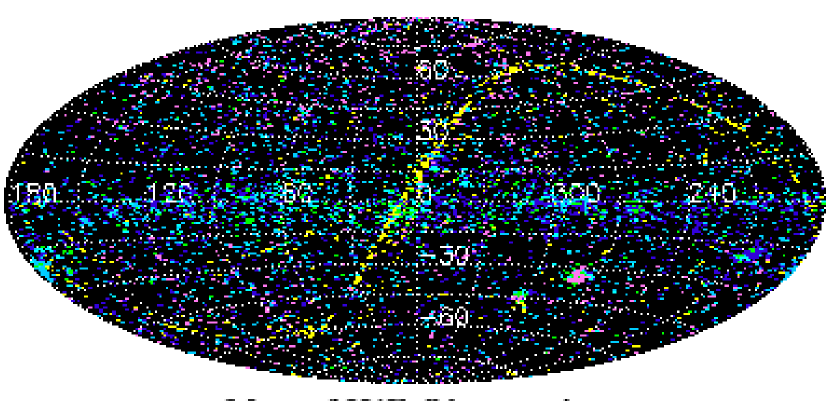
Although FUSE data is maintained and archived within MAST, most of the documentation available from the MAST FUSE page is obtained from the Johns Hopkins FUSE website.



Map of FUSE Observations

IUE International Ultraviolet Explorer

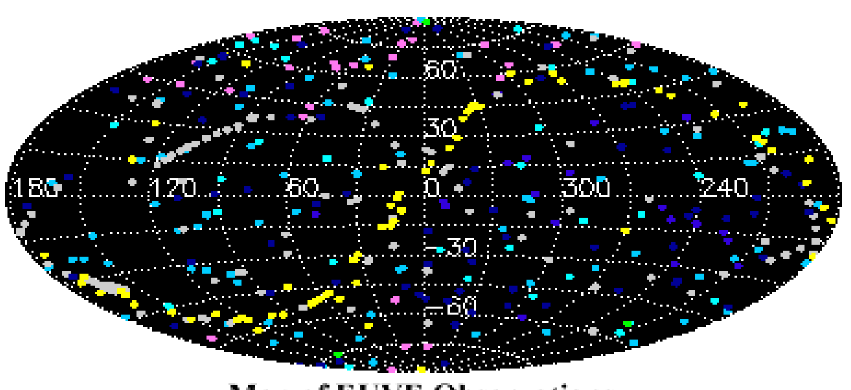
The ***International Ultraviolet Explorer (IUE)*** performed spectrophotometry at high (0.1-0.3 Å) and low (6-7 Å) resolution between 1150 Å and 3200 Å. The data cover a dynamic range of approximately 17 astronomical magnitudes: -2 to 10 for high dispersion; -2 and 14.9 for low dispersion. Over 104,000 ultraviolet spectra were obtained with IUE between January 26, 1978, and September 30, 1996.



Map of IUE Observations

EUVE Extreme Ultraviolet Explorer

Launched in June, 1992, The ***Extreme Ultraviolet Explorer (EUVE)*** conducted the first extreme ultraviolet (70-760 Angstroms) survey of the sky and subsequently began a Guest Observer Program of pointed spectroscopy, that ended on January 31, 2001. The satellite has four photometric imaging systems and a three-channel EUV spectrometer. The imaging instruments were used to complete the sky survey. The spectrometers were used for the pointed spectroscopic programs, which collected data from over 350 unique astronomical targets.



Map of EUVE Observations

Astro

Hopkins Ultraviolet Telescope (HUT)

Ultraviolet Imaging Telescope (UIT)

Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE)

The ***ASTRO Observatory*** had three primary instruments: the Ultraviolet Imaging Telescope (UIT), the Hopkins Ultraviolet Telescope (HUT) and the Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE). The Astro Observatory was designed to use many of the spacelab components and flew on two different shuttle flights. The first Astro flight was on December 2-11, 1990, aboard the shuttle Columbia. The X-ray experiment Broad Band X-Ray Telescope (BBXRT) was also part of the Astro-1 flight. The second flight was on March 2-18, 1995, aboard the shuttle Endeavour.

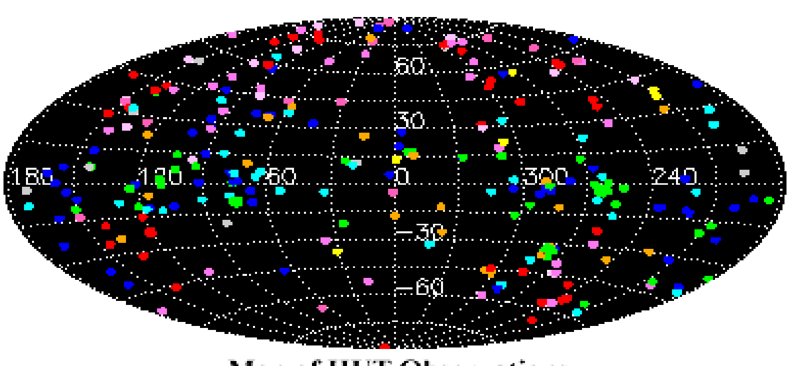
HUT obtained ultraviolet spectra of astronomical objects such as quasars, active galactic nuclei, and supernova remnants, extending into the little-explored ultraviolet range below 1200 Ångstroms. The instrument consisted of a telescope, prime focus spectrograph, and intensified photodiode array. Scientific studies have included research on the cores of active galaxies (where black holes likely reside), the torus of gas around Jupiter created by its moon Io, the characteristics of the intergalactic medium, and the stellar population in elliptical galaxies.

UIT consisted of a telescope and two image intensifiers with 70 mm film transports. The instrument acquired images of faint objects in broad ultraviolet bands in the wavelength range of 1200 to 3200 Ångstroms. Astronomers have investigated the present stellar content and history of star formation in galaxies, the nature of spiral structure, and non-thermal sources in galaxies using UIT data.

WUPPE obtained both ultraviolet spectra and polarimetry for celestial objects such as hot stars, galactic nuclei, and quasars. The instrument included a telescope, spectropolarimeter, and dual diode array detectors. Researchers have studied the interstellar medium, mass loss from hot stars, interacting binary stars, and active galaxies, among other topics.

HUT Hopkins Ultraviolet Telescope

The ***Hopkins Ultraviolet Telescope HUT*** was one of three ultraviolet instruments of the ASTRO-1 mission flown on the space shuttle Columbia during 2-10 December 1990. 106 spectrophotometric observations of 77 targets were obtained in the far-UV (i.e., 912-1850 Å) at a resolution of ~3 Å. A few sources were observed in the 415-912 Å region with a 1.5 Å resolution. The same three instruments were later flown on the space shuttle Endeavour from 3-17 March 1995 as part of the ASTRO-2 mission. During the longer ASTRO-2 mission, 385 observations of 265 targets were obtained.



Map of HUT Observations

UIT Ultraviolet Imaging Telescope

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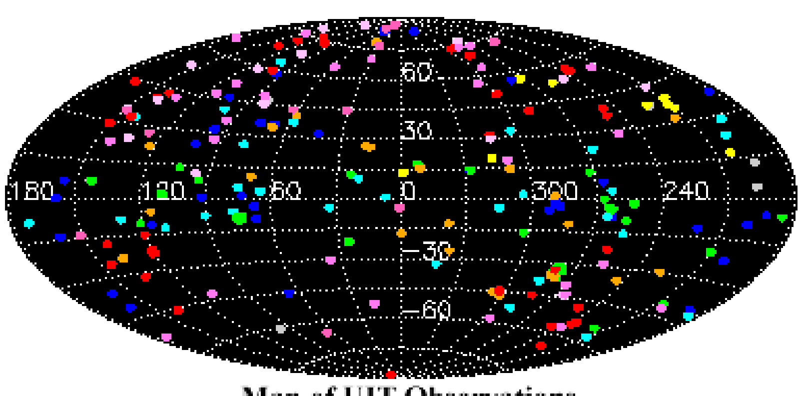
The ***Ultraviolet Imaging Telescope UIT*** was one of three ultraviolet telescopes on the ASTRO-1 mission flown on the space shuttle Columbia during 2-10 December 1990. The same three instruments were later flown on the space shuttle Endeavour from 3-17 March 1995, as part of the ASTRO-2 mission. Exposures were obtained on 70-mm photographic film in the 1200-3300 Å range using broadband filters and later digitized using a Perkin-Elmer microdensitometer. Image resolution was 3" over a 40' field of view. Overall, UIT-1 obtained 821 exposures of 66 targets, and UIT-2 obtained 758 images of 193 targets.



Map of UIT Observations

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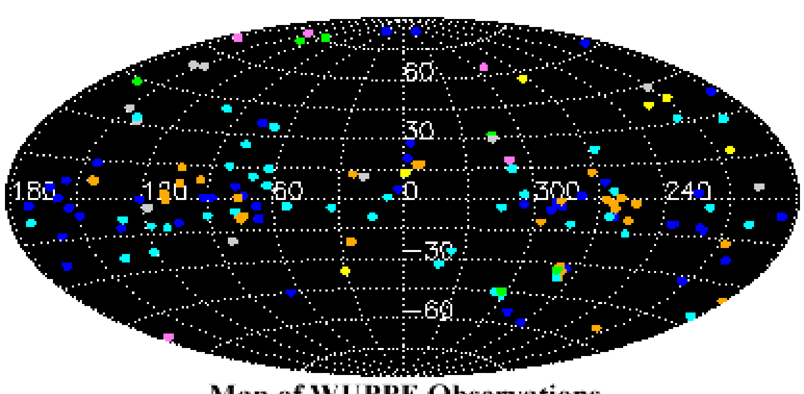
The ***Wisconsin Ultraviolet Photo-Polarimeter Experiment WUPPE*** was one of three ultraviolet telescopes on the ASTRO-1 mission flown on the space shuttle Columbia during 2-10 December, 1990. 98 observations of 75 targets were obtained. The same three instruments were later flown on the space shuttle Endeavour from 3-17 March, 1995, as part of the ASTRO-2 mission. During the longer ASTRO-2 mission, 369 observations of 254 targets were obtained.



Map of WUPPE Observations

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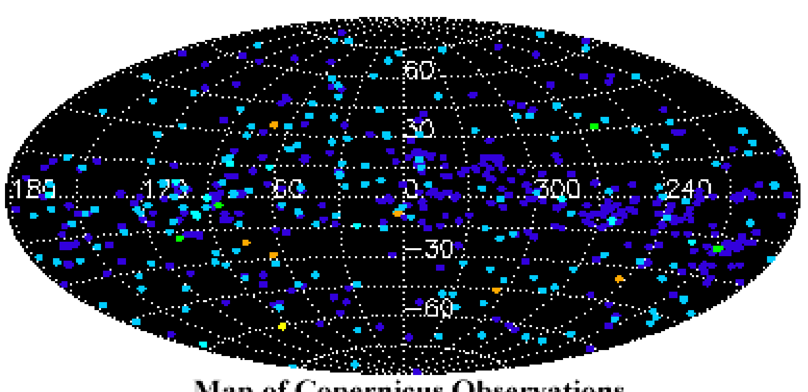
The ***Copernicus*** satellite, otherwise known as the Orbiting Astronomical Observatory 3 (OAO-3), obtained a series of high resolution far- (900-1560 Å) and near- (1650-3150 Å) ultraviolet spectral scans of 551 objects, primarily bright stars, from 1972 to 1981.



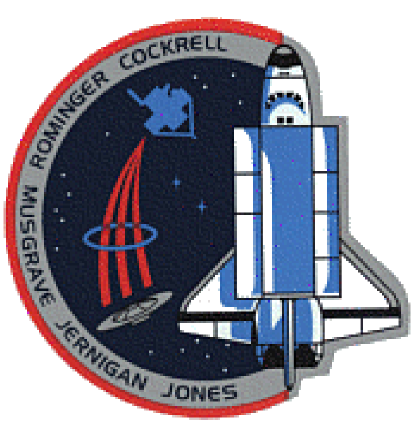
Map of Copernicus Observations

ORFEUS Orbiting Retrievable Far and Extreme Ultraviolet Spectrometers

Interstellar Medium Absorption Profile Spectrograph (IMAPS)

Berkeley Extreme and Far-UV Spectrometer (BEFS)

Tübingen Ultraviolet Echelle Spectrometer (TUES)



The ***Orbiting Retrievable Far and Extreme Ultraviolet Spectrometers (ORFEUS)-SPAS*** payloads were joint DARA (German Space Agency)/NASA missions flown on two shuttle flights. The first flight was September 12-22, 1993 aboard the shuttle Discovery. The second flight, aboard Columbia, was from November 19, through December 7, 1996.

The free-flying ORFEUS-SPAS platform was designed to be deployed and and retrieved from the shuttle.

The three instruments on the ORFEUS were designed to provide astronomical ultraviolet spectroscopic observations over the wavelength range from 40 to 140 nanometers. The three instruments were:

- Tübingen Ultraviolet Echelle Spectrometer (TUES); (PI) Prof. Michael Grewing; University of Tübingen
- Berkeley Extreme and Far-UV Spectrometer (BEFS); (PI) Dr. Mark Hurwitz; University of California, Berkeley. This instrument was called the Extreme Ultraviolet (EUV) Spectrometer in the ORFEUS-SPAS II Mission Research Announcement. It was later renamed.
- Interstellar Medium Absorption Profile Spectrograph (IMAPS); (PI) Dr. Edward Jenkins; Princeton University

The largest science instrument onboard was a 1-meter telescope. The telescope primary was coated with iridium to improve its light gathering power in the ultraviolet. Incoming light was focused to a movable mirror which deflected the light rays into the FUV Spectrometer (i.e., TUES), which operated in the 90-140 nanometer range. When the pick-off mirror was moved out of the beam, light fell instead onto the BEFS Spectrometer, which covered wavelengths between 39 and 120 nanometers. A second, separate instrument, the IMAPS Spectrograph, recorded extremely high resolution spectral data in the 95-115 nanometer range.

This information came from the ORFEUS-SPAS II Mission Research Announcement. A postscript version of this research announcement is located in /archive.stsci.edu/pub/pub/orfeus/orfeus_nra.ps

BEFS Berkeley Extreme and Far-UV Spectrometer

BEFS Target Search

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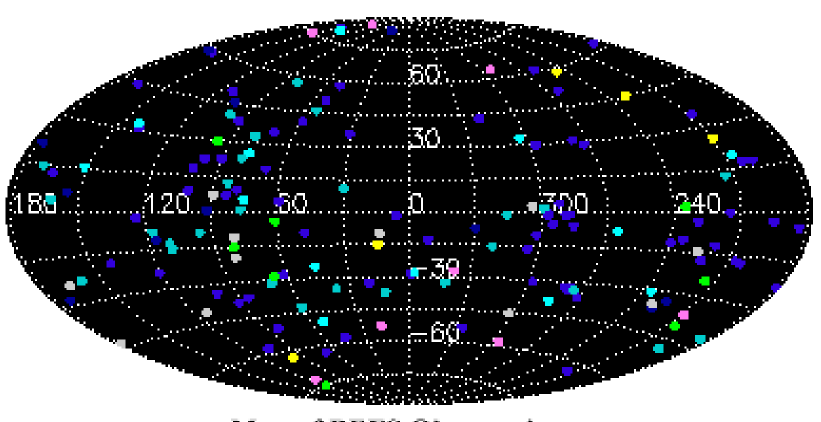
The ***Berkeley Extreme and Far-UV Spectrometer (BEFS)***, flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS I and II space shuttle missions in 1993 and 1996, returning high-resolution (λ/3000) FUV spectra (900-1200 Å) of 75 astrophysical objects from the first flight and more than 100 from the second. EUV spectra (400-900 Å) were obtained for a subset of these targets.



Map of BEFS Observations

IMAPS Interstellar Medium Absorption Profile Spectrograph

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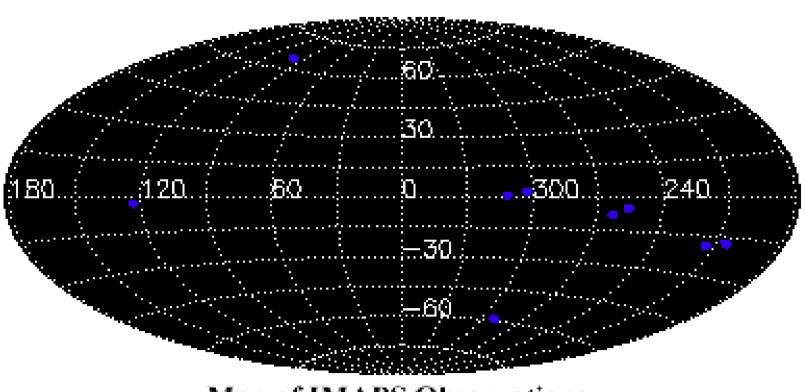
The **Interstellar Medium Absorption Profile Spectrograph (IMAPS)** obtained high resolution (R=75,000 for IMAPS-1) objective-grating echelle spectra of hot stars, over the spectral region 950-1150 Å. The Principal Investigator was Dr. Edward Jenkins from Princeton University. IMAPS was one of 3 spectrographs comprising the ORFEUS-SPAS mission. The ORFEUS-SPAS platform was deployed from the Space Shuttle Discovery in September, 1993 and from the Space Shuttle Columbia in November, 1996. The IMAPS archive currently contains roughly 600 spectral images of 10 hot stars from the first shuttle flight. Once the proprietary period ends for the second IMAPS mission, the archive will include an additional 3,900 spectral images of 29 stars.



Map of IMAPS Observations

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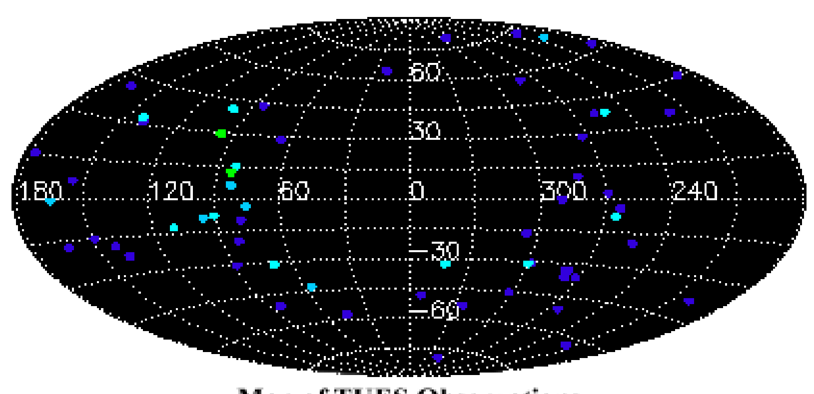
The ***Tübingen Echelle Spectrograph (TUES)***, designed and managed at the University of Tübingen, flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS II space shuttle mission in 1996, returning spectra in the 900 Å to 1400 Å wavelength range. The instrument was designed to achieve a spectral resolution of $\lambda/\Delta\lambda$=10000 when used with an entrance aperture of 10" diameter. During the 17.7 day flight, TUES returned 239 spectra of 62 targets.



Map of TUES Observations

DSS Digitized Sky Survey

The **Digitized Sky Survey** comprises a set of all-sky photographic surveys in E, V, J, R, and N bands conducted with the Palomar and UK Schmidt telescopes. The Catalogs and Surveys Branch (CASB) is digitizing the photographic plates to support HST observing programs but also as a service to the astronomical community.

The 6.5-degree x 6.5-degree plates are scanned using a modified PDS microdensitometer to a pixel scale of about 1.7 arcseconds per pixel for the POSS, SERC, and Palomar Quick-V surveys, and to about 1.0 arcseconds per pixel for the POSS-II surveys.

Images of any part of the sky may be extracted from the DSS, in either FITS or GIF format.

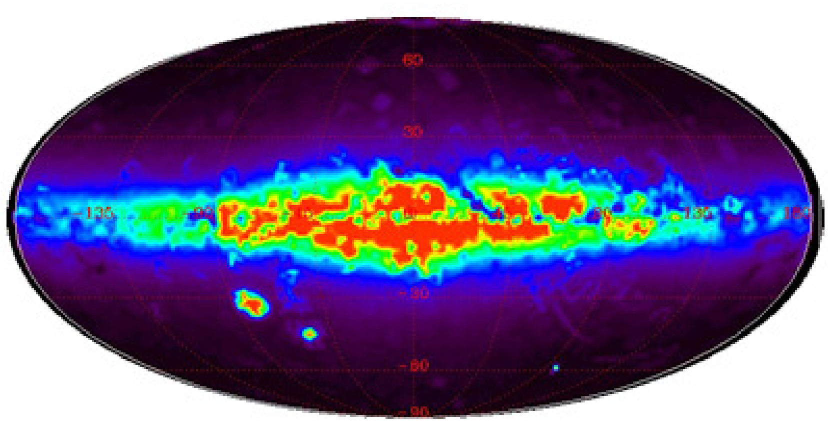
GSC Guide Star Catalogs

The Guide Star Catalogs were created by the staff of the Catalogs and Surveys Branch of the Space Telescope Science Institute.

The **Guide Star Catalog I** (GSC I) is an all-sky optical catalog of positions and magnitudes of approximately 19 million stars and other objects in the 6th to 15th magnitude range. GSC I catalog is used for the control and target acquistion of the Hubble Space Telesope. The **Guide Star Catalog II** (GSC II) is currently in production and will soon be released to the public. The GSC II is an all-sky catalog of approximately 2 billion stars and galaxies containing positions, magnitudes,colors and proper motions complete to a minimum of V =18.

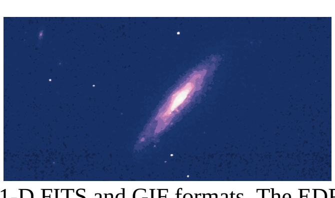
The **Guide Star Photometric Catalog** (GSPC-I) is an all-sky set of photoelectrically determined BV sequences in the magnitude range from 9 to 15, generally near the centers of the fields of the GSC-I plates. GSPC II is currently in production and will soon be released to the public. GSPC II is generally an extension of GSPC I sequences to V=19 in (B), V and R passbands based on CCD photometry. Its purpose is calibration of the GSC-II. New northern sequences are being added to support the POSS-II.

GSC 2.2 now available!.



GSC 2.2 - Galactic Coordinates

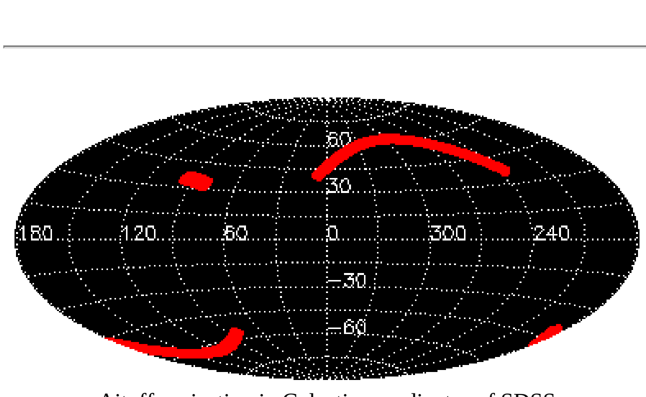
Welcome to the Sloan Digital Sky Survey Archive!



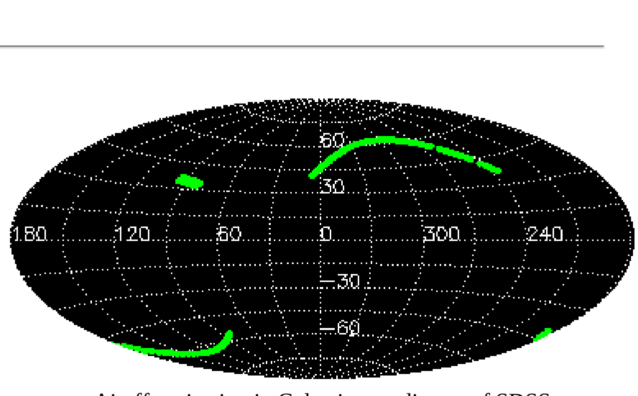
The **Sloan Digital Sky Survey** (SDSS) is using a dedicated 2.5 m telescope and a large format CCD camera to obtain images of over 10,000 square degrees of high Galactic latitude sky in five broad bands (u', g', r', i' and z', centered at 3540, 4770, 6230, 7630, and 9130 Å, respectively). Medium resolution spectra will be obtained for approximately 10^6 galaxies and 100,000 quasars. The early data release (EDR), on June 2001, includes searchable catalogs of images and spectra, images for display and scientific purpose in both 2-D FITS and JPEG formats, and spectra in both 1-D FITS and GIF formats. The EDR covers about 460 square degrees of sky. The next data releases will occur every 18 months or so.

Want to hear more? Sign up for one or both of our users' groups for the latest updates. All regular SDSS users must sign up for the Users' Group, or risk missing critical software and documentation updates.

Check the status of the SDSS archive server.



Aitoff projection in Galactic coordinates of SDSS Early Data Release Imaging Sky Coverage



Aitoff projection in Galactic coordinates of SDSS Early Data Release Spectral Sky Co verage

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Navigations hints:
The upper left SDSS logo takes you to the Public SDSS site
The upper right MAST logo takes you to the main MAST page
The top most banner links you to MAST related topics
The lower top banner links you to SDSS specific links and data products

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VLA-FIRST

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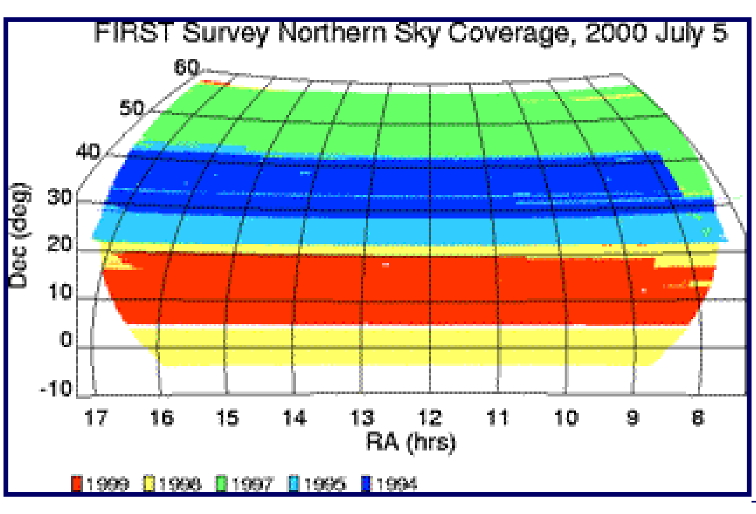
Faint Images of the Radio Sky at Twenty-cm **(FIRST)** is a systematic survey of the North and South Galactic caps begun in 1993, using the **NRAO** Very Large Array **(VLA)** . Typical images are comprised of 1150x1550 1.8" pixels with 5" resolution. Source catalogs are also available including peak and integrated flux densities generated from the high resolution coadded images. The survey yields very accurate (<1 arcsec rms) radio positions of faint (>1 mJy/beam) compact sources. The areas observed were chosen to coincide with the Sloan Digital Sky Survey. For more information, see the **VLA FIRST Web Site**.



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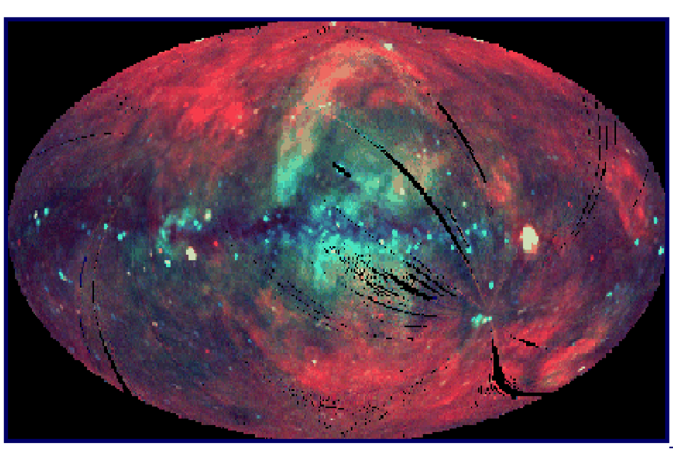
ROSAT,**the RÖntgen SATellite**, was an X-ray observatory developed through a cooperative program between Germany, the United States, and the United Kingdom. The satellite was designed and operated by Germany, and was launched by the United States on June 1, 1990. It was turned off on February 12, 1999. The ROSAT mission began with a 6-month, all sky Position Sensitive Proportional Counter (PSPC) survey, after which the satellite began a series of pointed observations that continued for the duration of the project.

ROSAT data is maintained and archived at HEASARC. Except for the search and acknowledgments pages, all images and linked pages above are provided by HEASARC.



About MAST

The **M**ultimission **A**rchive at **ST**ScI supports a variety of astronomical data archives, with the primary focus on scientifically related data sets in the optical, ultraviolet, and near-infrared parts of the spectrum. MAST is a component of NASA's distributed Space Science Data Services (SSDS).

MAST provides a **Cross Correlation Search** tool, enabling users to search all the MAST missions for data with one of the catalogs provided by MAST or a customized catalog provided by the user. Users may also do a **"quick search"** of the MAST holdings for a single object. Search pages for each individual mission are also provided. You may also look at the **Image/Spectral Scrapbook** to see representative images or spectra for a single target.

Preview images/spectra are available for most of the images, allowing users to more easily select the most useful data for their project.

MAST distributes data in a variety of different ways. HST and FUSE data, stored on the DADS optical disk system, are requested and staged either to the users disk or to an anonymous ftp area on this server. (The latter option is available only for non-proprietary data). Other datasets held by MAST are stored on CD in a pair of jukeboxes. Users may select desired data from the search results page and download the data directly to disk via their browsers. Alternatively, some data are available via anonymous ftp on this server.

MAST currently holds or provides links to archival data for the following missions or projects:

- Hubble Space Telescope (HST)
- Far Ultraviolet Spectroscopic Explorer (FUSE)
- International Ultraviolet Explorer (IUE)
- Extreme Ultraviolet Explorer (EUVE)
- ASTRO Missions
  - Hopkins Ultraviolet Telescope (HUT)
  - Ultraviolet Imaging Telescope (UIT)
  - Wisconsin Ultraviolet Photo Polarimetry Experiment (WUPPE)
- Copernicus (OAO-3)
- Orbiting and Retrieval Far and Extreme Ultraviolet Spectrograph (ORFEUS) missions.
  - Berkeley Extreme and Far-UV Spectrometer (BEFS)
  - Interstellar Medium Absorption Profile Spectrograph(IMAPS) (first flight)
  - Tübingen Echelle Spectrograph (TUES)
- Digitized Sky Survey (DSS) & Guide Star Catalog II (GSCII)
- Sloan Digital Sky Survey (SDSS)
- FIRST (VLA radio data)
- Roentgen Satellite (ROSAT)

Although there is no cost involved in retrieving data from MAST, researchers are requested to include an acknowledgement (as shown below) in their publications.

> "Some/all of the data presented in this paper was obtained from the Multimission Archive at the Space Telescope Science Institute (MAST). STScI is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555. Support for MAST for non-HST data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contracts."

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MAST Spectral/Image Scrapbook Help

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How we made the scrapbook

Introduction

The MAST Spectral/Image Scrapbook is designed to allow users to take a quick look at sample data in the MAST archive of a particular astronomical object of interest. It is particularly useful if the user is not already familiar with the datasets involved.

The tool utilizes a pair catalogs of representative spectra and images compiled from the MAST archive. Each of the tables lists unique datasets representing either each object or unique pointing observed by each MAST mission/instrument. These datasets contain either a calibrated spectrum or image, as the case may be. More than one dataset may be listed for an assortment of bandpasses, depending on the instrument. For instance, two GHRS spectra are included in the catalog for the star T Tauri, one for the long-wavelength and one for the short-wavelength ultraviolet ranges, among the 13 GHRS spectra in the archive. For IUE, representative images of an object are included for both low and high dispersion if they exist. For WFPC2 images only, one 2.5 x 2.5 arcmin U, B, V, R, and I image is included per pointing when available; a band centered on an emission line is also included when available. In addition, the table lists the names of the object returned by SIMBAD and NED, if available, and the name and coordinates of the object as given in the original observing catalog.

The user may query the table in one of several ways (see Search Criteria listed below):

- Enter an object name to be resolved by SIMBAD or NED, and use the SIMBAD/NED coordinates to search the catalog for any entries within a specified radius of that position.
- Enter a set of coordinates to search the catalog by position.
- Enter an object name to be resolved by SIMBAD or NED, and search the catalog for entries with that resolved name.
- Enter the mission target name to search by object name as catalogued by that mission (may include "%" as a wildcard).

Note that the individual spectra or images in the catalog are typical, not always the best quality available, and are intended to convey the general attributes and quality of the data. To explore further the data available, the user should proceed to the catalog search page for the relevant mission.

For extended objects, some missions obtained data from multiple pointings around the object. In this case for spectra, data from only a single pointing may be displayed (example: the Orion nebula). No attempt has been made to provide a listing of the various pointings for such objects.

Solar system objects are not included in this tool. A special solar system scrapbook tool is under consideration.

Input Parameters

This section describes the options available on the scrapbook search form. Only the target name or position is required; the remaining fields will default to the values shown.

Target
Enter the name or the coordinates of the astronomical object of interest.
- If you specify the name to be resolved for the "Coordinates" or "Resolved Target Name" search, use standard nomenclature as utilized by SIMBAD or NED for best results.
- For the "Mission Target Name" search mode only, a "%" can be used as a wildcard and all names are converted to upper-case; e.g., entering "r136%" will return all entries in which the mission object name begins with R136.
- To specify coordinates, enter J2000 RA and DEC as decimal degrees or as hours, minutes, and seconds. Several formats will be recognized as coordinates:
  - decimal degrees e.g. 65.4975 19.535 or 65.4975, +19.535
  - hours minutes seconds e.g. 4 21 59.4, 19 32 6 or 4 21 59.4 19 32 6
  - hours minutes, deg minutes e.g. 4 21 19 32 or 4 21, 19 32

Data Type
The user specifiies a request for spectral or image data (but not both). By default, spectral data will be displayed.

Search Criteria
Determines how the query of the catalog of representative spectra or images is performed. Three search options are currently available:
- **Coordinates -** Searching the TORS/TORI tables by coordinates within the defined search radius is the default search option. Users may enter their own coordinates (consult examples under "Target"), or use the SIMBAD/NED name resolvers to obtain coordinates. The software uses the resolvers automatically when characters are entered as part of the target name. SIMBAD is the default resolver. As an example, if one enters "NGC4151" for the target, then selects "coordinates" for the search criteria and "SIMBAD" for the name resolver, the scrapbook program uses SIMBAD to determine the coordinates for NGC4151, calculates a circular search area of specified radius centered on the returned coordinates, returns all entries from either Table of Representative Spectra or Images (depending which Data Type is selected) which fall within this area, and displays the spectra or images.
- **Resolved Target Name -** This mode compares the target name returned by SIMBAD or NED to the resolved names stored in the Table of Representative Spectra or Images. This mode is useful when looking for specific targets in crowded fields or for large extended objects, but may also miss some relevant entries. As an example of usage, if one enters "NGC 224", SIMBAD resolves the target as "M 31", and the tool returns entries from the table with the SIMBAD Name "M 31".
- **Mission Target Name -** In this mode the user's input object name is compared directly to the mission object names without using a name resolver. The mission object names are those assigned by the mission and listed in its observing catalog. The names may or may not be consistent with those of other missions. This mode can be useful for targets with unusual designations or to find certain types of objects such as "jets". All input target names are converted to upper-case and a "%" may be used as a wildcard. If one enters "NGC%4151" for example, then entries matching "NGC4151" and "NGC 4151" will be returned. If one enters, "%JET", the entries ending in "JET" such as "HH46-JET" will be returned. This mode is the fastest to execute, but may return only a subset of the desired entries due to differences in the assigned mission object names. Warning: using wildcards can result in extremely large search results.

Search Radius
Enter the coordinate search radius in arcminutes. The default of 3 arcmin will work for many objects, but a smaller radius may be needed in crowded fields. A larger radius may be needed to locate a large extended object. This parameter is not used when searching by name only (see above).

Maximum thumbnails per mission
By default, a maximum of 10 thumbnails will be displayed for each mission. This value may be changed to any number greater than zero. This option affects only the display of the thumbnails. The search results table will always list all the found entries.

Name Resolver
Select either SIMBAD (the default) or NED for name resolution. If the name is not found within either database, try entering coordinates (J2000) instead of a target name. This entry applies only to "Coordinates" and "Resolved Target Name" searches with an input name.

Submit Query
Click on this button to begin the query. The Table of Representative Spectra or Representative Images will be searched for entries which meet the specified search criteria. The result may be none, one, or many objects. You may wish to redo the search with a smaller search radius in a crowded field, or using different search criteria.

Reset
Clicking reset will return the form to its default values.

Help
Clicking help will display this help file. If you still have trouble, please e-mail your question to archive@stsci.edu.

Spectrum Output

The output of your query will include a list of representative data sets for the specified object or coordinates, thumbnails of the spectra or images, and links to browse files, data, and catalog search pages. You may also select spectra to be coplotted using the Customized Plot tool.

Table Headings

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page.

Plot
Click on the appropriate buttons to select the spectra that you would like to display together on one graph (see Customized Plot).

Dataset Name
The name of the dataset in the MAST archive. This may be a single observation or a combination of integrations, depending on the particular mission and instrument involved.

Mission Object Name
The name of the astronomical object as given in the mission catalog. Various

designations were used by the different missions. Since all stored object names are upper case, all input names are converted to upper case when using the "Mission Target Name" mode.

Comments
Explanatory comments regarding the data sets. The contents will vary with mission. Currently the field describes the gratings used by GHRS spectra.

Simbad/NED Name
The name of the astronomical object as returned by SIMBAD (or NED if selected). SIMBAD (NED) is used to resolve multiple designations and to help the user determine if the MAST datasets are of the same target or of multiple targets falling within the search radius. Since some SIMBAD names contain lower case characters, input names are not converted to upper case in "Coordinates" or "Resolved Target Name" modes.

RA (2000), Dec (2000)
The right ascension and declination in J2000 epoch as listed in the Table of Representative Spectra, taken from the mission observing catalog.

Angular Separation
When performing coordinate searches, the angular separation (radius), given in arcminutes, between the SIMBAD (or NED) coordinates and the mission object coordinates listed in the Table of Representative Spectra catalog. The output entries are sorted by mission and angular separation.

Customized Plot

The spectra that you selected will be automatically scaled to the full range of wavelengths and nearly the full range of fluxes (i.e., y axis plot scale runs from 0 (or .25 * the minimum flux for spectra with negative fluxes) to the 10th highest flux). Each spectrum is automatically assigned a color, up to a maximum of 15. The spectra are labelled by their dataset names, with a summary of the datasets plotted given below the plot. After inspecting the plot, you may wish to change the selection of datasets which are displayed. Use your browser "Back" button to do this.

Plot range
Adjust the minimum and maximum wavelengths (in Ångstroms) and minimum and maximum fluxes (in erg/cm^2/sec/Å) to select the spectral region of interest and to exclude noisy data.

Plot dimensions
Adjust the X size and Y size in pixels to create the size of plot desired. The maximum dimensions are 850 by 640 pixels.

Redraw plot
Use this button to replot the spectra when you have changed the plot range or plot dimensions.

Image Output

The output of your query will include a list of representative images for the specified object or coordinates, previews of the images, and links to browse files, data, and catalog search pages.

Table Headings

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page.

Dataset Name
The name of the dataset in the MAST archive. This may be a single observation or a combination of integrations, depending on the particular mission and instrument involved.

Mission Object Name
The name of the astronomical object as given in the mission catalog. Various designations were used by the different missions. Since all stored object names are upper case, all input names are converted to upper case when using the "Mission Target Name" mode.

Comments
Explanatory comments regarding the data sets. The contents will vary with mission. Currently the field describes the filters and apertures used for WFPC2 image data.

Simbad/NED Name
The name of the astronomical object as returned by SIMBAD (or NED if selected). SIMBAD (NED) is used to resolve multiple designations and to help the user determine if the MAST datasets are of the same target or of multiple targets falling within the search radius. Since some SIMBAD names contain lower case characters, input names are not converted to upper case in "Coordinates" or "Resolved Target Name" modes.

RA (2000), Dec (2000)
The right ascension and declination in J2000 epoch as listed in the Table of Representative Images, taken from the mission observing catalog. For WFPC2 images these refer to the position of the V1 axis, i.e., the center of the WFPC2 field of view.

Angular Separation
When performing coordinate searches, the angular separation (radius), given in arcminutes, between the SIMBAD (or NED) coordinates and the mission coordinates listed in the Table of Representative Images catalog. The output entries are sorted by mission and pointing.

Thumbnails and Links

The thumbnails displayed are small but readable quick-look versions of the calibrated data. Descriptions of how these thumbnails were created will be included in the planned mission help pages for the scrapbook.

Click on the mission/instrument name to go to the mission search page to query data from the full mission catalog. The search form will be loaded with the user-specified coordinates (or those derived from NED or SIMBAD) and the user-specified search radius, but the user may modify these or any other search parameter before searching the mission catalog.

For spectra, click on the data_id entry below each thumbnail to view the standard preview page. The preview pages contain a full-sized image of the spectrum and other associated information. Clicking on the mission name above the thumbnail will take the user to a query page filled out with the target name or coordinates and ready to be submitted. This is an alternative way of accessing mission-specific data products for the object. click on the data_id entry or the thumbnail to display a full-size image.

For non-HST missions, click on the object name listed below each thumbnail to download the data (fits files bundled in tar) to your disk. For HST data, click on the object name to display exposure informatiomn.

Click on "Cross Correlation Search" to search the entire MAST archive for a listing of the MAST data sets for a particular target. This will submit the user specified target name to the "xcorr" cross correlation search form. The resolver name, number of entries displayed per mission, and the search radius specified in the scrapbook search form will also be passed to xcorr.

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MAST Mission Search Help Page

Overview

This form allows one to

1. perform a quick search by target name or coordinates for a specified set of data types (default is all), or
2. list and briefly describe the available MAST missions for a specified set of data types (default is all).

Clicking the "search" button without any selection criteria will return a list of all the existing MAST data sets. The information below describes the various search options.

Note: if you already know which data set(s) you are interested in, (i.e., which mission or survey), you may instead

- click the "Data Search" link to display a list of links to mission-specific search scripts, or
- click on the mission names shown on the top MAST page to go to the mission home pages (a similiar list is displayed by clicking the "Missions" link at the top of the page).

For further assistance, contact a MAST staff member by clicking the "Contacts" link at the top of the page.

Target Name (or coordinates)
: Entering either a target name to be resolved by SIMBAD (by default) or NED, or J2000 coordinates (RA and DEC separated by a comma) will start a cross-correlation search for appropriate data sets within MAST. If data types are also selected, the search will be restricted to the selected missions.

Data Type(s)
: Archived data sets have been classified according to the type of data (i.e., spectral, image or other) and wavelength coverage. Selecting various data types and wavelength ranges and then clicking "Search", will return a list containing both a summary of each missions data holdings and a link to the mission home pages. If a particular target is also specified, the results page will list the actual data sets available from each of the selected missions.

: The wavelength ranges and data types used in the table are as defined below.

X-ray
: That portion of the electromagnetic spectrum having wavelengths from ~0.1 to ~124 Å (i.e., ~124 kev to ~100 eV).

Extreme UV
: The extreme ultraviolet wavelength range is defined as ~70 to 912 Å.

Far-UV
: The spectral region from 912 to 2000 Å.

Near-UV
: The spectral region from 2000 to 3400 Å.

Optical
: The spectral region from 3400 to ~7500 Å.

Near-IR
: The spectral region from ~7500 Å to ~30 µ.

Radio
: That portion of the electromagnetic spectrum having wavelengths greater than ~10 cm.

Images
: Image data refers to digital images obtained within various bandpasses and with various spatial resolutions. (Note: images of spectra are not included in this category.)

Spectra
: This category refers to spectroscopic data containing calibrated or uncalibrated fluxes as a function of wavelength.

Other
: Data sets listed in the "Other" category include polarimetric, photometric, and astrometric data.

MAST/Hipparcos Cross Correlation

Hipparcos Catalog

V magnitude

B-V color

Parallax (mas)

Spectral Type (case-sensitive)

Right Ascension Range (J2000)

Declination range (J2000)

Mark all | Unmark all

	Missions	Radius (arcmin)
☑	*HST*: WFPC2	3.0
☑	*HST*: WF/PC-1	3.0
☑	*HST*: FOS	1.0
☑	*HST*: GHRS	1.0
☑	*HST*: STIS	3.0
☑	*HST*: NICMOS	5.0
☑	*HST*: FOC	3.0
☐	*HST*: FGS	3.0
☐	*HST*: HSP	3.0
☑	*FUSE*	1.0
☑	*IUE*	1.0
☑	*EUVE*	1.0
☑	*Copernicus (Raw)*	1.0
☑	*UIT*	1.0
☑	*HUT*	1.0
☑	*WUPPE*	1.0
☑	*BEFS*	1.0
☑	*IMAPS*	1.0

Mark all | Unmark all

Show catalog entries that match any of the selected missions

Display 10 rows per mission

Submit query | Reset form | *Help...*

archive@stsci.edu

MAST/HIPPARCOS Cross Correlation Help

This page explains how to use the MAST/HIPPARCOS cross-correlator.

You can use this page to cross-correlate subsets of the HIPPARCOS catalog with the HST, IUE, and EUVE archives. To use the form, simply indicate the V magnitude, B-V color, Parallax (mas), and/or Spectral Type that define the subset of the catalog that you're interested in, and which missions you want to cross correlate this subset with. You can optionally specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will then extract the subset of the HIPPARCOS catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed these stars . The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

V Magnitude

Apparent magnitude in the Johnson V band.

```
Qualification  Meaning
-------------- ---------------------------------------
   > 18        V greater (dimmer) than 18
   < 22        V less (brighter) than 22
 18.5 .. 22.5  V between 18.5 and 22.5
   18.0        V of exactly 18
```

The range of values of this field in the HIPPARCOS catalog is -1.44 to 14.08. (This does not mean that the HIPPARCOS catalog is complete to 14.08.)

B-V Color

Johnson B-V color, expressed as a magnitude difference.

Parallax

Trigonometric parallax, in milliarcseconds (mas).

Spectral Type

The spectral type. This field is case-sensitive, so that searches using it will go faster. (The database engine wouldn't be able to use the index otherwise.)

Right ascension range

Right ascension range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of right ascensions. While a single RA would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the RA *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of right ascensions:

```
12 00 00 .. 14 00 00
12 00 .. 14 00
12h00m00s .. 14h00m00s
12h 00m 00s .. 14h 00m 00s
12h 00' 00" .. 14h 00' 00"
180 .. 210
```

Note that if the right ascension is given as a single floating-point number, as in the last line in the above set of examples, it will be interpreted as degrees, not hours.

You can also use < and >:

```
< 5 00 00
> 14 00 00
< 2, > 20
```

The last line means "less than 2 OR greater than 20". A comma may be to OR two RA qualifications.

Declination range

Declination range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of declinations. While a single Dec would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the Dec *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of declinations:

```
20 30 00 .. 21 00 00
20 30 .. 21 00
20h30m00s .. 21h00m00s
20h 30m 00s .. 21h 00m 00s
20h 30' 00" .. 21h 00' 00"
20.5 .. 21.0
```

You can also use < and >:

```
< 20
> -20
< -20, > 20
```

The last line means "south of -20 OR north of +20".

Missions

Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)

The radius in arcminutes on which to cross-correlate the mission with the object catalog catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions

When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission

Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

MAST/Sky2000 Cross Correlation

Sky2000 Master Star Catalog

V magnitude

B magnitude

B-V color

Parallax (mas)

Spectral Type (case-sensitive)

Right Ascension Range (J2000)

Declination range (J2000)

Mark all | Unmark all

	Missions	Radius (arcmin)
☑	*HST*: WFPC2	3.0
☑	*HST*: WF/PC-1	3.0
☑	*HST*: FOS	1.0
☑	*HST*: GHRS	1.0
☑	*HST*: STIS	3.0
☑	*HST*: NICMOS	5.0
☑	*HST*: FOC	3.0
☐	*HST*: FGS	3.0
☐	*HST*: HSP	3.0
☑	*FUSE*	1.0
☑	*IUE*	1.0
☑	*EUVE*	1.0
☑	*Copernicus (Raw)*	1.0
☑	*UIT*	1.0
☑	*HUT*	1.0
☑	*WUPPE*	1.0
☑	*BEFS*	1.0
☑	*IMAPS*	1.0

Mark all | Unmark all

Show catalog entries that match any of the selected missions

Display 10 rows per mission

Submit query | Reset form | *Help...*

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MAST/SKYMAP SKY2000 Version 3 Correlation Help

This page explains how to use the MAST/SKY2000 cross-correlator.

Version 3 of the SKY2000 master catalog contains nearly 300,000 star entries with visual magnitudes between -1.4 and 12.92, all of which have coordinates accurate to less than or equal to 1.5 arcsec. More than 99% of the entries have Johnson V magnitudes, however note that not all the included fields have values for every star entry.

To use the SKY2000 form, simply indicate the V or B magnitude, B-V color, coordinates, Parallax (mas), and/or Spectral Type that define the subset of the catalog that you're interested in, and which missions you want to cross correlate this subset with. The page is initially displayed to search all MAST missions except FGS and HSP. To search on individual missions, first click the "unmark all" button and then select the specific missions desired. (Selecting fewer missions will speed up the search.) You can also specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will extract the subset of the SKY2000 catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed these stars. (Note that queries returning a large subset of the SKY2000 catalog can take a long time to complete.) The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

The MAST project wishes to thank Wayne H. Warren Jr. (Raytheon Technical Services Company) and Christopher B. Sande (Computer Sciences Corporation) for their assistance in obtaining the SKY2000 master catalog and documentation.

V Magnitude
Apparent magnitude in the Johnson V band.

```
Qualification  Meaning
-------------- ---------------------------------------
   > 18        V greater (dimmer) than 18
   < 22        V less (brighter) than 22
 18.5 .. 22.5  V between 18.5 and 22.5
   18.0        V of exactly 18
```

The range of values of this field in the SKY2000 version 3 catalog is -1.44 to 12.92. (This does not mean that the SKY2000 catalog is complete to 12.92.)

B Magnitude
Apparent magnitude in the Johnson B band. The range of values for this field is -1.43 to 16.66.

B-V Color
Johnson B-V color, expressed as a magnitude difference. Values range from -0.6 to 5.9.

Parallax
Trigonometric parallax, in milliarcseconds (mas). Values range from 742 to -343 although negative values have no physical meaning.

Spectral Type
A 30 character field containing spectral class, luminosity class, and peculiarity type. This field is case-sensitive, so that searches using it will go faster. (The database engine wouldn't be able to use the index otherwise.)

Right ascension range
Right ascension range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of right ascensions. While a single RA would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the RA *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of right ascensions.

```
12 00 00 .. 14 00 00
12 00 .. 14 00
12h00m00s .. 14h00m00s
12h 00m 00s .. 14h 00m 00s
12h 00' 00" .. 14h 00' 00"
180 .. 210
```

Note that if the right ascension is given as a single floating-point number, as in the last line in the above set of examples, it will be interpreted as degrees, not hours.

You can also use < and >:

```
< 5 00 00
> 14 00 00
< 2, > 20
```

The last line means "less than 2 OR greater than 20". A comma may be to OR two RA qualifications.

Declination range
Declination range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of declinations. While a single Dec would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the Dec *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of declinations:

```
20 30 00 .. 21 00 00
20 30 .. 21 00
20h30m00s .. 21h00m00s
20h 30m 00s .. 21h 00m 00s
20h 30' 00" .. 21h 00' 00"
20.5 .. 21.0
```

You can also use < and >:

```
< 20
> -20
< -20, > 20
```

The last line means "south of -20 OR north of +20".

Missions
Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)
The radius in arcminutes on which to cross-correlate the mission with the object catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions
When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission
Use this selector to determine how many rows from each mission will be displayed. When ALL is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

MAST/AGN Cross Correlation

AGN Catalog

Redshift (z)

Visual magnitude

6cm Flux (mJy)

Object Class

- AGN UNCLASSIFIED
- BL LAC
- LINER
- QSO (NO V-MAG)
- QSO RADIO-LOUD
- QSO RADIO-QUIET
- RADIO GALAXY
- SEYFERT TYPE 1
- SEYFERT TYPE 2
- SEYFERT?
- STARBURST GALAXY

Mark all | Unmark all

	Missions	Radius (arcmin)
☑	***HST*: WFPC2**	3.0
☑	***HST*: WF/PC-1**	3.0
☑	***HST*: FOS**	1.0
☑	***HST*: GHRS**	1.0
☑	***HST*: STIS**	3.0
☑	***HST*: NICMOS**	5.0
☑	***HST*: FOC**	3.0
☐	***HST*: FGS**	3.0
☐	***HST*: HSP**	3.0
☑	***FUSE***	1.0
☑	***IUE***	1.0
☑	***EUVE***	1.0
☑	***Copernicus (Raw)***	1.0
☑	***UIT***	1.0
☑	***HUT***	1.0
☑	***WUPPE***	1.0
☑	***BEFS***	1.0
☑	***IMAPS***	1.0

Mark all | Unmark all

Show catalog entries that match any **of the selected missions**   **Display** 10 **rows per mission**

Submit query | Reset form | ***Help...***

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MAST/AGN Cross Correlation Help

This page explains how to use the MAST/AGN cross-correlator. For information on how the AGN catalog was constructed, see the page describing the contents of the AGN catalog.

You can use this page to cross-correlate subsets of our AGN catalog with the HST, IUE, and EUVE archives. To use the form, simply indicate the classes, redshift range, visual magnitude range, and/or 6cm flux range that define the subset of the AGN that you're interested in, and which missions you want to cross correlate this subset with. You can optionally specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will then extract the subset of the AGN catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed the AGN. The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

Object Class

The classification of the AGN. For information on how the AGN were classified, see the section The Classification in the page describing the contents of the AGN catalog.

You may select one or more of these classifications. If you select more than one, then the cut will find AGN that fall into any one of the selected classes. (Each AGN has only one class associated with it.)

Redshift

The redshift of the AGN, expressed as *z*. You can enter a range of floating point numbers here in any of the following ways:

Qualification	Meaning
> 4	*z* greater than 4
< 2	*z* less than 2
2.5 .. 3.5	*z* between 2.5 and 3.5
2.0	*z* of exactly 2

Visual Magnitude

The visual magnitude (*V*) of the AGN. For information on how the visual magnitude was derived, see the page describing the contents of the AGN catalog.

This field can accept a range of floating point numbers:

Qualification	Meaning
> 18	*V* greater (dimmer) than 18
< 22	*V* less (brighter) than 22
18.5 .. 22.5	*V* between 18.5 and 22.5
18.0	*V* of exactly 18

6cm Flux

The radio flux at 6cm, in mJy. For information on how the 6cm flux was derived, see the page describing the contents of the AGN catalog.

This field can accept a range of floating point numbers:

Qualification	Meaning
> 18	flux greater than 18 mJy
< 22	flux less than 22 mJy
18.5 .. 22.5	flux between 18.5 mJy and 22.5 mJy
18.0	flux of exactly 18 mJy

Missions

Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)

The radius in arcminutes on which to cross-correlate the mission with the object catalog catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions

When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission

Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

The AGN Catalog

The Catalog

The Active Galactic Nuclei (AGN) catalog is heavily based on A Catalogue of Quasars and Active Nuclei (7th Edition), ESO Scientific Report No. 17, by Véron-Cetty & Véron (1996) [VV96]. That includes 11,442 quasars and active galaxies, and gives optical magnitudes, redshift, and some radio information. To this we have added: 1. the BL Lac catalog of Padovani & Giommi (1995), updated with BL Lacs discovered in 1996 (for a total of 265 sources); 2. the radio galaxies in the 1 Jy, S4, and S5 radio catalogs, mostly not included in VV96. The resulting database, which totals 12,021 AGN, was also cross-correlated with various radio catalogs providing 6 cm data, namely the PKS database, the PMN survey , the GB6 catalog, the 1 Jy, S4, and S5 radio catalogues. Individual radio fluxes for radio-quiet AGN not included in radio catalogs (radio fluxes < 1 - 30 mJy), taken from the literature, were also added. The V magnitudes in VV96 are actually mostly B or photographic magnitudes when no (B-V) value is available. Therefore, for objects without (B-V) colors, V magnitudes have been derived from the given values by subtracting (B-V) values typical of the class to which an object belongs to, unless the reference was to a paper which gave V magnitudes directly. One should remember that most AGN are variable so the reported V magnitudes should be taken only as indicative. (See Padovani (1997) and Padovani et al. (1997) for some astrophysical applications of an extended version of the catalog.)

The Classification

The classification is based mostly on the one given by VV6, to which the user is referred to, with some differences and additions. Namely:

- AGN UNCLASSIFIED: unclassified sources in Table 3 of VV96 (which includes "active galaxies").
- BL LAC: sources appearing in the BL Lac catalogue of Padovani & Giommi (1995), updated with BL Lacs discovered in 1996.
- LINER: classified as S3 (or Seyfert 3) in VV96.
- QSO: this includes all quasars appearing in Table 1 of VV96, defined by a value of the blue absolute magnitude brighter than -23; for these objects a sub-classification as radio-loud or radio-quiet has been done, based on the two point spectral index alpha_ro (defined here between 5000 Angstroms and 6 cm [5 GHz]). Objects with (K-corrected) alpha_ro > 0.19 (corresponding to the "standard" dividing value of radio flux to optical flux > 10) have been called radio-loud. For the purpose of calculating alpha_ro, V magnitudes have been corrected for extinction following Wilkes et al. (1994) and for the presence of emission lines according to Natali et al. (1998). Radio-loud Seyfert 1 galaxies have been included with the radio-loud QSO, where they belong according to unified schemes for AGN (see, e.g., Urry & Padovani 1995). Note that sometimes radio fluxes are available only at wavelengths other than 6 cm (e.g., from the FIRST or NVSS surveys). In these cases the radio flux at 6 cm used to calculate alpha_ro has been derived by extrapolating the flux assuming a radio spectral index typical of the class to which an object belongs to.
  - QSO (NO V-MAG): 196 QSO without (believe it or not) V magnitude;
  - QSO RADIO-LOUD; QSO (and Seyfert 1 galaxies) with alpha_ro > 0.19 (includes a few QSO without V magnitude but radio flux > 0.5 Jy);
  - QSO RADIO-QUIET; QSO with alpha_ro <= 0.19.
- RADIO GALAXY; from the 1 Jy, S4, and S5; also, radio-loud Seyfert 2 galaxies were checked individually and classified as radio-galaxies if appropriate (radio galaxies are classified as Seyfert 2 galaxies in VV96).
- SEYFERT TYPE 1; sources in Table 3 of VV96 classified as S1 (excluding objects with broad lines in polarized light only); radio-loud Seyfert 1 galaxies are included with the radio-loud QSO (see above).
- SEYFERT TYPE 2; sources in Table 3 of VV96 classified as S2, plus S1 in VV96 with broad lines in polarized light only (classified as S1 in VV96).
- SEYFERT?; sources in Table 3 of VV96 classified as S or S?.
- STARBURST GALAXY; sources in Table 3 of VV96 classified as H2.

Useful Hints

(work in progress)

Disclaimer

Classification of astronomical objects is a complex subject and in many cases the assignement of an object to a given class can be a matter of dispute. We have done our best to be as objective as possible but are obviously open to comments and suggestions about the catalog. These should be sent, along with any questions, to Archive hotseat.

MAST/Abell Clusters Cross Correlation

Abell Clusters Catalog

Redshift (z)

Mag 10

Galactic Latitude

Galactic Longitude

Richness
0
1
2
3
4
5

Note Since a cluster can cover a relatively large area of the sky, the search radius for Abell Clusters will be the aperture radius *plus the radius of the cluster*. The cluster radius, in arcminutes, is calculated from the redshift; see the help file.

Mark all | Unmark all

Missions	Radius (arcmin)
☑ ***HST***: WFPC2	3.0
☑ ***HST***: WF/PC-1	3.0
☑ ***HST***: FOS	1.0
☑ ***HST***: GHRS	1.0
☑ ***HST***: STIS	3.0
☑ ***HST***: NICMOS	5.0
☑ ***HST***: FOC	3.0
☐ ***HST***: FGS	3.0
☐ ***HST***: HSP	3.0
☑ ***FUSE***	1.0
☑ ***IUE***	1.0
☑ ***EUVE***	1.0
☑ ***Copernicus (Raw)***	1.0
☑ ***UIT***	1.0
☑ ***HUT***	1.0
☑ ***WUPPE***	1.0
☑ ***BEFS***	1.0
☑ ***IMAPS***	1.0

Mark all | Unmark all

Show catalog entries that match [any] of the selected missions

Display [10] rows per mission

Submit query | Reset form | *Help...*

archive@stsci.edu

MAST/Abell Clusters Cross Correlation Help

This page explains how to use the MAST/Abell Clusters cross-correlator.

You can use this page to cross-correlate subsets of the Abell Clusters catalog with the currently archived MAST missions. To use the form, simply indicate the redshift range, visual magnitude range (see below), richness class(es), and/or a range of galactic coordinates that define the subset of the clusters that you're interested in, and which missions you want to cross correlate this subset with. You can optionally specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will then extract the subset of the Abell Clusters catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed the clusters. The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

A note about the search radius: Abell clusters can be large, so a search radius on the order of the instrument aperture may be too small. We have therefore defined radii for all of the clusters for which we have a valid redshift. The search radius will be the cluster radius (in arcminutes) *plus* the aperture radius for the instrument. (Clusters for which a radius has not been defined- because a redshift was not available- will be searched on the aperture radius alone.)

Richness Class

The richness class of the cluster.

You may select one or more richness class. If you select more than one, then the cross-correlator will find clusters that fall into any one of the selected classes.

Redshift

The redshift of the cluster, expressed as z. You can enter a range of floating point numbers here in any of the following ways:

Qualification	Meaning
> .75	*z* greater than .75
< .3	*z* less than .3
.3 .. .75	*z* between .3 and .75
.3	*z* of exactly .3

Mag 10

The visual magnitude (*V*) of the 10th-brightest galaxy in the cluster. This field can accept a range of floating point numbers:

Qualification	Meaning
> 18	*V* greater (dimmer) than 18
< 22	*V* less (brighter) than 22
18.5 .. 22.5	*V* between 18.5 and 22.5
18.0	*V* of exactly 18

Galactic Longitude Range

Galactic longitude range (*lii*). Use this field to restrict the catalog to a range of galactic longitudes.

This field can accept a range of floating point numbers:

Qualification	Meaning
> 270	*lii* greater than 270 degrees
< 30	*lii* less than 30 degrees
160 .. 200	*lii* between 160 and 200 degrees
< 30, > 270	*lii* between 270 and 30 degrees (including 0 degrees)

If you enter a single floating-point number, the cross-correlator will try to match that number exactly, so this probably isn't a useful way to qualify this field.

Galactic Latitude Range

Galactic latitude range (*bii*). Use this field to restrict the catalog to a range of galactic latitudes.

This field can accept a range of floating point numbers:

Qualification	Meaning
> 60	*bii* greater than 60 degrees
< -60	*bii* less than -60 degrees
-30 .. 30	*bii* between -30 and +30 degrees
< -60, > 60	*bii* less than -60 or greater than +60 degrees

If you enter a single floating-point number, the cross-correlator will try to match that number exactly, so this probably isn't a useful way to qualify this field.

Missions

Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)

The radius in arcminutes on which to cross-correlate the mission with the object catalog catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions

When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission

Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

MAST Cross Correlation

Uploaded Catalog **Path to Your Local File** [ ] Browse... [1] **Column Delimiter** [Tab] **Dec Column Number** [2] **RA Column Number**	Mark all / Unmark all

	Missions	Radius (arcmin)
☑	*HST:* WFPC2	3.0
☑	*HST:* WF/PC-1	3.0
☑	*HST:* FOS	1.0
☑	*HST:* GHRS	1.0
☑	*HST:* STIS	3.0
☑	*HST:* NICMOS	5.0
☑	*HST:* FOC	3.0
☐	*HST:* FGS	3.0
☐	*HST:* HSP	3.0
☑	*FUSE*	1.0
☑	*IUE*	1.0
☑	*EUVE*	1.0
☑	*Copernicus (Raw)*	1.0
☑	*UIT*	1.0
☑	*HUT*	1.0
☑	*WUPPE*	1.0
☑	*BEFS*	1.0
☑	*IMAPS*	1.0

Mark all / Unmark all

Show catalog entries that match [any] **of the selected missions** **Display** [10] **rows per mission**

Submit form | Reset form | *Help...*

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MAST Cross Correlation Help

This page explains how to use the MAST cross-correlator.

You can use this page to cross-correlate a list of sky positions with the HST, IUE, and EUVE archives. To use the form, you will need a file containing the list of sky positions you want to use as an input catalog. The format of this file is discussed below. Also, select which missions you want to cross correlate this input catalog with. You can optionally specify a search radius for each mission different form the default given in the page.

The MAST cross-correlator will then parse your input catalog and begin polling the selected mission databases to see which missions have observations at your catalog potisions. The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions.

Format of the Input File

The input file should have one entry per row; blank lines and lines beginning with a # character will be ignored. Each row should contain columns delimited by one of the column-delimiting characters shown in the Column Delimiter popup menu in the form. (currently, these are tab, comma, pipe, semicolon, and colon). The RA and Dec can appear in any column. (Currently, the coordinates will be assumed to be equatorial with an equinox of J2000.)

Here are some examples of input-file formats:

- Comma-delimited file, RA in column 1, Dec in column 2:

```
240.083157,-22.621305,HD143275
261.347982,-56.377399,HD157246
67.278648,-13.048497,HD28497
24.426019,-57.236367,HD10144
```

- Pipe-delimited file, RA in column 2, Dec in column 3:

```
HD143275 | 16:00:19 | -22:37:16
HD157246 | 17:25:23 | -56:22:38
HD28497  | 04:29:06 | -13:02:54
HD10144  | 01:37:42 | -57:14:10
```

- Tab-delimited file, RA in column 1, Dec in column 2, with a comment line (which will be skipped):

```
# RA              Dec
16 00 19        -22 37 16
17 25 23        -56 22 38
04 29 06        -13 02 54
01 37 42        -57 14 10
```

Make sure that each column is separated by only one delimiter.

Once you have your input file, in the cross-correlation form, indicate the name of the file on your system, the character which delimits the columns (see below), and the column numbers of the RA and Dec (see below). Then hit the **Submit Query** button. Your browser will then send the contents of your input file to our server, which will search the Archive at the positions given in your input file. (Your file will not be saved on the server; it will be deleted as soon as the cross-correlation ends or the CGI script dies.)

Path to Your Local File
: The pathname to the catalog file on your disk. Your browser will send the contents of this file to the cross-correlator to use as an input catalog. Depending on your browser and your platform, you may need to give the full path to this file (e.g., `/home/kimball/xcorr.lis`).

Column Delimiter
: This is the character that delimits the columns in your file. The choice is currently limited to tab, comma, pipe (or vertical bar), semicolons, and colons. Let us know if you think something else would be useful here.

The cross-correlator currently cannot handle input lists of fixed-length records. When we work out a reasonable interface for this, however, we'll implement it.

RA Column Number, Dec Column Number
: These are the column numbers of the RA and Dec columns within your file. The first column is assumed to be column #1.

Sometimes a catalog will start with a column-delimiting character. For example, if your catalog looks like this:

```
| HD143275 | 16:00:19 | -22:37:16 |
| HD157246 | 17:25:23 | -56:22:38 |
| HD28497  | 04:29:06 | -13:02:54 |
| HD10144  | 01:37:42 | -57:14:10 |
```

then the cross-correlator will think that column 1 is always empty, so you should start counting columns at column #2. Therefore, in this example, the RA will be in column #3 and the Dec in column #4.

Missions
: Select one or more missions with which to cross-correlate your input catalog. You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match and catalog row in order for that row's results to be displayed.

Radius (arcmin)
: The radius in arcminutes on which to cross-correlate the mission with the input catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission. (Later on, we may break HST up into its individual instruments, treating each one like a separate mission. In that case, these fields will have default values appropriate for that instrument.)

Show catalog entries that match any/all of the selected missions
: When you select multiple missions, you can use this selector to control how a catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find entries observed with *either* HST *or* IUE.

Display *n* rows per mission
: Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

Cross-Mission Search Tools

The forms listed below offer a variety of cross-mission search options using either positions extracted from online catalogs, or user-specified target names or positions. Submitting any of the forms will return a table of entries listing the data available from the MAST archive for the target or targets of interest. The "MAST Scrapbook" form will return a table of representative data sets as well as a set of thumbnail images displaying either a plot of the spectrum or the image.

Form	Help	Description
MAST Scrapbook		Lists and displays representative spectra or images from the MAST archive based on user-specified target name or coordinates.
Single Target quick search		Cross-correlation search based on user-specified target name or coordinates.
Hipparcos Catalog		Make cuts on the Hipparcos Catalog and cross-correlate them with MAST's holdings.
SKY2000 Catalog		Query the SKY2000 Catalog (version 3) and cross-correlate results with MAST's holdings.
Active Galactic Nuclei		Make cuts on our catalog of AGN, derived from the Veron-Cetty and Veron (1996) catalog, and cross-correlate them with MAST's holdings.
Abell Galaxy Clusters		Make cuts on the Abell Galaxy Clusters catalog (including the supplementary southen catalog), and cross-correlate them with MAST's holdings.
User-Supplied Catalog		Upload your own list of equatorial sky positions to cross-correlate with MAST's holdings.

MAST Scrapbook

Search the MAST catalog of representative spectra or images for an astronomical object. Enter a target name or coordinates (see help for other options). Only fixed targets (i.e., no solar system objects) are available. A table of results will be displayed along with thumbnails of images or spectra.

Target: [ ] Data Type : (•) Spectra ( ) Images

Search Criteria: Coordinates

Name Resolver : (ignored for mission target name search) SIMBAD

Search Radius (arcmin): (coordinate search only) 3.0 Max thumbnails per mission: 10

Submit Query | Reset | Help

What's New Help

Overview

In order to allow more specific listings of changes within MAST, the user may now select both the mission and time period for which to view changes. Once these options are choosen, clicking **GO** will generate and display the requested list of changes.

The **What's New** links available from the individual mission pages access the same master list of changes, but the link is hardcoded with the mission name and a time period of 1 year. In other words, clicking the Whats New link from the mission pages will display changes for that particular mission made during the past year.

Mission
: This entry specifies the mission for which to view changes. Besides the current MAST-supported missions (i.e., BEFS, COPERNICUS, DSS, EUVE, FIRST, FUSE, HST, HUT, IUE, IMAPS, ROSAT, UIT, and WUPPE), one may also select ALL (the default selection) or OTHER, which describes general changes not related to a particular mission (note ALL includes OTHER).

Time Period
: The period of time over which to view MAST-related changes, starting from the day the list is generated. The current options include: last month, last 3 months (the default), last 6 months, last year, and all.

IUE Archive Search

Important downtime notice

Object Name	Resolver		
	◉ SIMBAD ○ NED ○ Don't resolve	Get coordinates	
RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

International Ultraviolet Explorer

Exp Time	Obs Date	Program ID

Class
01 EARTH
02 MOON
03 PLANET
04 PLANETARY SATELLITE
05 MINOR PLANET
06 COMET

Camera:	☑ LWP	☑ LWR	☑ SWP
Dispersion:	☑ Low	☑ High	
Aperture:	☑ Large	☑ Small	
Image ID			

SEARCH | Clear form | Reset to defaults | Help...

Output Options

Output columns
Mark
Image ID
Camera
Image
Object Name
Disp
Aper

Sort output by:
1. Camera ☐ *reverse*
2. Image ☐ *reverse*
3. Disp ☐ *reverse*

Maximum number of hits
100

Output Equinox
J2000

☐ Show SQL query

Getting Started
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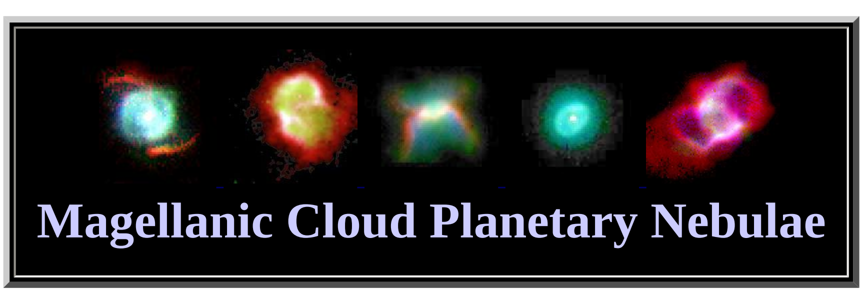
Sloan Digital Sky Survey Quasar Catalog

The Sloan Digital Sky Survey Quasar Catalog consists of 3814 objects (3000 discovered by the SDSS) contained in the initial public release. Each object has at least 1 emission line with a full width at half maximum larger than 1000 km/s, luminosities brighter than M(i*)=-23 and highly reliable redshifts. The area covered by the catalog is 494 square degrees; most of the objects were found in SDSS commissioning data using a multicolor selection technique. The quasar redshifts range from 0.15-5.03.

Calibrated spectra of all objects in the catalog, from 3800-9200 Angstroms, are also available in a gzipped tar file.

Notes: the sample is not homogeneous and is not intended for statistical analysis. The lead author is Donald Schneider from the Dept. of Astronomy and Astrophysics at Penn State University (dps@astro.psu.edu). This sample is the preferred quasar catalog for Sloan analysis, and should supercede the quasar catalog in the EDR.

- PostScript file of the paper as submitted to the Astronomical Journal in October 2001. (1.3 Mbytes)
- ASCII Catalog (0.7 Mbytes)
- A gzipped (compressed) tarfile containing a FITS spectrum for each of the 3814 quasars: edrqsosp.tar.gz (WARNING: very large filesize of 245 MBytes, 623 MBytes uncompressed)
- A web-based EDR QUASAR search interface, developed by MAST, allows you to search the EDR Quasar catalog and retrieve individual spectra. A "simple" and an "advanced" interface are both available. This interface is a generic MAST data retrieval interface, under development by MAST. Comments to archive@stsci.edu are welcome.



Planetary nebulae (PNs) are the gaseous relics of the outermost red giant layers, ejected as a superwind after the Asymptotic Giant Branch (AGB) phase. They carry a wealth of information on the evolution of their progenitor stars, and they retain information on the galaxian environment at the time of the formation of their progenitors. In short, they are the ideal probes of stellar evolution and formation of those stars that undergo the AGB phase.

The importance of studying Magellanic Cloud Planetary Nebulae (MCPN) is twofold: it allows the determination of physical parameters of PNs and their central stars, since their distances are known (as opposed to Galactic PN distances, that suffer large uncertainties); and they are the ideal probes of stellar evolution in low-metallicity galaxies. Small Magellanic Cloud PNs are probably the only direct way to study evolved stellar populations in a very low metallicity environment.

Our project is based on Hubble Space Telescope (HST) imaging with STIS and WFPC2, and optical and ultraviolet slitless spectroscopy. Only with HST can Magellanic Cloud PNs be resolved in their sizes and shapes, and their central stars can be detected. Ground based spectroscopic studies have been used to determine the plasma abundance of the nebulae.

Web site contents

- Home: project highlights and current events
- Observations: listing of our observations and access to calibrated FITS data
- Images: collections of GIF images for easy viewing and comparison
- Analysis: object coordinates, dimensions, fluxes, classifications, and notes
- Papers: published journal articles, conference proceedings and posters
- Links to related web sites: background/educational information, galactic planetary nebulae galleries

The MCPN project team

Letizia Stanghellini (STScI), Richard Shaw (NOAO), Max Mutchler (STScI), J. Chris Blades (STScI), Eva Villaver (STScI), Bruce Balick (Univ. of Washington), Stacy Palen (Univ. of Washington), George Jacoby (NOAO/WIYN), Mike Dopita (MSSSO), Orsola DeMarco (ANHM)

WFPC2 Pointings

Coordinates: Choose either a more traditional search by Target Name/Coordinate, or the serendipitous approach, to search by RA/Dec/Galatic Latitude and/or Ecliptic Latitude ranges. You do not have to search by coordinates at all.

Target Name/Coordinates Resolver SIMBAD Radius (arcmin) 3.0

RA Range degrees **Dec Range** degrees

Galactic Latitude Above & Below Plane > ± degrees

Ecliptic Latitude Above & Below Plane > ± degrees

Band: To search for specific bands, enter the number of exposures required per band (e.g. 4, >1, or <10). Specify if the search is to be for all specified bands (and) or any of the specified bands (or).

And Or

U B V R I Narrow Line

Exposure Times: To query on exposure times, enter exposure limits (in seconds) for the total exposure time in each band (e.g. >1000, or <10). Specify if the search is to be for all specified bands (and) or any of the specified bands (or).

And Or

U B V R I Narrow Line

# of Unique Bands | Total # of Exposures | # of Days between first & last exp. | Min. Total Exposure Time

Max Number of Pointings displayed: 100

Submit Query Reset Help

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MAST Pointings Help

Help Index:

Introduction

The MAST "Pointings" interface allows a user to search for WFPC2 exposures in a new powerful way. We have assembled a searchable data table that allows users to look for sky regions (or pointings) which have been observed more than N times, observed with 2 or more filters, or has been observed more than twice with a time separation of more than (or less than) N days. An exposure is defined to be the file created after the shutter closes. (So a CR-SPLIT results in at least 2 exposures.) All exposures within a 40 arcsecond radius are considered one "pointing". The total number of exposures within the U, B, V, R, I and for Narrow Line filters were tallied for each pointing. Included in the table are the total number of exposures for a pointing and the number of unique bands. Each band is defined by 3-4 WFPC2 filters (see Table). Filters not in this table, or exposures made with more than one filter were classified as "other" and were included in the total number of exposures. Note that an individual dataset might cover one or more pointings. The table also lists the date/time of first and last exposure for every pointing.

Because the definition of a "pointing" is a little arbitrary, results from this table should be regarded as a starting point for a continued search and subsequent retrieval request.

An example of the kind of query this table will allow is: How many high galactic latitude observations exist [for RA between 9 - 18 hours in the northern hemisphere (dec > -20) observable from the northern hemisphere in the early spring] where there has been at least two observations, and where at least one of those observerations was in the I-band, and at least one of those observations was in any other filter?

Galactic Latitude Above & below plane +/- > 20.0 degrees
Band I >0
Number of Unique Bands >1
Total Number of Exposures >1
RA 09..18
Dec >-20.0

Filter choice for all bands					
U	**B**	**V**	**R**	**I**	**Line**
F300W	F450W	F606W	F702W	F814W	F656N
F336W	F439W	F555W	F675W	F791W	F673N
F255W	F467M	F569W	F622W	F785LP	F502N
F380W	F410M	F547M			F658N

Input Parameters

This section describes the options available

Coordinate Query Options
The first section of the search form contains the various coordinate search options that may be included in the query. Note that the RA/Dec range options may be combined with either the galactic or ecliptic latitude options. Entering a target name or specific coordinates for Target Name/Equatorial Coordinates however, may not be combined with the other coordinate search options.

Target Name/Equatorial Coordinates
Enter the name or the coordinates of the astronomical object of interest.
- If you specify the name to be resolved for the "Coordinates" or "Resolved Target Name" search, use standard nomenclature as utilized by SIMBAD or NED for best results.
- For the "Mission Target Name" search mode only, a "%" can be used as a wildcard and all names are converted to upper-case; e.g., entering "r136%" will return all entries in which the mission object name begins with R136.
- To specify coordinates, enter J2000 RA and DEC as decimal degrees or as hours, minutes, and seconds. Several formats will be recognized as coordinates:
  - decimal degrees e.g. 65.4975 19.535 or 65.4975, +19.535
  - hours minutes seconds e.g. 4 21 59.4, 19 32 6 or 4 21 59.4 19 32 6
  - hours minutes, deg minutes e.g. 4 21 19 32 or 4 21, 19 32

Name Resolver
Select either SIMBAD (the default) or NED for name resolution. If the name is not found within either database, try entering coordinates (J2000) instead of a target name. This parameter applies only to the "Target Name/Coordinates" search option.

Search Radius
Enter the coordinate search radius in arcminutes. The default of 3 arcmin will work for many objects, but a smaller radius may be needed in crowded fields. A larger radius may be needed to locate a large extended object. This parameter applies only to the "Target Name/Coordinates" search option.

RA/DEC Range
Specify a start & end RA and/or DEC in decimal degrees (J2000) using the "x .. y" syntax. For example, to search for all pointings between 10 and 30 degrees, enter: **10 .. 30** . Other possible conditions include: **<, >, <=,** or **>=** .

Galactic Latitude
Search on galactic latitude.
- **Above & Below Plane >:** ± Search above or below the galactic plane using designated latitude. e.g. entering 20 in > box will result in search where galactic latitude > +20 and < -20.
- **Within Plane <** ± Search within the galactic plane the galactic plane using designated latitude. e.g. entering 20 in the box will result in search where galactic latitude < +20 and > -20.
- **>** Search where galactic latitude is greater than number entered: e.g. entering 20 in the box will result in search where galactic latitude > 20
- **<** Search where galactic latitude is less than number entered: e.g. entering 20 in the box will result in search where galactic latitude < 20.

Ecliptic Latitude
Search on ecliptic latitude.
- **Above & Below Plane >** ± Search above or below the ecliptic plane using designated latitude. e.g. entering 20 in > box will result in search where ecliptic latitude > +20 and < -20.
- **Within Plane <** ± Search within the ecliptic plane the ecliptic plane using designated latitude. e.g. entering 20 in the box will result in search where ecliptic latitude < +20 and > -20.
- **>** Search where ecliptic latitude is greater than number entered: e.g. entering 20 in the box will result in search where ecliptic latitude > 20
- **<** Search where ecliptic latitude is less than number entered: e.g. entering 20 in the box will result in search where ecliptic latitude < 20

Band
Specify specific bands for the search. If nothing is entered into any bands, bands are not used for search criteria.

Specify if selection is to be on all bands chosen (and) or on any of the bands chosen.
- **And** Select on all bands designated
- **Or** select on any bands chosen
- **U** Enter the number of U band exposures required (e.g. 2, >=2, <10)
- **B** Enter the number of B band exposures required (e.g. 2, >=2, <10)
- **V** Enter the number of V band exposures required (e.g. 2, >=2, <10)
- **R** Enter the number of R band exposures required (e.g. 2, >=2, <10)
- **I** Enter the number of I band exposures required (e.g. 2, >=2, <10)
- **Line** Enter the number of Narrow band exposures required (e.g. 2, >=2, <10)

The filter numbers in the table refer to wavelength in nanometers.

Filter choice for all bands					
U	**B**	**V**	**R**	**I**	**Line**
F300W	F450W	F606W	F702W	F814W	F656N
F336W	F439W	F555W	F675W	F791W	F673N
F255W	F467M	F569W	F622W	F785LP	F502N
F380W	F410M	F547M			F658N

Exposure Times
Enter exposure limits (in seconds) for the total exposure time in each desired band (e.g. >1000, or <10). You may also specify if the search is to be for all specified bands (and) or any of the specified bands (or). For example, specifying "And" and entering >100 for "U" and >100 for "B" will return pointings for which the total exposure times are > 100 seconds in the U filter and > 100 seconds in the B filter. Specifying "Or" would return all pointings for which the total exposure times are > 100 seconds in the U filter or > 100 seconds in the B filter.

Number of Unique Bands
Enter a restriction for the number of unique filters.

Number of Exposures
Enter the number of for the total number of exposures e.g. <30

Number of Days between first and last exposure
Enter the number of days required between the first and last exposure. Entering >365 will look for pointings with exposures taken at least a year apart.

Submit Query
Click on this button to begin the query. The Pointings Tables will be searched for entries which meet the specified search criteria. The result may be none, one, or many objects. You may wish to redo the search with a smaller search radius in a crowded field, or using different search criteria.

Reset
Clicking reset will return the form to its default values.

Maximum Number of Pointings Displayed
The maximum number of rows (i.e., pointings) to be displayed on the search results page. Allowed values are 10, 100, 500, 1000, and 5000. The default is 100. Note displaying more rows will increase execution time.

Help
Clicking help will display this help file. If you still have trouble, please e-mail your question to archive@stsci.edu.

Output

The output of your query will include three parts:

- A summary section including a definition of the query used to interrogate the database, and a summary table containing the total number of pointings found, the total number of unique exposures found, etc. (See summary table heading descriptions below.)
- A table of pointing entrees in which each row represents one pointing matching the users search criteria. See descritpion of pointings table below.
- Links in the above two tables allow a third table to be displayed which describes information about the individual exposures contained in the selected pointing or pointings. (See exposures table description below.)

Summary Table

This table summarizes the search results. Note that clicking on the filter entrees in either the Summary table or the Pointings table will display the individual exposures described by the table entry. The summary table column headings are described below.

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page. Currently only information concerning HST/WFPC2 pointings are avaiable in the pointings table.

# of Pointings
Total number of pointings found for a given query, where a pointing is defined as a group of exposures falling within a 40 arcsecond radius.

Exposures
Total number of **unique** exposures for the specified search criteria (i.e., exposures contained in 2 or more pointings are only counted once).

U
Total number of **unique** exposures taken with a U band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "U" column of the pointings search results table).

B
Total number of **unique** exposures taken with a B band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "B" column of the pointings search results table).

V
Total number of **unique** exposures taken with a V band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "V" column of the pointings search results table).

R
Total number of **unique** exposures taken with a R band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "R" column of the pointings search results table).

I
Total number of **unique** exposures taken with a I band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "I" column of the pointings search results table).

Line
Total number of **unique** exposures taken with a Narrow band filter (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "Line" column of the pointings search results table).

Other
Total number of **unique** exposures taken with any filter or filter combination not explicity assigned to a band. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "Other" column of the pointings search results table).

Exposure Display Format
Clicking on the filter totals in the summary table will run a script to display the unique exposures for that particular filter and selected search criteria. The default **"retrieval list"** format will display data set names in an html table with options for downloading files. The **"print list"** option displays a comma-separated list of data set names which can be cut and pasted into other data retrieval tools. The **"file list"** option writes the list of data set names (one per line) to a file (dsn.txt) which can be downloaded to the users computer.

Maximum Number of Exposures Displayed
The maximum number of rows (i.e., exposures) to be displayed on the exposure search results page. Allowed values are 50, 100, 500, 1000, and 5000. The default is 100. Note displaying a large number of rows will increase execution time and displaying a large number of buttons may cause some browsers problems.

Found Pointings Table

Each row of the pointings table contains information on the exposures within one pointing. The non-zero "U", "B", "V", "R", "I", "LINE", or "OTHER" filter entries contain two numbers: the total number of exposures taken with a given filter (upper number), and the sum of the exposure times for those exposures in seconds (lower number). Clicking on the upper number will display the exposures table (see below). The pointings table column headings are described below.

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page. Currently only information concerning HST/WFPC2 pointings are avaiable in the pointings table.

RA (2000), Dec (2000)
The right ascension and declination in J2000 epoch as defined for a particular pointing.

Galatic Latitude and Longitude
The galactic latitude and longitude as listed in the pointings table, as calculated from the J2000 ra and dec in the mission catalog.

Ecliptic Latitude and Longitude
The ecliptic latitude and longitude as listed in the pointings table, as calculated from the J2000 ra and dec in the mission catalog.

Angular Separation
When performing equatorial coordinate searches, the angular separation (radius), given in arcminutes, between the SIMBAD (or NED) coordinates and the coordinates listed in the pointings table.

Total
Total number of exposures counted for the pointing.

U
Total number of exposures taken with "U band filters" counted for the pointing.
B
Total number of exposures taken with "B band filters" counted for the pointing.
V
Total number of exposures taken with "V band filters" counted for the pointing.
R
Total number of exposures taken with "R band filters" counted for the pointing.
I
Total number of exposures taken with "I band filters" counted for the pointing.
Other
Total number of exposures taken with any other filter or filter combination for this pointing.
Line
Total number of exposures taken with "Narrow band filters" counted for the pointing.
Unique
Total number of unique bands within this pointing.
First Date
The date of observation the earliest exposure for this pointing was acquired.
Last Date
The date of observation the latest exposure for this pointing was acquired.

Exposures Table

This table lists the individual exposures and data set names associated with the pointings selected from the pointings search results page. Options on the search results page control both the page format (i.e., html table or comma-separated list), and the maximum number of entries displayed. The html table format allows the display of preview images and data retrieval. Column headings are described below.

Row
The row number in the results.

Mark
Mark this dataset for retrieval by pressing this checkbox. After you have marked for retrieval all the datasets that you're interested in, hit the **Retrieve Marked Datasets for Retrieval** button to initiate the retrieval.

Dataset Name
The unique identifier for an HST observation. This value is hyperlinked. By clicking on it, you can display a preview image of the observation.

Target
The name of the target of the observation, as given by the proposer.

PEP ID
The ID number of the observing program. Clicking on an entry in this field will display the HST proposal search page containing the proposal title, PI's name, abstract, ads links to published papers, and a table of all known observations.

Occasionally, you will see target names like `PAR`, `UNKNOWN-TARGET`, and so on; these are (most likely) parallel observations, which are observations done by one instrument while another is making the primary observing of the telescope's visit.

RA
The equatorial right ascension of the instrument aperture, in equinox J2000.

(For the WFPC2, the aperture right ascension coincides with the V1 right ascension, which is the middle of the field of view.)

Dec
The equatorial declination of the instrument aperture, in equinox J2000.

(For the WFPC2, the aperture declination coincides with the V1 declination, which is the middle of the field of view.)

V3 Position Angle

The V3 position angle (PA_V3) is the direction in degrees east from north that the tip of the L shape formed by the 3 WF chips would point, if the L shape is imagined to form the tip of an arrow. (see WFPC2 Position & Orientation). The V3 position angle is 180 degrees different (exactly opposite in direction) rom the U3 position angle, which is specified by the observer during the Phase 2 proposal process as the "ORIENT".

Exposure Time
The exposure time of the observation, in seconds.

Filter
The HST filter used for the observation.

Observation Date
The starting date and time of the observation (GMT).

Release Date
HST data has a nominal proprietary period of one year (though in special cases, this may be shortened or extended). The Release Date field gives the end of the dataset's proprietary period.

On-the-Fly Reprocessing of HST Data

Welcome to the STScI OTFR WWW site.

Through OTFR, Hubble archive users can obtain data that are processed with the latest calibration files, software, and data parameters. The OTFR system reconstructs the data files with update headers and calibrates data when processing a user's request for the data from the archive. WFPC2, NICMOS, and STIS data can now be retrieved with OTFR system.

The raw data returned to users through OTFR is reconstructed from telemetry files to include updates to data parameters.

The following links provide information for users:

- Description
- Instructions

What's New for MAST during last 6 months

- **WUPPE Added to MAST Scrapbook**
  2002 March 15
  Representative spectra from the ASTRO WUPPE mission have been added to the MAST scrapbook available at http://archive.stsci.edu/scrapbook.html

- **New WUPPE Preview Files**
  2002 February 28
  The WUPPE Preview files have been updated following the format adopted for the other MAST missions. Besides a plot showing flux, polarization, and polarization position angle as a function of wavelength, there are now links to display the FITS header, display the ASCII table file, display/customize a plot of flux versus wavelength, and download data in FITS format. Links to known literature references are also displayed.

- **More MAST mission data now on-line**
  2002 February 27
  All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

- **Larger Staging area for HST and FUSE data**
  2002 February 27
  The staging area for HST and FUSE data retrieved with the HOST option has been significantly increased to around 500 GB from 27GB.

- **Name Resolver Option Available in Cross Correlation search**
  2002 January 15
  The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

- **New MAST/ADS Data Links**
  2002 January 11
  The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

- **Coplotting Option now available for IUE Spectra**
  2001 December 10
  A new option is available on the search results page of the IUE search script which allows users to coplot up to 15 selected IUE spectra and interactively rescale the resulting plot.

- **New Interface for SDSS EDR Quasar Data**
  2001 December 3
  A web-based search and spectra retrieval interface for the SDSS EDR Quasar catalog and spectra, is now available at http://archive.stsci.edu/sdss/quasars/. The interface is based on a generic MAST interface we are developing and comments and suggestions, as always, are welcome at archive@stsci.edu.

- **Magellanic Cloud Planetary Nebulae Data Sets now Available**
  2001 November 15
  HST prepared datasets of the Magellanic Cloud Planetary Nebulae are now available.

- **HST Literature Links Update**
  2001 November 13
  The HST reference database table entries (and ADS data links) are now complete through the first half of this year.

- **EUVE Previews Updated**
  2001 October 24
  Preview files were made available for the last 83 EUVE observations obtained in 2000 and 2001.

- **New Plotting Option Offered in MAST Scrapbook**
  2001 October 18
  A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

- **Exposure time searches offered for WFPC2 Pointings**
  2001 September 27
  The WFPC2 Pointings search form now allows searches to be performed on total exposure times. See the pointings help page for more information.

- **OTFR Implemented for NICMOS Data**
  2001 September 26
  As of today, all requests for archived NICMOS data will utilize the On-the-fly Reprocessing (OTFR) system.

FAQ Help

Overview

Welcome to the MAST Frequently Asked Question (FAQ) help page. If you don't see an answer to your question, or have suggestions for adding new FAQs, please contact the archive help desk at the e-mail address shown at the bottom right of this page.

The FAQ links on the various mission pages will display all the FAQs specific to that mission. A form shown at the top of the FAQ page however will allow FAQs from other missions and/or specific categories to be displayed. To use the form, simply select the mission and/or category from the menu list and click "GO".

Mission/Category

This entry specifies the mission for which to view FAQs. Note that for some missions, the MAST pages simply link to FAQ pages maintained at remote sites and will therefore have a different appearance and format. This currently applies to FUSE, VLA-FIRST, and ROSAT. MAST FAQs currently exist for the remaining MAST-supported missions. A general FAQ page also exists for MAST itself.

If a category follows the mission name separated by a "/", only the FAQ's for that particular category will be displayed. If only the mission name is selected, all the missions FAQs will be displayed.

STScI Archive Manual

Version 7.0
June 1999

Send comments or corrections to:

E-mail: archive@stsci.edu

Revision History

Version 3.0 January 1993, edited by Stefi Baum
Version 4.0 February 1994, edited by Kirk Borne
Version 5.0 December 1994, edited by Andy Fruchter
Version 6.0 September 1996, edited by Megan Donahue
Version 7.0 June 1999, edited by Paolo Padovani

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for the National Aeronautics and Space Administration

Data Systems Division/Archive Branch
3700 San Martin Drive
Baltimore, Maryland 21218

SPACE
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Data Reduction/Analysis

Reading/Writing IUE data in FITS

- IUEDAC Routines for Reading/Writing IUE FITS Files
- IRAF Routines for Reading/Writing IUE FITS Files

Software Packages

- IUEDAC - IUE IDL library
- IUEDAC User's Guide
- Starlink and IUEDR software
- MIDAS data analysis software (for NEWSIPS data)
- IRAF/STSDAS IUE calibration software
- Contributed Software

Instrumentation/Operations

Mission Operations

Spacecraft Description

Science Instrument Description

IUE Observing Guide

History of the Project

GSFC Observing Scripts - a form for displaying GSFC observing scripts (or preview images) for a specified camera and image sequence number.

IUE Observing Programs - a very long list.

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Project Publications

MAST Electronic Newsletters

IUE Electronic Newsletters

NASA IUE Newsletters

IUE Observing Guide

IUESIPS Image Processing Information Manual

NEWSIPS Image Processing Information Manual

IUE Data Analysis Center User's Guide

Project Publications

- GO Handbook
- Data Products Guide
- Software Users Guide
- Electronic Newsletters

Data Reduction/Analysis

- Analyzing Individual Scans - Examples of analyzing raw data scans.
- Reading Copernicus Files
- Early Project Memos - The following are early Copernicus memos (HTML versions courtesy of Jim Caplinger, CSC) describing various aspects of Copernicus data. The following individual articles are included:
  1. Stray Light in PEP - 8 December 1972
  2. Stray Light in PEP, II - 15 December 1972
  3. Scattered Light in U1 - 2 March 1973
  4. Background in *Copernicus* Data Tubes - 9 December 1974
  5. U1 Instrumental Profile - 11 April 1975
  6. Corrections to the U2 Wavelength Scale Between 1026 and 1110Å - 7 January 1976
  7. Spurious Emission Line Detection - 12 January 1976
  8. Sensitivity Loss in *Copernicus* - 8 September 1982
- Background Issues - a look at the sources of background counts in scans.
- Common Data Problems - including data register overflow, changes in the particle background (South Atlantic Anomaly), tracking errors, and other glitches.
- Photometric Reductions - describes the photometric corrections used for the Copernicus Spectral Atlases by Rogerson, et al. including a discussion on correcting for guidance variations.
- Observation Time Correction - describes the algorithm used to duplicate the start and end observation times found listed in old Copernicus computer printouts.

Instrumentation/Operations

- Spacecraft Description - Section III of the Guest Observers guide describing the Princeton Experiment.
- Instrument Description - Description of Copernicus spectrometer.
- Instrument Performance - Excerpts from the final Copernicus Operations Report.
- Guest Observer's Guide - Second edition prepared in April,1975 by Ted Snow.

Project Publications

Instrument and Data Descriptions

"The Ultraviolet Imaging Telescope: Design and Performance," T.P. Stecher, G.R. Baker, D.D. Bartoe, F.H. Bauer, A. Blum, R.C. Bohlin, H.R. Butcher, P.C. Chen, N.R. Collins, R.H. Cornett, J.J. Deily, M.R. Greason, G.S. Hennessy, J.K. Hill, R.S. Hill, P.M.N. Hintzen, J.E. Isensee, P.J. Kenny, W.B. Landsman, D.L. Linard, S.P. Maran, S.G. Neff, G.R. Nichols, J. Novello, R.W. O'Connell, J.D. Offenberg, R.A. Parise, B.B. Pfarr, T.B. Plummer, F.F. Richardson, M.S. Roberts, S.D. Sitko, A.M. Smith, A.K. Stober, J.D. Stolarik, and J.C. Tebay. 1992,ApJ,395,L1

"Correcting the Distortion of Images Taken With the Ultraviolet Imaging Telescope," M.R. Greason, J.D. Offenberg, R.H.Cornett R.S. Hill, and T.P. Stecher. 1994,PASP,106,1151

"The Ultraviolet Imaging Telescope: Instrument and Data Characteristics," Stecher, T.P. Cornett, R.H., Greason, M.R., Landsman, W.B., Hill, J.K., Hill, R.S., Bohlin, R.C., Chen, P.C., Collins, N.R., Fanelli, M.N., Hollis, J.I., Neff, S.G., O'Connell, R.W., Offenberg, J.D., Parise, R.A., Parker,J., Roberts, M.S., Smith, A.M., and Waller, W.H. 1997,PASP,109,584.

Catalogs

"UIT Near Ultraviolet Bright Objects Catalog," E.P. Smith, A.J. Pica, R.C. Bohlin, R.H. Cornett, M.N. Fanelli, W.B. Landsman, R.W. O'Connell, M.S. Roberts, A.M. Smith, and T.P. Stecher. 1996,ApJS,104,287

Lists of Scientific Publications

UIT Papers from the ASTRO Missions, compiled by UIT project, covers 1992 - 1998.

WUPPE Target Search

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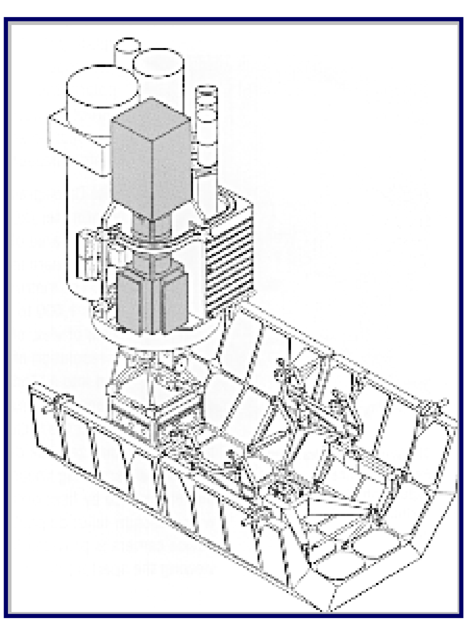
Instrument Description

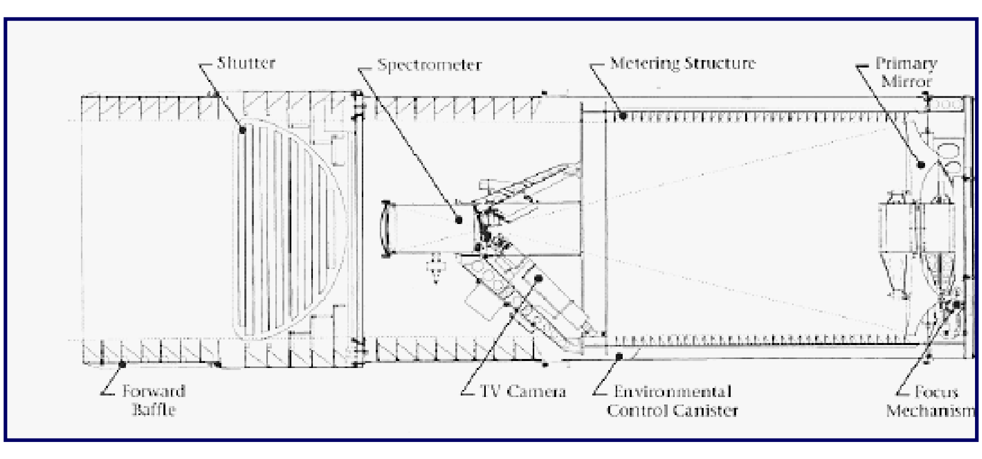
- **Developing Institution:** *University of Wisconsin*
- **Telescope Optics:** *Cassegrain system, f/10 focal ratio*
- **Instrument:** *Spectropolarimeter with dual electronic diode array detectors*
- **Primary Mirror:** *50 centimeters (20 inches) diameter*
- **Field of View:** *3.3 x 4.4 arc-minutes*
- **Spectral Resolution:** *6 angstroms*
- **Wavelength Range:** *1,400 to 3,200 angstroms*
- **Magnitude Limit:** *16*
- **Weight:** *446 kilograms (981 pounds)*
- **Diameter:** *70 centimeters (28 inches)*
- **Length:** *3.7 meters (12.14 feet) length*

WUPPE was designed to obtain simultaneous spectra and polarization measurements from 1400 to 3300Å. WUPPE has a 0.5m f/10 classical Cassegrain telescope (area = 1,800 square centimeters, 279 square inches) and a spectropolarimeter, with a field of view of 3.3 by 4.4 arc-minutes and a resolution of 6 angstroms. The telescope feeds light to a low resolution spectrometer equipped with various polarimetric analyzers. The spectrometer is a modified Monk-Gilleson spectrometer: two rotating wheels are used to select the focal plane aperture and the polarimetric analyzer; a magnesium fluoride Wollaston polarizing beam-splitter placed between the aperture and the relay mirror splits the beam into two orthogonally-polarized spectra which fall on the detector. The detector consists of dual Reticon self-scanning linear arrays of 1024 pixel photodiodes (to detect both beams simultaneously) coupled by fiber optics to a microchannel plate intensifier with a cesium-telluride photocathode. A charge-coupled device camera is provided for target acquisition and for viewing the aperture during a measurement. The focal plane scale is 26 arcsec/mm and the dispersion is 78 Å/mm, blaze at 2000 Angstroms. A set of halfwave plates at 6 different angles provided spectropolarimetric modulation with 5 angstrom resolution on point sources through apertures from 6 to 40 arcsec. A "Lyot" analyzer was used to provide 50-100 angstrom spectropolarimetric resolution on faint point targets and diffuse nebulae.



Page taken from WUPPE Web site

Instrumentation and Operations



Principal Investigator:	Dr. Arthur F. Davidsen
Developing Institution:	The Johns Hopkins University
Telescope Optics:	90-centimeter (36-inch) aperture, f/2 focal ratio, silicon carbide-coated, parabolic mirror
Spectrograph:	Prime-focus, Rowland-circle design using a 600 line/mm grating coated with silicon carbide
Spectral Resolution:	3.0 angstroms
Wavelength Range:	825 to 1850 angstroms (first order)
	420 to 925 angstroms (second order)
Detector:	photon-counting
	microchannel-plate intensifier
	cesium iodide photocathode
	1024 element photo-diode array detector
Time Resolution:	1 ms in high time mode
	2 s in histogram mode
Dark Count Rate:	0.001 counts/Angstrom/s
Peak Effective Area:	35 sq. cm at 1200 angstroms
Sensitivity:	S/N of 10 per Angstrom in 1800 s for Flambda=3.3e-14 ergs/cm2/s/A
Weight:	789 kilograms (1736 pounds)
Dimensions:	1.1 meter (4 feet) diameter
	3.7 meters (12 feet) length
Field of View of Guide TV:	10 arc-minutes

The Hopkins Ultraviolet Telescope (HUT) was designed and built by members of the Center for Astrophysical Sciences and the Applied Physics Laboratory of The Johns Hopkins University in Baltimore, Maryland. HUT consists of a 90-centimeter (36-inch) f/2 mirror that focuses light from celestial sources onto a prime focus spectrograph.

Covering the 825-1850-angstrom region with about 3-angstrom resolution, HUT opened the astrophysically important 912 to 1200-angstrom window to detailed scrutiny for the first time. In typical 1800 s integrations, HUT observed faint astronomical objects with visual magnitudes of about 16.

Originally designed to explore the far- and extreme-ultraviolet ranges on Astro-1, HUT was modified for Astro-2 to concentrate on the far-ultraviolet. The changes made to HUT for Astro-2 included a new detector system and new silicon carbide coatings on the mirror and grating which replaced the original iridium and osmium. These improvements provided a factor of 2.3 increase in sensitivity in the primary operating range of 825 to 1850 angstroms, especially in the 912- to 1200-angstrom region unique to HUT.

This page taken from HUT Project web site.

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Electronic Newsletters

The electronic newsletters provide information about the various archives supported by the Multi-mission Archive at STScI (MAST). In addition to HST data, MAST also provides support for VLA First, IUE, Copernicus, EUVE, FUSE, HUT, UIT, WUPPE, BEFS, TUES, IMAPS-1, DSS, and GSC.

Archive of Newsletters

- June 2001
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- November 1998
- June 1998
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- Feb. 1998
- Nov. 1997

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Who do I contact for help with proposal preparation?

STScI is maintaining a hotseat from 9:00am to 5:00pm Eastern Time at 410-338-1082 or (toll-free in the U.S.) 800-544-8125, and e-mail to help@stsci.edu. There is also the ST European Coordinating Facility, at 49-89-320-06-291, email: stdesk@eso.org, as well as a list of contacts in Appendix A of the Call For Proposals.

If you have a question regarding Archive facilities used in preparing your proposal (such as duplication checking or the Planned and Archived Exposures Catalog), please contact us at archive@stsci.edu

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Can I do duplication checking on the web?

You can use the web-based duplication search to do check you proposals for duplication conflicts. Duplication checking is still available via StarView.

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Why can't I log into archive.stsci.edu as `guest` ?

The archive guest account has been discontinued. You can install StarView6 on your machine. You can also use the Web form. If neither of these approaches is sufficient to meet your needs, please let us know.

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How do I get the latest FOS calibrated data?

Improved calibrations for FOS data are available using STSDAS software available from the www.stecf.org web site. Additional FOS information is also available from this site.

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How can I retrieve HST data?

You'll need to register for a retrieval account. Your retrieval account will give you access to any science, calibration, or engineering data in the Archive. PIs need a special authorization attached to their retrieval accounts which allows them to retrieve proprietary data from their own proposals; see this answer for details. You can retrieve public data using one of the

following options:
- by installing and running StarView6 at your site;
- by using the HST Archive Search on the Web;
- The archive guest account has been discontinued.

The data can be retrieved either to the staging disk using the `HOST` option or directly to your own site using the `NET` option. Both options are now available via StarView6 or the HST Archive Searches on the Web.

If you use the `HOST` retrieval option, DADS will retrieve the data to the staging disk of the host machine listed in your retrieval completion message.

If you use the `NET` retrieval option, you will need to specify the machine address, login, password and directory where you wish the data to be retrieved.

> DADS will ftp the data directly to a directory on your computer. (Note that we protect your destination information when it is transferred to us with the same kind of secure-web mechanism that is used by commercial sites conducting online commerce.)

Note that the `NET` option is the only one available to retrieve proprietary data across the internet.

If internet transfers are not feasible, both public and authorized proprietary data can also be retrieved to tape-- just use the `TAPE` retrieval option. We will ship it to the address given in your account registration.

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I'm the PI on proposal xxxx. Can I use StarView or the Web to retrieve my data?

We're happy to tell you that you can! You can have your retrieval account set up so that you will be able to retrieve proprietary data from those proposals directly to a directory on your home machine.

Just send an email to archive@stsci.edu. Please note the proposal id's, and designate any others who you believe should have access to the data.

You can't retrieve *any* proprietary data to the Archive hosts; it has to be delivered to your machine using the `NET` option or to tape using the `TAPE` option.

You can also designate your co-investigators for this privilege.

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I'm the PI on proposal xxxx. Why can't I retrieve the data?

You can, but you'll need to let us know you want it. Currently, PIs do not receive automatic electronic access to their data. (This is a technical limitation, not a policy.) If you are the PI and want electronic access to your proposal, contact *archive@stsci.edu* and let us know the proposal ID and your archive username. We will attach the proper access privileges to your account to allow you to retrieve this data electronically.

You can also authorize co-investigators and co-workers to have electronic access as well. Just tell us the proposal ID and the names and archive usernames of those to whom you wish to grant access. (If they don't have accounts, or you're not sure if they do, then let us know their email addresses to we can help them set up accounts for access.)

Authorization may be set up only on a per-proposal basis; we cannot restrict access to certain data within the proposal.

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How do I get permission to retrieve my proprietary data and documents?

We ask that the PI send us an email (to archive@stsci.edu). In that email, note the proposal id's, and designate any others who you believe should have access to the data.

Once an individual is authorized for a particular proposal, they have access to all proprietary data in that proposal only.

Be sure to use the *`NET`* retrieval option!!

If while retrieving your data you get a message saying that the data are still proprietary, one of the following has happened:

- You are trying to retrieve the data to the Archive Host staging disk. The staging disk is an anonymous FTP area, so we can allow only non-proprietary data to be written to it. Have the data sent directly to your disk or sent to you on tape instead.
- We made a mistake and didn't properly authorize your account. This may be particularly true if you (for some reason) have more than one archive account.
- The data are under restriction, which means that they were found to duplicate planned or existing proprietary observations, and an access restriction has been placed on them until the data with which it conflicts is released.

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I forgot my password...

Don't worry, it happens to the best of us. Just call the Archive Hotseat and we'll reset it for you.

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How long should a retrieval take?

The retrieval time depends on a variety of factors:
- the type of data in the request. Some older data is stored offline and requires an operator's intervention.
- the size of the request- the larger the request the longer it takes, both to move the request up the queue , and to retrieve the data.
- the number of requests in the system at the time.
- the destination of the request. The internet connections between STScI and some sites, especially those overseas, is sometimes a significant source of delay.

If everything is running smoothly, expect a median turn around time of a few hours. If it takes more than one day, and you don't think any of the factors listed above are playing a significant role, please contact us.

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When I submit a request, it fails immediately, telling me my host password contains forbidden characters

There are 5 characters that are forbidden:
( ) * " /
In order to successfully submit a request, you will need to change you password to something not containing those characters. We hope to fix this eventually, as it can be a significant inconvenience.

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I submitted a retrieval, but never got a notice that my request was submitted and queued...

DADS may be down, so it's not reading its mail. The way a retrieval works is that StarView emails the request to DADS. (If you have your mailer set to automatically log outgoing mail, then you'll see these requests, in their encrypted form, in your outgoing mail folder.) DADS then reads its mail and puts your emailed request onto the retrieve queue.

If DADS is down, or is not reading its mail for some reason, then your message will be held in the folder until DADS comes back up, when it starts reading its mail and queueing requests again. That's when you'll be notified.

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I tried retrieving some data, but the staging disk is full...

Fortunately, this doesn't happen as often as it used to, since we installed a bigger staging disk on one of the Archive host machines. (You can check its capacity to be on the safe side.) However, if it does, you can either contact the Hotseat and we'll see if we can do anything to make room (usually by contacting other users and asking them if we can delete their data), or by resubmitting the request and having the data delivered directly to a directory on your home machine (`NET` option), rather than onto the staging disk.

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My request failed. Now what do I do?

If it failed for a reason you can identify (such as a mistyped password/directory/login or no space left on destination device) go ahead and resubmit the request with the necessary alterations. Once a request fails in DADS, it is dropped from the system.

We do not resubmit failed requests for users, you will need to do that yourself.

If the failure occurred for a reason that isn't clear, contact the Archive hotseat with a description of the failure and we will investigate.

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I submitted a request two days ago, and it hasn't finished yet.

Chances are it won't finish. Retrievals may have crashed and taken your request with it. We will contact you when that happens, but sometimes we may not be able to.

DADS retrieval times are dependent on the size of your request, the destination you specified and the number of requests in the system. A median retrieval turnaround time is a few hours, so if your request has taken more than a day without you getting a completion message, contact the Archive Hotseat and ask about your request. It has been our experience that users outside the United States sometimes experience longer retrieval times.

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How can I find out how my retrieval's doing?
UPDATED

Via the web, you can check the status using a simple tool at http://archive.stsci.edu/cgi-bin/reqstat.

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I retrieved some data and got a notice that it was ready. Where is it?

If you selected the `HOST` option in StarView or on the Web then the data was retrieved to the staging disk of stdatu.

It has a "lifetime" on that disk of about 3 days.

Use anonymous FTP to get your data (ignore the `/stdatu/dads_stage` part of the pathname).

If you selected `NET` as the media option, then the data will have gone to the node name and directory you gave to Starview as the destination directory.

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I don't want the data I just requested. Can you kill this request?

Once the request has been queued, we can't kill it-- at least, not without bringing down retrievals completely.

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Can I get the data in (GIF/JPEG/whatever) format?

The data are delivered from the Archive in multigroup Flexible Image Transport System (FITS) format only. We currently do not support conversion to other formats; you will have to do this yourself.

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How do I display data in FITS format?

There are various FITS readers available. For example SAOimage (ds9), which can be retrieved via anonymous FTP from sao-ftp.harvard.edu in the directory /pub/rd/ds9, runs on various systems. More information on HST data and data analysis software is available on-line (in particular, see the HST Data Handbook).

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I know I have an account on stdatu, but I can't log into it any more...

The Archive guest account has been discontinued. Users should either:

- Install StarView6 at their home sites
- Use the Web tools for searching the catalog and retrieving data

If neither of these options meet your needs, please contact us at archive@stsci.edu.

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I don't need the whole dataset. How do I retrieve just one file extension?

With the current OTFR system, this is not possible. You will get a `Dataset` `does not exit` error. For instruments not using On The Fly Calibration or Reprocessing, it will still work.

This option will eventually be reactivated.

We recommend not using it in the meantime.

As of May 15 2000, ST ScI stopped archiving calibrated WFPC2 data. For datasets archived after this date, selecting a calibrated file extension will return a dummy file containing no data. Use the On-The-Fly Calibration option to retrieve calibrated data for WFPC2 datasets archived after May 15 2000.

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StarView6, a Java application released

NEW

Developed in Java, StarView version 6 provides an easy to use, highly capable user interface that runs on any Java enabled platform as a standalone application.

You can download and install it. It requires Java 1.2 or higher to run.

The old StarView 5.4a has been discontinued. All x-windows and crt-versions of are no longer functional. Users will need to switch to StarView6.

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Does StarView run on platform X?

StarView6 needs a system that has a Java 2 Runtime Engine. You will need to make sure that you have a version of Java that is 1.2 compliant. See download and install links for more information

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Can I install the StarView software on my machine?

Yes. StarView6 is available from the web.

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Can I get the source code for StarView and compile it on my machine?

Please use StarView6.

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How do I run StarView?

You can install StarView6 and run it from your home site.

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I need to run StarView on archive.stsci.edu. Why can I not login with my archive user id and password?

The Archive guest account was been discontinued. Users should either:

- Install StarView6 on their home sites
- Use the Web tools for searching the catalog and retrieving data

If neither of these options meet your needs, please contact us at archive@stsci.edu.

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When I try to start StarView5.4 (xwindows distributions), it crashes immediately. What is wrong?

StarView 5.4 is now obsolete. Please install StarView6.

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I need to recalibrate some data. Can I retrieve the calibration files?

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Yes. In Starview, for each instrument, there is a calibration screen that will show you what files the dataset was calibrated with, and which files you should use if you are recalibrating. Each of these screens has special buttons to mark the used or recommended calibration files for retrieval.

If you already have the names of the files you want, then you can retrieve them directly. Go directly into the Retrieval screen through the Commands menu and use the "Add dataset by name" or "Add datasets from file" options. In the "File Options" screen, just press the "Calibrated" (or "OTFC" for STIS or WFPC2) button. That will ensure you get the right files.

Via the Web, select the appropriate choice from the Retrieval Options page: "Best Reference" or "Used Reference" files.

To search for specific calibration files, you will need to know the names of the files and search for and retrieve them using the Dataset List Search page.

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How do I find observations of an object by name?

You can try entering this in the "Target name" field of a search screen, but the target names in our database are chosen by the proposer, so they might be a little (or a lot) different than you might guess.
The best way to search for a specific (fixed) target is to use the "Get Coordinates"/Resolve button. Press this button and a window will pop up asking you for a target name. When you enter a target name and search, it will resolve the target names into RA and Dec through SIMBAD or NED. It will then enter the target's RA and Dec on the StarView screen, along with a 10-arcminute search radius (which you can change, if you want). (If you do a lot of extragalactic work, you can choose the NED resolver instead of SIMBAD.)

For solar-system targets, you may still need to search by target name. In this case, it would be wise to wildcard the target name. For example, to search for observations of Jupiter, enter `*JUP*` into the target name field. Also, you can constrain your search to solar-system proposals by entering `Solar System*` in the "Description" field, if there is one on the screen. (Note the wildcard!)

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How do I find all the observations for a class of objects (like Seyferts?)

Specify a target description. Pull down the "Help" menu and select "On Targets". This help topic will show you how to search for observations of classes of objects. There is also an up-to-date list of target descriptions currently in the HST Archive.

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Can I use StarView or the Web to cross-correlate a list of my targets?

Both StarView and the web offer cross correlation.
There are instructions on how to use the StarView cross correlation in the online StarView help documentation.

Cross correlation is also available on the web at http://archive.stsci.edu/search/. There are help texts that describe how to use this function.

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I had some observations made recently, but I haven't yet received a tape...

As of August 1, 2000, we are no longer generating tapes for proposals. If you wish to have a tape of your data, please submit a retrieval request as you normally would, and use the TAPE retrieval option.

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Can I have multiple copies of a tape made for my collaborators?

Because of the volume of data that we handle, we can only make one copy of the data. However, see the question about PIs retrieving their own data for information on how to let your CoIs retrieve the data from the Archive directly.

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Can I get my tapes sent via a next-day carrier?

All tapes are sent out via FedEx Next Day Air by default.

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How do I generate paper products myself?

- We offer paper products electronically in PDF format. As of **August 1, 1999** we no longer manufacture hardcopies of the paper products, but will still provide them for extreme need cases. Please contact us if this is the case.

  Users will need to retrieve their paper products using the PDF Search Page

  Files are password protected (unless the proposal is a calibration program) and users will need their archive name and password to access documents (as well as authorization to access the proposal). This interface is not intended for general archive users but specifically for PIs of HST programs.

- You can also generate paper products from your data using a task in IRAF/STSDAS called pp_dads.

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Where can I get the Archive Manual?

- The ***Archive Manual*** is also available on-line.
- The ***HST Data Handbook*** can be found here.
- You can get these via anonymous FTP from:
  - ftp.stsci.edu, in the directory `archive-html`
  - archive.stsci.edu, in the directory `pub/manuals`
- You can also use our document request form to order printed copies (they're free), or just contact the Archive Hotseat.

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How do I find out the latest versions of the Archive Manual?

We will keep the most up to date manual we have available on-line.

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Is there an Archive Newsletter?

Yes. The electronic newsletters provide information about the various archives supported by the Multi-mission Archive at STScI (MAST). In addition to HST data, MAST also provides support for VLA First, IUE, Copernicus, and EUVE data. Data from the FUSE, Astro-1 and Astro-2 missions for the UIT, HUT, and WUPPE instruments will be added in the future.

It is sent out electronically to a distribution list. You can also read it on-line.

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Where do I find the ASCII catalogs, namely the AEC and PAEC?

The ASCII catalogs are online at http://archive.stsci/hst/catalogs.html.

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How often are the catalogs updated?

The AEC is updated monthly. Check the file README.AEC for the date through which the AEC is complete.

The PAEC and proposal catalogs are usually done once or twice each proposal cycle.

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What does this error message mean?

`General FTP error`: Transfer failed due to ftp errors. If it isn't clear from the code and comments what caused the error, and it continues to occur, please contact us and we will investigate.

`File not found`: Usually a result of a hardware error on our end. You can resubmit the request and usually the problem goes away. If it doesn't, please contact us.

`File not processed`: If you receive this error and cannot subsequently retrieve the data, please let us know.

`Dataset does not exit`: This can result when you have submitted a request using the customize retrieval options, or have edited your request file. Double check that there are no errors in the filenames, classes and extension you requested. If you are certain that this file should exist, please contact us and we will look into it.

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Frequently Asked Questions

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1. Why do I get 2 IUESIPS MELO files for some low dispersion images but only 1 NEWSIPS MXLO file?

- In IUESIPS, the extracted data for large and small aperture data from a given image were archived as two separate files (e.g. MELO1 and MELO2). In NEWSIPS, the extracted data for both apertures were archived in the same FITS file (e.g. MXLO).

2. Can I request IUE data in ASCII format?

- ASCII versions of the mxlo and mxhi files are available. From the search results page click on the object name to display the preview image. The ASCII versions can be downloaded by clicking on the line "Download a gzipped ASCII file of the large/small aperture preview spectrum." This line is found at the bottom of the preview page. If the image contains an exposure for both apertures, there will be a line and file for each aperture.

3. Why are some IUE NEWSIPS data not available? The IUESIPS version is available from the archive.

- There are various reasons why certain images may not be available. Some images are have problems that can't be handled by the NEWSIPS software but are glossed over by IUESIPS. Some images were misplaced during the processing and archiving process; we are chasing them down now. If you are interested in a particular image that doesn't seem to be available, please contact us and we will find out and make it available to you if possible.

4. How do I read NEWSIPS files into IRAF?

- The **iuetools** package will allow users to read NEWSIPS files. Currently the package requires IRAF (V2.11 or later), TABLES (V2.0 or later) and STSDAS (V2.0 or later). Here is more information.

5. How do I read NEWSIPS files into IDL?

- IDL programs are available to read in the NEWSIPS files. Use READMX to read either MXLO or MXHI files, and READSI to read either SILO or SIHI files. See the IUEDAC User's Guide for more information.

6. Why are my RDAF-format IUESIPS files unreadable after I transferred them from NDADS to my unix workstation?

- RDAF format files from NSSDC use the VAX VMS floating point data format and must be converted to IEEE format before being copied to a unix workstation. See our helpful hints about file copying from NDADS for more information. (Note however that IUE files are no longer available from NDADS.)

7. Can I use SAOimage to look at NEWSIPS files?

- Yes, it will handle the RI, LI, and SI files but not the VD and MX files. Use the options -fits to tell SAOimage that the files are FITS and -upperleft to display the images in the usual orientation, e.g. saoimage -fits -upperleft SWP12345.RILO. Adding the options -min and -max to scale the dynamic range of the grayscale display is also a good idea.

8. What is the wavelength scale used for NEWSIPS? Is it heliocentric?

- Yes, the wavelengths have been corrected for both the Earth's motion around the Sun and the IUE spacecraft's motion around the Earth, computed as of the start of the exposure. A more up-to-date platinum-neon line library was used to create the wavelength calibration, resulting in some small systematic changes in the wavelength scale compared to IUESIPS. Some other small differences compared to IUESIPS are described in the NEWSIPS Manual Appendix III.

9. I have a NEWSIPS image which may not have been processed correctly (wrong dispersion, wrong exposure time). How can I get a correct version?

- Please let us know; we certainly would like to correct any errors. We have a limited capability to reprocess images through NEWSIPS if there was an error in the processing. Send email to archive@stsci.edu.

10. The wavelengths for the Mg II h and k lines are very different, by almost an Ångstrom, between my IUESIPS and NEWSIPS high-dispersion data. Is this an error?

- The IUESIPS data follows the old convention of giving wavelengths in air for wavelengths greater than 2000 Å and in vacuum for wavelengths shorter than 2000 Å. The NEWSIPS data follow the new convention, also used by HST, of giving all ultraviolet wavelengths in vacuum. The difference is pretty large. For instance, Mg II h is 2802.695 in air but 2803.52 in vacuum, Mg II k is 2795.53 in air but 2796.35 in vacuum, and Mg I is 2851.65 in air but 2852.49 in vacuum.

11. The wavelengths for my high-resolution NEWSIPS spectra seem to be off by almost an Ånsgtrom. What happened?

- The NEWSIPS data follow the new convention of using ultraviolet wavelengths in vacuum. Most IUE data users are accustomed to using wavelengths in air for wavelengths longward of 2000 Å, i.e. all LWP and LWR data. (See also the answer to 10.)

12. Are there ASCII files containing the IUE Merged Log?

- Yes, there are ASCII files with the IUE Merged Observing log. There are several subsets of the observing log available also.

13. When analyzing data, which of the data quality flags should I use to throw out pixels?

- Almost certainly all of the nonzero flags. One can imagine situations (the only spectrum in the archives of your source) where you would want to "look" at a spectral feature which was uncalibrated, on the edge of the camera field, or whose fluxes were extrapolated beyond the highest ITF-calibration level - but even in this regime one would probably not want to try to conduct a quantitative analysis of the feature.

  Users should also be aware that no attempt was made in NEWSIPS to eliminate cosmic rays from the high-dispersion images, and the attempts made for low dispersion probably err on the conservative side. The reason for this was a concern that a provision for cosmic rays would lead NEWSIPS inadvertently to remove actual emission lines. Users should especially be cautious about the influence of oblique, diffuse cosmic rays, which can subtlely affect the background surface by 150 pixels or more from the centroid of the "hit" region and be responsible for less than optimal fits to the background surface. We suggest that the SIHI or SILO images be first visually screened before the extracted spectra are analyzed.

14. When coadding like spectra, should I weight the constituent spectra by exposure time or the square root of exposure time?

- Probably neither. An analysis of the noise properties of the IUE cameras for IUESIPS (e.g. as given by Ayres, PASP, 102, 1420, 1990 and PASP, 105, 538, 1993), but probably also applicable to NEWSIPS, suggests that the signal to noise gain is an increasing function of exposure time, but which is slower than either the limits of Exp_time or sqrt(Exp_time). Of course, the actual situation is even more complicated. For example, for integration longer than the "optimal" exposure time, illuminated pixels saturate and are useless. In this regime the quality of the data quickly *degrades*; saturated pixels can never be used for any purpose.

  For the coaddition of data, we recommend weighting individual spectra by reciprocal of the means of their noise fluctuations. (But in computing such a mean consider only those pixels with zero-value quality flags!) The "sigma" vector is computed by NEWSIPS as an estimate of these fluctuations as a by-product of the flux extraction process. For the extracted MXHI data the estimate for each wavelength pixel is based on predicted fluctuations of extraction slit pixels from the noise model for the same region of the camera. The units of the sigma vector in high dispersion are in "FNs" (Flux Numbers), the same as the *net flux* vector. For MXLO data the sigma vector is derived from the noise model, but it depends also upon the relative illuminations of pixels along the extraction slit. In this case the result is also scaled to units of *absolute flux*.

15. Whew! Is there a simpler way of estimating noise?

- Yes. The time-honored way is to find a stretch of continuum in the extracted spectra which contains no spectral features and is free of pixels of with negative data-quality flag values and then compute the rms formally from its noise fluctuations.

  Since "clean" continuum is not always easy to find, let's consider an empirical procedure which works well even for a spectrum containing features. As long as the flux errors are primarily gaussian- distributed, we can make use of the fact that randomly drawn samples will differ from one another, on average, by exactly one standard deviation. In the computing language IDL, an estimate of the rms may be computed conveniently by a few steps. Defining "*f*" as a spectral flux array taken from pixels near the blaze maximum (so the noise will be approximately uniform along the spectrum) and containing only zero-valued quality flags, we compute the mean point to point fluctuation of two pixels separated by a short distance *n*:

  The distribution of noise fluctuations among these pixels can be obtained from the computation:

  rmsdist = abs(*f* - shift(*f* , *n*)) .

  The median of this distribution is computed by sorting the distribution *rmsdist* and finding the middle element of the sorted *rmsdist* array, which by definition is half the number of elements in the distribution. Thus:

  ntot = n_elements(*rmsdist*), so *ntot2* , = *ntot*/2 ,

  Now we compute the sorted index distribution and take the value of *rmsdist* we need:

  isort = sort(*rmsdist*) ,

  medrms = *rmsdist*(isort(*ntot2*)) . *medrms* is the our noise estimate using the median average.

  The *mean* of the distribution can likewise easily be determined from:

  meanrms = total(*rmsdist*)/*ntot* .

  This value will be biased on the high side if there are outlying fluctuations in the spectrum. In practice the pixel separation distance *n* should be at least a spectral resolution element (3 or more).

Frequently Asked Questions

*** DATA REQUESTS**

- Where do I get Copernicus archival data?
- How do I download the Copernicus Spectral Atlas data?

*** COPERNICUS INSTRUMENTS**

- What are the wavelength ranges of the various Copernicus detectors?
- Did the instrument sensitivity significantly degrade with time?

*** DATA ANALYSIS**

- How do I read a Copernicus FITS file?
- How do I coadd Copernicus Scans?
- How do know what wavelength regions were observed for a particular object?

Where do I get Copernicus archival data?

- At the end of the mission, Princeton provided the National Space Science Data Center (**NSSDC**) with a compact set of data on 9-track tapes as the final archive of the *Copernicus* science mission. The data were formatted in such a manner that special programs were needed to extract the information, bit by bit, from the archive. Under a grant from NASA's Astrophysics Data Program, the **Laboratory for Astronomy and Solar Physics** and the **IUE Data Analysis Center** have converted the tape files into **FITS** format disk files and created an on-line archive of *Copernicus* ultraviolet spectra.

  There is one FITS file of raw scans for each of the 551 objects observed by *Copernicus*. These files can be retrieved from the **raw target list**, the **Copernicus search page**, and via the anonymous FTP at archive.stsci.edu in the **/pub/copernicus/raw** subdirectory. The FITS files containing the raw spectral scans are constructed using a Binary table extension and the proposed "variable length array facility" as described in the NOST FITS Draft Standard. Each row of the binary table contains the data from one spectral scan.

  In addition to the raw data files, coadded contemporaneous scans from the U1 high resolution channel (900-1560 Å) and U2 (900-1650 Å) channel are available from the **Copernicus Coadded Scan search page**, and via the anonymous ftp at archive.stsci.edu in the **U1 coadded scan directory** and the **U2 coadded scan directory** The files are stored as standard Binary table FITS files using fixed length vector fields. The files are intended primarily for quick-look data analysis.

How do I download the Copernicus Spectral Atlas Files?

- The spectral atlas files are available online from the **Copernicus spectral atlas page**. References to the original published papaers are also given. The files can also be retrieved via anonymous ftp at archive.stsci.edu in the **spectral atlas directory**. All the spectral atlas files use FITS binary table extensions with scalar fields.

What are the wavelength ranges of the Copernicus detectors?

- The table below shows the spectral coverage of each detector. Note however that the individual scans generally covered a much smaller wavelength range.

Name	Exit Slit* (Å)	Wavelength (Å)	Step Size* (Å)
1 - U1	0.05	710-1500**	0.025
2 - V1	0.10	1640-3185	0.05
3 - U2	0.20	750-1645	0.20
4 - V2	0.40	1480-3275	0.40
5 - V3	?	3430 (fixed)	-
6 - U3	?	1320 (fixed)	-

*****Note: Exit slit and step size vary slightly with wavelength.
******For brighter stars, the 1500-1560 angstrom range can be scanned with U1 in the first order.

Did the instrument sensitivity significantly degrade with time?

- The principal malfunction in the Copernicus instrumentation was the rapid decline in the far-UV sensitivity. The decision to terminate the spacecraft was based partly on the loss of far-UV sensitivity. The following **figure** shows the relative sensitivity of the high-resolution far-UV phototube U1 from orbits 100 to 44000. A rapid (approximately 50 percent) decline at shorter wavelengths was experienced during the first year followed by smaller declines in subsequent years. The low-resolution far-UV phototube U2 exhibited a behavior similar to that of U1. The near-UV phototubes, V1 and V2, did not exhibit the rapid decline seen in the far-UV phototube. For further information, see the **Final Operations Report**.

How do I read a Copernicus FITS file?

- The raw data sets are probably the most difficult files to read since they use the proposed variable length array facility for storing vectors in a binary table extension. In any event, **<examples>** of how to read all the Copernicus data sets using a variety of FITS readers are available. Many users will want to work with individual scans. Examples of how to work with them are on the **<third example>** page just cited.

How do I coadd Copernicus Scans?

- The IDL program **STACK** allows U1 or U2 Copernicus scans to be coadded. This software was used to create the "quick-look" coadded scan files and is available to users from either the **Copernicus Spectral Scan** page (which currently requires you to know the name of a coadded scan file), or from the browse files accessible after searching the **coadded scan database**. In principle, STACK can coadd any Copernicus scans, however only scans taken close in time and using the same detector can produce meaningful results. For this reason, use of STACK is restricted to addiing or subtracting the existing sets of coadded scans.

How do I know what wavelength regions were observed for a particular object?

- The min and max wavelength for each scan is stored as scalar fields in the raw data sets (note wavelengths could be scanned in either direction, so some vectors are in order of decreasing wavelength). However, to help users determine wavelength coverage for U1 and U2 scans, a **spectral coverage table** was created. This can be a useful tool since most U1 scans only cover a couple of Angstroms, and U2 scans normally covered less than 50 Angstroms. The rows of the spectral coverage table represent the observed targets, while the columns list various wavelength regions. Each entry in the table shows the number of scans obtained in that particular spectral region and is also a link to a gif-format plot file showing the spectral range of each scan within that spectral region.

EUVE FAQ

* **DATA REQUESTS**

1. Where do I get EUVE archival data?

2. How do I get multiple EUVE data sets? .

* **EUVE Instruments**

3. What are the wavelength ranges of the EUVE instruments?

4. What are common EUVE spectral features? (i.e is there any signal here!)

5a. What about the Deep Survey Dead-spot?

5b. What about the Deep Survey's short wavelength response?

* **EUVE PERMANENT ARCHIVE DATA**

6. How do I get started with the EUVE permanent archive data?

7. How do I extract an EUVE Spectrum?

8. I run *euvextract* and get an error: "dispaxis not found".

9. How do I make a Deep Survey Light-curve?

---

1. Where do I get EUVE archival data?

- As of Nov 1997, the EUVE project in Berkeley is no longer delivering EUVE archival data. Events and image datasets, which may be reduced to create spectra and light-curves are available from this web site: click here to search the EUVE archive.

2. How do I get multiple EUVE datasets?

- If you are requesting multiple EUVE datasets, for now (since the data resides at HEASARC) you have to click on each data set or go to their ftp site. We will have a batch option in the future.

3. What are the wavelength ranges of the EUVE instruments?

-

  Spectrometer Range (Ang) Resolution SW 70-190 0.5 Ang MW 140-380 1.0 Ang LW 280-760 2.0 Ang Imagers: 10% Filter Bandpasses (Ang) DS Lexan 67-178 DS Al/C 157-364 ScA/B Lexan 58-174 ScA/B Al/Ti/C 156-234 ScC Ti/Sb/Al 345-605 ScC Sn/SiO 500-740

4. What are the common EUVE spectral features?

- The EUVE spectrometers have some common background features caused by airglow and scattering in the upper atmosphere.

  SW- The short-wavelength spectrometer can have a bright rim at shortest wavelengths (left) caused by scattered Lyman alpha.

  MW- The medium-wavelength spectrometer has a broad feature at 304 Angstroms from geocoronal helium.

  LW- The long-wavelength spectrometer has a broad feature at 584 Angstroms from geocoronal helium, which includes the 304 Angstrom line in second order.

5a. What about the Deep Survey Deadspot?

- There is a region of low gain (the "dead-spot") near the center of the Deep Survey Lexan/B band caused by the Feb 1993 observation of HZ 43. The region is about 2 arcmin in diameter and is described in detail in the EUVE technical memo.

5b. What about the Deep Survey's short wavelength response?

- The short wavelength response of the DS has been investigated to explain large count rates observed from high column sources, like Sco X-1 and has often been termed "X-ray leak". The latest ideas have been summarized in John Vallerga's Memo.

6. How do I get started with the EUVE permanent archive data?

- Once you have obtained events and/or fits images from http://archive.stsci.edu/cgi-bin/euve

  3 steps to read them:

  1) gunzip the files.

  2) read fits files with *strfits* (in *stsdas.fitsio*) (step no longer needed with IRAF 2.11, which allows you to read the fits files with out converting them. And *cep* will run on fits files).

  3) the img file will produce ds,sw,mw,and lw images + good times tables [you can go onto spectral extraction from these or continue and reduce the events files.]

  4) the evt file will produce the equivalent of the old format data (like table0 and so on) tables produced will have the following names: adcnts.tab lw_events.tab orientation.tab sw_events.tab ds_events.tab mw_events.tab quadrant.tab valid_times.tab)

  5) run *cep* to produce qpoe files using the appropriate script in archpipe (in egodata1.16) {Note: Only use "Rebuild DS SourceCentered Archive QPOE" for moving targets}

  6) use qpoe file as before

  Please also see the Permanent Archive Guide EUVE Permanent Archive Data Products Guide

7. How do I extract an EUVE Spectrum?

- In IRAF Use the EUV task *euvextract* on the two dimensional image file (which you get get from the source_date_img.fits file). See also: quick help on Spectral extraction?

8. I run *euvextract* and get an error: "dispaxis not found".

- You are missing DISPAXIS header line. This card was omitted from the EUVE archival format because it is specific to reduction of spectra under IRAF and, unlike the old GO products, the archival data format is not IRAF-specific.

  You can add the DISPAXIS card to an image with the standard IRAF task *hedit* . It will need to have the value '1', meaning the spectra run along the x-axis, as long as you haven't rotated the images.

9. How do I make a Deep Survey Light-curve?

- Quick Help on making a DS Light-curve

archive@stsci.edu

BEFS FAQ

1. Where can I get BEFS archival data?

2. What are the differences between BEFS I and BEFS II? .

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1. *Where do I get BEFS archival data?*

- Both BEFS I and II data can be obtained by searching the on-line catalog at click here to search the BEFS archive.

  Or by ftp access (please see the obtaining BEFS data page.

2. *What are the differences between BEFS I and BEFS II?*
For BEFS II, two of the four diffraction grating were overcoated with silicon carbide and the instrument electronics were modified for improved imaging at high count rates. Three apertures were added for spectroscopy: 1) with an on-axis 26" hole, 2) a second clear hole displaced by 2.4' and 1.4 times larger for diffuse sky glow or serendipitous spectroscopy, and 3) a large 2' aperture with a tin filter opaque to FUV radiation, but transparent in the EUV and used primarily for observations of epsilon CMa.

Frequently Asked Questions

Where do I get TUES archival data?

- See the obtaining TUES data web page.

Can you explain the TUES file naming conventions?

- Basically names are of the form TUESnnnn_m_o.fits where the target ID ("nnnn") is a special 4-digit target identification number and the observation number ("m") refers to the order in which the exposures (for a given target) were obtained. A third number ("o") indicates several pointings were obtained during a single observation (sometimes to improve the alignment of the telescope). A "_PH" denotes an integration from single photon events recorded onboard but integrated after the mission. See also the TUES file naming conventions described in the data products page.

How accurate are the calibrated flux values?

- A HST archive model of G191B2B http://garnet.stsci.edu/STIS/models/tables/g191b2b_mod_002.tab" was used as a reference for the absolute flux calibration. The calibration was additionally checked with a model of BD +28°4211 (R.Napiwotzki). We guess an accuracy of ±10% for the flux calibration. This is valid, if the object was fully centered within the diaphragm. There are, however, some observations for which the object was not completely centered. The reasons are probably due to temperature drifts of the telescope causing a shift of the alignment. In some cases also slightly wrong coordinates of the target might have led to a decentralization.

What is the wavelength coverage of the echelle spectra?

- The Tübingen Echelle (TUES) obtained moderate dispersion observations (R= 13,000) using an echelle grating including orders 40-61 covering the wavelength range from 910 to 1410 Angstroms.

GSC-II Target Search

GSC Home
Getting Started
GSC Search and Retrieval
Data Access
Software Tools
What's New
FAQ
Instrumentation/Operations
Papers/Publications
Related Sites
Acknowledgments

Frequently Asked Questions

GSC

GSPC

How were the Guide Star Catalogs created?

- The basic steps involved include:
  - scanning and digitizing the Schmidt plate material,
  - image processing,
  - calibration for astrometry, photometry, and object classification,
  - Comparison to external catalogs

What is the difference between GSC-I and GSC-II?

- For a quick summary of the properties of these two catalogs see: http://www-gsss.stsci.edu/gsc/gsc2/CatalogProperites/GSCIIProperties.htm

  The GSC I catalog (version 1.0) was constructed to support pointing and target aquistion for the HST. The catalog contains approximately 19 million stars and other objects in the sixth to fifteenth magnitude range, primarily determined from an all-sky, single epoch collection of 6.4 degree by 6.4 degree Schmidt plates. The Schmidt plates for north of +6 degrees consists of a 1982-1984 epoch "Quick V" survey (IIaD, 20 minute exposure) obtained from the Palomar Observatory. The southern fields consist 0f 50-75 minute exposure IIIa-J Schmidt plates, from the UK SERC J/EJ survey (epoch 1975-1988) and a supplemental 4 minute IIa-D southern Galactic plane extension (epoch approximately 1988).

  For more information on the Schmidt plates used to construct the GSC I catalog see: http://www-gsss.stsci.edu/PlateMaterial/plateMaterial.htm

  GSC 1.1 is the catalog used for control and target acquistion for the HST. The improved catalog corrected a number of known problems in the GSC 1.0. The corrected defects included spurious entries (principally due to false detections on the diffraction spikes of bright objects), grossly incorrect entries for the brighter stars (V<7) that were produced from heavily over-exposed Schmidt images, and different entries for the same object having more than one name because of blend-resolution difficulties, as well as astrometric errors at the plate edges.

  GSC 1.2 An astrometric re-calibration of the GSC 1.1 reducing the systematic errors present in the GSC 1.1 positions. This catalog has not been been installed on the HST Guide Star Selection system, so it must not be used for HST observation planning.

  The GSC II will be an all-sky catalog based Schmidt plates at two epochs and three bandpasses, from the Palomar (POSS I and POSS II) and UK Schmidt telescopes (SERC/UK surveys). This catalog will contain postions, magnitudes, colors and proper motions for all objects to at least 18.5 in photographic F. The construction of the GSC II is in progress. A preliminary catalog, GSC 2.2 is now available.

  The GSC2.2 is an all-sky, magnitude-selected subset of this data that has been extracted to support telescope operations at the GEMINI and VLT telescopes. This Telescope Operations version contains positions, classifications, and magnitudes for 435,457,355 objects. The magnitude limits (18.5 in photographic F and 19.5 in photographic J) were implemented to ensure the photometric quality of the released data. Since bright objects are extremely overexposed on the Schmidt plates, positions from the Tycho-2 catalog were used.

  The final version (GSC 2.3), expected to be released in 2002, will also contain proper motions.

  For more information on the Schmidt plates used to construction the GSC I catalog see: http://www-gsss.stsci.edu/PlateMaterial/plateMaterial.htm

When would one use GSC-I instead of GSC-II?

- GSC-II has not been installed in HST Guide Star Selection system, so it should not be used for HST observation planning.

What material is the GSC II based on?

- See http://www-gsss.stsci.edu/PlateMaterial/plateMaterial.htm#GSCIIPlates

What reference frame is used for the GSC II catalog?

- The International Celestial Reference Frame (ICRF).

What magnitude system is used with GSC II?

- The magnitudes are in the natural system of the photographic plates. See http://www-gsss.stsci.edu/gsc/PlateMaterial/plateMaterial.htm for bandpass information.

How were the positions, magnitudes, and classification selected for objects imaged on more than one plate ?

- Although the database from which the catalog was constructed contains multiple epochs and observations for a given source, the GSC 2.2.0 exported catalog positions, magnitudes, and classifications for each unique source were selected by the following criteria:

  Positions and magnitudes from plate observations were selected by choosing the observation which occurs closest to the plate center prioritized by bandpass F,J,V, and N respectively. Magnitude cutoffs were applied (F=18.5, J=19.5, V=19.5). If the observation occurred at different plate scanning resolutions, the highest resolution (15 um pixels) was selected over the lower resolution (25 um pixels) for each bandpass regardless of plate location. Classifications were assigned by voting observations into star (0) or nonstar(3) codes.

  For more details see: http://www-gsss.stsci.edu/gsc/gsc2/gsc22_release_notes.htm

What epoch was used for positions?

- The positions are at the epoch from the plate that they were taken from. We did not take an average or combine in any way the positions imaged on more than one plate. The positions were selected by choosing the observation which occurs closet to the plate center prioritized by bandpass F, J, V, and N repectively.

How were positions determined for bright stars?

- Since bright objects are extremely overexposed on the Schmidt plates, positions obtained from the Tycho-2 catalog were used (see http://www.astro.ku.dk/%7Eerik/Tycho-2/).

Can you provide the photometric transmission curves ?

- Yes, here (http://www-gsss.stsci.edu/DSS/Transmission%20Curves/transmission_curves.HTML)

What is the GSPC?

- To support the photometric calibration of the Guide Star catalogs, CASB produced the Guide Star Photometric Catalog. GSPC I is an all-sky set of photoelectrically determined BV sequences in the magnitude range from 9 to 15, generally near the centers of the fields of the GSC-I plates. The GSPC II, a joint project between CASB and Osservatorio Astronomico di Torino, is generally an extension of GSPC I sequences to V=19 in B, V, and R passbands based on CCD photometry.

  For more detailed information see: http://www-gsss.stsci.edu/gspc/GSPChome.htm

What is the sky coverage of the GSPC II?

- http://www-gsss.stsci.edu/gspc/gspc2_coverage_map.htm

How do I obtain the GSPC data?

- http://www-gsss.stsci.edu/support/data_access.htm#table

HUT Frequently Asked Questions

The Mission

1) What is HUT and What Does it Do?

- See the HUT project answer.

2) What is the history behind HUT?

- See the HUT history page.

3) Where can I find a HUT Technical Summary?

- See the HUT technical summary page.
- A detailed view of the HUT2 telescope module can be seen in the hardware chapter of the HUT data handbook. or alternatively in the HUT instrument and operations page.

4) What are some major publications using HUT data?

- See the HUT publications page.
- Note also the papers by Kruk et al. on final calibration of HUT 1 and HUT-2 (ApJS, 122, 299) data.

Data Handling

5) How do I retrieve HUT data?

Data retrieval proceeds in much the same way as most other MAST-archived datasets. Go to the how to search HUT data page for instructions and the HUT search page for downloading of data. Data will be returned very quickly in a tarred file consisting of many zipped data files and an ASCII filetypes.txt file explaining some of the contents. For further information go to the HUT data products page.

6) How do I read HUT data?

- See the HUT data reading page.

Data Characteristics

7) What are the instrumental error sources in HUT data?

- Unwanted time-dependent signals (dead time, phosphor persistence).
- Airglow in emission lines (geocoronal Lyman alpha can be the dominant feature in the spectrum).
- Extreme UV contamination (white dwarf only; corrected from model atmospheres estimates).
- Telluric absorption (yes, there is atmosphere above the Shuttle!).
- Flux loss from field astigmatism (extended sources only).
- pointing-jitter errors (jitter corrected every 2 secs).

The calibrated data consist of corrections for all these error sources. See the calibration chapter of the HUT data handbook.

8) Did HUT lose sensitivity during its missions?

Yes, the losses were noticeable on an approximately 48 hour timescale, particularly in the far-UV. This is modeled in Figure 5 of Kruk et al. (ApJS, 122, 299, 1999). By the end of the mission the sensitivity of the detector (CsI photocathode) had decreased by 26% at 912 Å and 5% at 1840 Å.

9) What were the differences between HUT1 and HUT2?

The second mission:

- lasted longer (16 days compared to 8 days; 205 hours of on-target time vs. 40 hours).
- made more observations (385 of 265 targets, compared to 136 of 87 targets).
- had greatly improved pointing stability.
- had less sensitivity to extreme-UV contamination because of SiC coatings on the optical elements.

Frequently Asked Questions

*** DATA REQUESTS**

1. Why does it take so long to download the UIT files?

2. How can I tell which files are fully calibrated?

*** READING FILES**

3. How do I read the UIT data files?

---

1. Why does it take so long to download the UIT files?

- The combined files for each observation are fairly large, about 28 Mb compressed, 51 Mb uncompressed. If you need only one file for a given observation, such as the fully calibrated and geometrically corrected ("G") file, you may wish to obtain it from the anonymous ftp site (see Obtaining UIT Data).

2. How can I tell which files are fully calibrated?

- The easiest way is by the file name. The raw image (digitized densitometer output) filenames end in D, e.g. fuv0345d.fits. The linearized, flat fielded image filenames end in E (no good astrometry solution) and F (good astrometry solution). The fully calibrated, geometrically corrected image filenames end in G.

3. How do I read the UIT data files?

- The image files are in FITS format, with the data stored in the primary arrays. The point-source photometry data are stored in ASCII table extensions, with no primary array. These simple FITS formats should be readable by a variety of FITS readers. See Reading UIT Data for more information.

Frequently Asked Questions

* **DATA REQUESTS**

1. How can I tell whether polarization data, as well as the UV spectrum, are available for a particular object?

* **READING FILES**

2. How do I read the WUPPE data files?

3. How do I convert the Stokes parameters Q and U to linear polarization parameters?

---

1. How can I tell whether polarization data, as well as the UV spectrum, are available for a particular object?

- In the search results page, the polarization and position angle will both be set to 0.000 if no polarization data are available. In this case, only the ultraviolet spectrum is available from the archive. In addition, the FITS file for an observation including polarization data is significantly larger (typically 34560 bytes uncompressed) than one with only spectral data (11520 bytes).

2. How do I read the WUPPE data files?

- The image files are in FITS format, and should be readable with standard FITS readers. See Reading WUPPE Data for more information.

3. How do I convert the Stokes parameters Q and U to linear polarization parameters?

- Linear polarization = sqrt($Q^2 + U^2$), while position angle = 1/2 $\tan^{-1}$(U/Q)

Contents

Using the Web Service

"Is there a way to retrieve DSS images in batches?"

No. We know this would be a convenient service, and we would like to do it, but our jukebox is currently getting over 1500 hits a day (more like a thousand, if you count internal accesses and accesses to the Medium Deep Survey), and potential abuse of a batch service could easily put the jukebox into a perpetually busy state, denying the DSS to everyone.

"What are SIMBAD & NED?"

SIMBAD (in Strasbourg, France) and NED (in Pasadena, California) are centralized astronomical databases that provide services like taking an object name and returning its coordinates. That's how they're used here: to redraw the DSS form with your object's RA and Dec in place, so you don't have to go look them up.

Note: SIMBAD and NED only catalog fixed objects, like stars and galaxies. These databases don't track moving targets, like planets, comets, and asteroids. The Sky Surveys were designed to avoid bright solar-system objects anyway, so there won't be any images in the DSS of Saturn or Comet Hale-Bopp.

Also, remember that NED only catalogs objects outside our own galaxy, like external galaxies, quasars, etc. NED doesn't catalog individual stars or nebulae.

(For you acronym fans, SIMBAD stands for **S**et of **I**dentifications, **M**easurements, and **B**ibliography for **A**stronomical **D**ata; NED stands for **N**asa **E**xtragalactic **D**atabase.)

"I tried to use SIMBAD, but it never came back."

SIMBAD is a wonderful service, but unfortunately, the network connection between Baltimore and Strasbourg isn't the best it could be. Sometimes, the network hangs; other times, SIMBAD is just too busy to answer right away.

If you're looking for extragalactic objects, and SIMBAD isn't working, try NED. Ned is in California, and our network connection is a bit better there.

"Are there other sites that offer DSS services?"

Yes, there are. Here's a partial list.

Exposure and Survey Information

"How can I tell what telescope/filter was used for a given image?"

The data are either from the UK Schmidt or the Oschin Schmidt (Palomar) telescopes. You can tell which survey the data come from by looking at the `REGION` keyword in the FITS header. You can also get the observatory ID from the header keyword `TELESCOP`.

For the First Generation DSS, the emulsion/filter combinations are:

- `XE` - POSS-E RED PLATE,
- `XV` - SERC-V Equatorial extension,
- `S` - SERC-J Survey

(Also, see below about the short-exposure plates near M31 and the Magellanic Clouds.)

For the Second Generation, these are:

- `ER` - 'Equatorial Red' survey (UK Schmidt) IIIaF + RG610
- `XS` - 'Second Epoch Southern' survey (UK Schmidt) IIIaF + RG610
- `GR` - 'Galactic Red' survey (UK Schmidt) IIIaF + RG610 SHORT exposure in galactic plane
- `XP` - POSS-II Red IIIaF + RG610
- `XJ` - POSS-II Blue IIIaJ + GG385
- `XF` - POSS-II Near-IR IVN + RG9

(To get information about individual images, you'll need to get them in FITS format and look at the header. This information is not preserved in the GIF image.)

"What do the pixel values represent?"

Scans in the DSS are digitizations of photographic plates. The pixel values in the scans are a measure of the photographic density of the original plate, which is non-linear with the intensity.

"Is a photometric calibration available?"

Yes. The Catalogs and Surveys Branch (originators of the Digitized Sky Survey and the Guide Star Catalog) recently completed a photometric calibration for the First Generation survey (northern POSS-E, souther SERC-J, and southern Galactic Plane SERC-V).

(There was a crude calibration done on the *southern* SERC plates; see Lasker, B., et al. 1990 AJ 99, 2019. Equation 1 shows this solution. Table V lists coefficients for Palomar, too, but *don't use them!* They were for a Mini-J survey, not the actual POSS.)

"How about the exposure time?"

That's in the `EXPOSURE` keyword in the FITS header. (Note that the exposure time there is in minutes.) All exposures are between 2400 and 4200 seconds.

"What's the plate scale?"

For the First Generation scans, the plate scale is 1.7 arcsec per pixel; for the Second Generation scans, it's 1.0 arcsec per pixel. (The plate scale is derivable from the FITS keywords `PLTSCALE` and `XPIXELSZ` / `YPIXELSZ`).

"What Second-Generation survey plates are currently available?"

A complete list of the plates currently available for the Second Generation survey is available at http://archive.stsci.edu/cgi-bin/dss2list.

Image Anomalies

"What's this funny line/feature/UFO in my scan?"

These images were scanned from photographic plates, so every once in a while, you will encounter a scratch, internal telescope reflection, fingerprint, etc. in your image. So far, none have turned out to be aliens. I'm compiling an informal catalog of regions with plate anomalies, so if you run across one, let us know.

"I have a field near M31 that I know should have a lot of stars in it, but I only see a few."

This field was probably drawn from the special short-exposure plate of M31.

There are three such plates, for the Large Magellanic Cloud, the Small Magellanic Cloud, and M31, exposed for 5 minutes instead of the usual 50 or so:

- `XX001` - The Large Magellanic Cloud
- `XX002` - The Small Magellanic Cloud
- `XX005` - M31 (Andromeda Galaxy)

These plates are in the V band; specifically, they were taken with IIaD emulsion and GG 495 filter.

The Quick V version may look better; you can access it through the Phase II proposal preparation form.

"I tried to get an image of the Orion Nebula, but all I got was a big white spot!"

It worked; you just need to extract a wider image to see it. The Orion Nebula is so big that all a 15'x15' extraction shows you is the very center, which in these scans *is* a big white spot. Go to a bigger scan size (if you don't mind handling the correspondingly bigger image file).

Using the Images

"If I use the DSS in my published research, do I need to acknowledge it?"

We request that you do. The Catalogs & Surveys Branch (CASB) has a recommended acknowledgment.

"Can I use images from the DSS in a CD-ROM or some software that I'm writing?"

If you're using images from the DSS for research, teaching purposes and other non-profit activities, you may use them freely, and we only request that you acknowledge the source. Commercial applications require a license. For information about licensing, contact the STScI Business Office:

Contract & Business Services
Space Telescope Science Institute

3700 San Martin Drive
Baltimore MD 21218

DSS FAQ

Frequently Asked Questions

Data

- What type of data are supported by MAST?
- How do I search MAST?
- How can I retrieve MAST data?

Documentation

- Are there manuals available for the MAST Archives?
- Is there a MAST Newsletter?

More FAQ

- Can I find FAQ's for individual missions?

User Support

- What level of support is provided for the various missions?

Data

- ***What type of data are supported by MAST?***
  The Multimission Archive at STScI supports:
  - The Hubble Data Archive (HDA), which contains spectroscopic (1,100 - 11,000 Angstroms range; slitless spectroscopy up to 2.5 microns with NIC3) and imaging (1,150 - 25,000 Angstroms) data taken with Hubble Space Telescope. As of August 1998, the HDA contains over 5.2 Tbytes of science and engineering data, for a total of approximately 150,000 science exposures.
  - The Far Ultraviolet Exporer (FUSE) covers the 905-1187 Å spectral region. This active mission contains high planetary resolution spectra of hot and cool stars, AGNs, supernova remnants, planetary nebulae, solar system objects and the interstellar medium.
  - The International Ultraviolet Explorer (IUE) Final Archive, which contains over 104,000 spectra of approximately 10,000 individual astronomical sources (covering the 1,200 - 3,350 Angstroms range).
  - The Extreme Ultraviolet Explorer (EUVE) Archive, which at present contains spectroscopic observations (in the 70 - 760 Angstroms range) of about 300 sources, mostly Galactic.
  - The Hopkins Ultraviolet Telescope (HUT) Archive, which contains 106 spectrophotometric observations of 77 targets were obtained in the far-UV (i.e., 912-1850 Å) at a resolution of ~3 Å. These were obtained during the first ASTRO mission. An additional 385 observations of 265 targets were obtained during the ASTRO-2 missions.
  - The Ultraviolet Imaging Telescope (UIT) Archive, which contains 1,579 images of 259 targets (covering the 1,200 - 3,300 Å range) obtained by UIT as part of the ASTRO-1 and ASTRO-2 missions.
  - The Wisconsin Ultraviolet Photopolarimeter Experiment (WUPPE) Archive, which contains 467 observations of 169 objects. WUPPE obtained simultaneous spectral and polarization measurements from 1400 to 3300 Å during the ASTRO-1 and ASTRO-2 missions.
  - The Copernicus Archive, which includes far- (900 - 1,560 Angstroms) and near- (1,650 - 3,150 Angstroms) ultraviolet spectra of 551 objects, primarily bright stars.
  - The Berkeley Extreme and Far-UV Spectrometer (BEFS), flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS I and II space shuttle missions in 1993 and 1996, returning high-resolution (/3000) FUV spectra (900-1200 Å) of 75 astrophysical objects from the first flight and more than 100 from the second. EUV spectra (400-900 Å) were obtained for a subset of these targets.
  - The The Interstellar Medium Absorption Profile Spectrograph (IMAPS) obtained high resolution (R=75,000 for IMAPS-1) objective-grating echelle spectra of hot stars, over the spectral region 950-1150 Å. The IMAPS archive currently contains roughly 600 spectral images of 10 hot stars from the first shuttle flight. Once the proprietary period ends for the second IMAPS mission, the archive will include an additional 3,900 spectral images of 29 stars
  - The Tübingen Ultraviolet Echelle Spectrometer (TUES) flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS II space shuttle mission in 1996, returning spectra in the 900 Å to 1400 Å wavelength range. The instrument was designed to achieve a spectral resolution of $\lambda/\Delta\ \lambda$=10000 when used with an entrance aperture of 10" diameter. During the 17.7 day flight, TUES returned 239 spectra of 62 targets.
  - The Digitized Sky Survey (DSS). The Catalogs and Surveys Branch of the STScI has been digitizing the photographic Sky Survey plates from the Palomar and UK Schmidt telescopes in order to support HST operations and provide a service to the astronomical community. Archive users can easily retrieve image data for any part of the sky.
  - The The Guide Star Catalog I (GSC I) is an all-sky optical catalog of positions and magnitudes of approximately 19 million stars and other objects in the 6th to 15th magnitude range. The GSC II is an all-sky catalog of approximately 2 billion stars and galaxies containing positions, magnitudes, colors and proper motions complete to a minimum of V =18.
  - The Sloan Digital Sky Survey (SDSS) is using a dedicated 2.5 m telescope and a large format CCD camera to obtain images of over 10,000 square degrees of high Galactic latitude sky in five broad bands (u', g', r', i' and z', centered at 3540, 4770, 6230, 7630, and 9130 Å, respectively). The first data release, planned for June 2001, includes: imaging data containing a searchable catalog, images in several formats (FITS and JPEG), and spectra in both FITS format and GIF spectra with line identifications. This first public data release will contain over 500 square degrees of sky.
  - The Faint Images of the Radio Sky at Twenty-centimeters (FIRST) Archive. The FIRST project is designed to produce a radio survey at 20 cm (1.4 GHz) of over 10,000 square degrees down to a flux of 1 mJy. MAST provides access to the radio images and the source catalog, which currently includes about 437,000 entries.
  - The ROSAT, the RÖntgen SATellite, was an X-ray observatory developed through a cooperative program between Germany, the United States, and the United Kingdom. ROSAT data is maintained and archived at HEASARC. Except for the search and acknowledgments pages, all images and linked pages are provided by HEASARC.

- ***How do I search MAST?***
  Every single archive can be searched using its search page. Links to the Web pages of the various archives included in MAST are available from the MAST main page. Moreover, for users wanting to search more than one archive at the same time, two interfaces are provided:
  - From the MAST main page one can conduct a quick search by typing the name of a target to see if any of the MAST supported archives have observations of this target.
  - The MAST Cross Correlation page provides a facility to allow the user to cross-correlate lists of positions with data in our archives. You can compile lists externally or use one of our online catalogs.

- ***How can I retrieve MAST data?***
  All MAST data can be retrieved from the appropriate Web pages. HST, FIRST, and DSS data can also be retrieved using StarView.

Documentation

- ***Are there manuals available for the MAST Archives?***
  Yes. You can get them here:
  - The HDA Manual
  - IUE Reduction/Analysis Documentation
  - IUE Instrumentation/Operations Documentation
  - IUE Project Publications
  - EUVE Project Publications
  - Copernicus Reduction/Analysis Documentation
  - Copernicus Instrumentation and Operations Documentation
  - UIT Publications
  - WUPPE Instrumentation and Operations Documentation
  - HUT Instrumentation and Operations Documentation

- ***Is there a MAST Newsletter?***
  Yes. It is sent out electronically to a distribution list. You can also read it on-line. If you would like to subscribe to the mailing list, please send e-mail to archive_news-request@stsci.edu and put the single word SUBSCRIBE in the BODY of the message.

More FAQ

- ***Can I find FAQ's for individual missions?***
  More FAQ for the single archives are available on the following pages:
  - HDA FAQ Page
  - IUE FAQ Page
  - Copernicus FAQ Page
  - EUVE FAQ Page
  - FUSE FAQ Page
  - BEFS FAQ Page
  - TUES FAQ Page
  - GSC FAQ Page
  - HUT FAQ Page
  - UIT FAQ Page
  - WUPPE FAQ Page
  - DSS FAQ Page

User Support

- ***What level of support is provided for the various missions?***
  Assistance is available for users of the various data included in MAST, although at different levels. Namely:
  - Full support for HST data analysis.
  - Full support for IUE data analysis (except for enhancement of post-pipeline data products).
  - Moderate support for EUVE data analysis.
  - Limited support for DSS, Copernicus, UIT, HUT, and WUPPE data analysis.

  Questions about HST data analysis should be sent to help@stsci.edu. Questions about IUE, EUVE, Copernicus, and UIT data analysis should be sent to archive@stsci.edu.

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OAO-3 "Copernicus" High Resolution Spectral Atlases

During the *Copernicus* mission several stars were observed intensively with the high-resolution spectrometers to obtain as complete wavelength coverage as possible. Ultraviolet high resolution spectral atlases were constructed for six stars: Alpha CMa (Sirius), Alpha Lyr (Vega), Beta Ori (Rigel), Gamma Peg, Iota Her, and Tau Sco.

The atlas data were delivered to GSFC by the Copernicus Project at Princeton University in the early 1980s. The data are now available in FITS binary table format and can be selected from the following table. Each star also has a corresponding journal article describing the details of the extraction and analysis, including identification of spectral features. Summary information on the atlas contents and file descriptions are included on the pages for each atlas.

Star	V	Sp Type	Wavelength (Å)	Resol (Å)	Reference
Alpha CMa	-1.46	A1 Vm	1650-3170	0.10	Rogerson, *Ap.J. Supp*, 63, 369, 1987
Alpha Lyr	0.03	A0 Va	2000-3185	0.10	Rogerson, *Ap.J. Supp*, 71, 1011, 1989
Beta Ori	0.16	B8 Ia	999-1420 1420-1560	0.05 0.10	Rogerson & Upson, *Ap.J. Supp*, 49, 353, 1982
Gamma Peg	2.82	B2 IV	967-1430 1430-1500	0.05 0.10	Rogerson, *Ap.J. Supp*, 57, 751, 1985
Iota Her	3.80	B3 IV	999-1420 1420-1470	0.05 0.10	Upson & Rogerson, *Ap.J. Supp*, 42, 175, 1980
Tau Sco	2.84	B0 V	949-1420 1420-1560	0.05 0.10	Rogerson & Upson, *Ap.J. Supp*, 35, 37, 1977

The files may be read with any FITS reader that supports the binary table format. The IUEDAC procedure IFITSRD is a generic IDL based FITS reader which can be used to read these files.

EUVE Atlas of Stars

This page takes you to a table containing EUVE (Extreme Ultraviolet Explorer Data) spectra of 94 stars selected by Craig et al. (1997). The list is roughly representative of the sample of stars by the EUVE project during its lifetime (1992-January 2001). These spectra were taken whenever possible with all the three bandpasses, short- (SW; 70-190 Å), medium- (MW; 140-380 Å), and long-wavelength (LW; 280-760 Å). The spectral resolutions for these cameras are 0.5, 1, and 2 Å, respectively.

The stars are organized in a table by spectral type and by subcategories within each type. A user may click on the 'ps' link to browse a multi-panel image or one of the three bandpass links to download the data in compressed FITS format. The x-axis is in wavelength units, while the y-axis is in units of photons/cm^2/s/Å).

It is important to point out that the spectra in this atlas were only the best available at the time of the compilation. In some cases longer exposures were made after the atlas was constructed (late in the mission lifetime) and are available in the HEASARC/MAST archives.

Available Data

FOS Composite Quasar Spectrum

This is a mean quasar spectrum, between 350 and 3000 Å, constructed from 2 84 FOS obser vations of 101 quasars with redshifts z > 0.33, as described in **Zheng, W., et al. 1997 ApJ,475,469**, from the 1 Feb issue of *The Astrophysical Journal*. This reduced archival data is made available courtesy of Wei Zheng .

The spectrum is available as a flat ASCII file:

- **Uncompressed** (409.96 kbytes)
- **Unix compressed** (93.087 kbytes)
- **gzip compressed** (78.277 kbytes)

(Your browser should attempt to save the above files to disk, rather than displa ying them.)

The table columns are:

- **Rest wavelength (Å)**
- **Relative flux F(λ)**
- **Error**
- **RMS**

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HST/GHRS Spectral Atlas of the O9 V Star 10 Lacertae

This page brings you to an ultraviolet atlas of 10 Lacertae constructed by members of the HST Goddard High Resolution Spectrograph (GHRS) scientific development and calibration teams. The star 10 Lac was chosen because it is unique as a bright O (O9V) star exhibiting a very sharp-lined spectrum. As a member of the Lacerta OB1 association, the star is known to have a distance of about 600 pc.

The atlas consists of a number of plots of relative flux versus wavelength over the range 1181 -- 1777 Å. The data were recorded by 4:1 substepping the G160M (medium resolution) grating over an angle corresponding to one pixel at the detector. Each pixel corresponds to a spectral resolution element of about 15 km/s. Fluxes of "continuum pixels" range from 32,000 to 100,000 photon counts across the total spectral range, resulting in a signal-to-noise ratio in excess of 100. The data were recorded over a total time of about 5 hours on 6 November, 1992 through the small science aperture. Note that these observations were done before the installation of the COSTAR corrective optic element. Full details of these observations are given by Brandt et al. (1998).

Taking into account the signal to noise, wavelength range, and the wealth of unblended sharp lines, this is probably the most comprehensive ultraviolet spectral atlas of a hot star published to date. Wavelength identifications were obtained with the aid of a spectral line synthesis codes and model atmosphere data. This has permitted some line blends to be designated. Identifications are given in the atlas for 45 interstellar lines of 17 ions. Stellar wind lines are evident in the form of asymmetric C IV (1548, 1551 Å) and N V (1239, 1243 Å) absorption lines as well as nearly symmetric absorption lines of strong lines of He II, Si IV, and N IV. The atlas is dominated by the presence of over 700 absorption lines of six ionization levels of 16 chemical elements. The interstellar line list and the full list of photospheric lines is given in the accompanying two tables. The "Data" consist of two-column ascii files listing the wavelengths (Ångstroms) and flux (10^9 ergs cm^2/s/Å). "ID" list both measured and laboratory wavelengths; the sources for the latter are given in the Brandt et al. paper.

Available Data

HST/GHRS Observations of the HgMn star chi Lupi

A major, eight-year investigation of the extraordinarily detailed ultraviolet spectrum of the sharp-lined, non-magnetic, main-sequence chemically peculiar star chi Lupi (B9.5pHgMn + A2Vm) was undertaken as a GHRS GTO team project. The UV observations are comprised of 345 Å of the spectrum acquired with the Goddard High Resolution Spectrograph on board the *HST*, at an average resolution of 0.023 Å. The major results of this program are summarized in Leckrone et al. (1999), and the complete set of echelle spectrograms is presented as an atlas in Brandt et al. (1999).

We present here an online version of our reduced data, as well as the synthetic spectra and line identification lists used to produce the figures in Brandt et al. (1999). We anticipate that this atlas will be a useful resource for both astrophysicists and atomic physicists and will serve as a roadmap for future UV spectroscopy of late-B and early-A stars.

Available Data

Related Publications

HST/GHRS Chromospheric line Atlas for Procyon

This page brings you to a short series of ultraviolet spectra of chromospheric lines of Procyon (F5 IV-V) constructed and published by Dr. Brian Wood and colleagues at the University of Colorado (see Wood et al. (1996). MAST is grateful to these investigators for providing their data of a chromospheric spectrum of a near-solar type star.

The F5 IV star Procyon (alpha CMi = HD61421) was chosen it is a nearby star with prominent chromospheric emission lines in its spectrum. These lines appear to be broadened by nonthermal mechanisms and are formed over a range of layers in the chromosphere. Therefore, they exhibit similarities to chromospheric lines in the solar spectrum.

The Wood et al. atlas consists of plots of absolute flux for seven wavelength bands ranging from Si III, Lyman-alpha, and N V lines near 1200 Å to the Mg H/K lines near 2800 Å. The data shortward of 2000 Å were recorded through the Large Science Aperture (LSA) by 4:1 substepping the G160M or G200 (medium resolution) gratings, giving a resolution of 17,000 to 21,000. Longward of 2500 Å the small science aperture (SSA) was used, and substepping was again done, this time with the EB-20 or EB-22 echelle gratings, giving a resolution of about 75,000.

The data given in the table and figures are very similar but not precisely equivalent to those published. The new data provided by Dr. Wood differ from those published in that: (1) a more recent flux calibration has been employed, (2) wavelengths are given "old style" (in-air wavelengths longward of 2000 Å), (3) annotations in the figures give the in-air laboratory wavelengths of the chromospheric lines, (4) multiple lines of an ion on any one plot arise from the same multiplet, (5) very weak lines identified in the paper are omitted from our rendition of the plots. In addition, note that the Wood et al. paper details the small redshifts of these features.

Available Data

HST/GHRS Spectral Atlas of the M2 Iab Star Alpha Orionis

This page brings you to an ultraviolet atlas of Alpha Orionis (Betelgeuse) constructed by members of the HST Goddard High Resolution Spectrograph (GHRS) scientific development and calibration teams. This star was chosen because of extensive observations of it from ground-based spectrographs, photometers, and interferometers in the optical and IR spectral regions and because of the time coverage of its variations from ground sites and the IUE satellite by many observers.

The spectral data were recorded on 1992 Septmber 24 using the GHRS Small Science Aperture (SSA). (Note that these observations were done before the installation of the COSTAR corrective optic element.) The atlas consists of a number of plots of relative flux versus wavelength over the range 1979 -- 3300 Å. The data were recorded through the Large Science Aperture (LSA) by 4:1 substepping the G270M (medium resolution) grating over an angle corresponding to one pixel at the detector. The pixel-to-pixel sampling decreases with increasing wavelength from 3.7 to 2.0 km/s, or about 1/4 of a resolution element. The signal to noise in "continuum pixels" varies from 3 near 2000 Ångstroms to about 30 at 3000 Ångstroms; in the emission lines the SNR is somewhat higher. Full details of these observations are given by Brandt et al. (1995).

Taking into account the signal to noise, wavelength range, and the wealth of unblended sharp lines, this is possibly the most comprehensive ultraviolet spectral atlas of a cool star published to date. Wavelength identifications were obtained primarily from lines already observed in this star and other luminous red stars by the IUE. Laboratory measurements were taken from R. L. Kelly (J. Phys. & Chem Ref. Data, 16, Suppl. No. 1, 1987).

The "Data" consist of two-column ascii files listing the wavelengths (Ångstroms) and flux (10^9 ergs cm^2/s/Å); the column headers must be stripped before being numbers are read. The identifier "ID" lists both measured and laboratory wavelengths; the sources for the latter are given in the Brandt et al. paper. Note that some fluxes in the original data are negative; these have been set artificially to zero.

Available Data

HST/Time Series of gamma Cas GHRS observations

This page brings you to an ultraviolet grayscale timeseries of difference spectra for gamma Cas in the neighborhood of the SiIV resonance lines. This is a unique kind of data set for the GHRS.

The spectral data were recorded for over 21 hours while gamma Cas was in HST's "continuous viewing zone" on 1996 March 14-15 using the GHRS 2" Large Science Aperture (LSA). This mode of observing permitted observations to be made continuously except for a few minutes of wavelength recalibration at the end of each orbit and except for interruptions of the South Atlantic Anomaly, which became non-negligible toward the end of the observing sequence. The observations covered 1045 out of a total of 1280 minutes. The data were obtained at a cadence of one spectrum per second in the ACCUM mode (8100 counts per second per pixel) with the G160M grating and were later rebinned to 1 spectrum per minute. The ACCUM mode permitted only a modest resolution (30 km/s) but provided the ability to integrate fluxes unobstructed by an aperture and construct a pseudo-continuum light curve from "non-line pixels." The spectral range covers approximately 1382--1417 Ångstroms.

Several instrumental effects had to be removed to obtain the final spectra. These effects included included fixed pattern noise artifacts from the detector, differential spacecraft velocities, and shifts of the spectrum in both detector coordinates caused by changes in the Geomagnetic field (so-called "GIMP") as the spacecraft traced its orbit. The removal of the velocity effect gives a slight residual wavy appearance to sharp features in the grayscale plot. Finally, photometric variations in a 140 pixels to the red of the Si IV line complex were removed and are presented as a separate data file. Finally, a maximum-spectrum template was obtained from the spectra by submtracting the maximum flux at each pixel from each spectrum of the time series. The data shown are from difference spectra from that template in units of continuum = 1. Full details of the data reductions and of the continuum light curve are given in Smith, Robinson, and Hatzes (1998).

The spectra were taken as part of a simultaneous campaign with the RXTE satellite and contemporaneously with IUE and optical observations two months earlier. A full analysis of the details of the X-ray characteristics are given in Smith, Robinson, and Corbet (1998). The analysis of the quasi-continuum light curve obtained from these and wavelength-integrated IUE data are discussed in terms of occulting magnetic clouds by Smith, Robinson, and Hatzes (1998). The analysis of the variations of the photospheric Si IV lines, the blue-to-red moving (striated) features, and many other faint features away from the Si IV complex is published by Smith and Robinson (1999). An analysis of the Si IV DAC features in the context of X-ray illumination is given by Cranmer, Smith, and Robinson (2000, in preparation).

The "Available Data" consist of spectral and photometric data files. The photometric file lists time from start in minutes and the flux normalized to unity for (normalized for the first two orbits) is a UV pseudo-continuum light curve The spectral files consist of two-column ascii files listing the wavelengths (Ångstroms) and flux in continuum units. The one line identifying header must be stripped before numbers are read in the wavelength and flux files. Postscript and files of the grayscales are scaled in intensity to bring out the global development of the dominant, Discrete Absorption Features of Si IV and also the faint absorptions and striations ("migrating subfeatures") that are ubiquitous in this region of the spectrum. These figures show wavelength from left to right and time in minutes from bottom to top.

Available Data

Suggested Guidelines for Authors of Prepared Science Products

The MAST Prepared Science Products site provides a user with on-line information that can be browsed or downloaded (e.g., preview images, data files) by users. In general, these science products should be data that have been processed and interpreted to a degree considerably beyond that obtained from pipeline processing, i.e. modifications to the pipeline data product that are critical to the published scientific result. Common examples are spectral atlases, greyscale spectral images of temporal activity of an object, and image atlases. Datasets of related images and spectra of objects are also encouraged. Tables of extracted parameters (e.g., equivalent widths, radial velocities) would not in themselves comprise a complete Prepared Science Product. We have introduced a separate subcategory for prepared science products that are catalogs with links to the published data.

MAST reserves the right to select which datasets will be posted in this site. In some cases MAST will agree to point to an external site that already adheres to its standards and protocols. Authors interested in contributing data to the MAST Prepared Science Products site should contact the address given at the bottom of this page.

Here are some guidelines that MAST has found useful to aid users interested in offering data for this site:

1. the prepared science product should be published in a refereed journal or have a demonstrable record of use,
2. the data may be prepared either in the form of standard FITS files, or (spectra only) ASCII tables. If possible, the FITS headers should provide information pertinent to the observation (date, exposure time, instrument). Other data products (preview images, documentation) do not have to be limited to these formats,
3. the home page should consist of a prolog or introduction to the use of the prepared science product. This page should link clearly to a catalog or data listing. This page should give a simple explanation of what instrument was used to obtain the data, the purpose of the observations, detailed information on data processing (especially non-standard procedures), and any other useful information to orient the user (the user should be considered to be a professional astronomer from any of many diverse subcommunities),
4. clear links (preferably not embedded in text) should be provided for easy navigation,
5. data should be listed in a catalog or table referring to a common object (or sky region),
6. preview images should be put in a standard imaging format, such as gif, ps, jpeg, etc.,
7. each image should refer to a separate object or sky region (e.g. no spectral montages of different objects having similar physical properties),
8. A copyright statement supplied by MAST should be displayed at the end of the home page,
9. No extra data processing should be required from MAST staff.

MAST Prepared Science Products

The following is a listing of sites of highly processed datasets from missions supported by MAST. These are datasets consisting of atlases, images, and/or the data themselves which have been placed on the web either as final data products or as appendices referenced in recent published papers. These data are in the public domain and/or will soon be published. The datasets are organized by type of observation (survey, individual objects, time series) and will include a growing number of catalogs with links to the data and in some cases spectra and/or images.

Deep Sky Surveys

- Hubble Deep Field
- Hubble Deep Field South
- Medium Deep Survey

Wide Field Survey Catalogs

- Magellanic Clouds Planetary Nebulae (HST)
- SDSS Quasar Catalog

Spectral Atlases: multi-object samples

- Ultraviolet Spectral Atlas of Standard Stars (IUE)
- Library of Copernicus Atlases of Selected Stars
- Far-Ultraviolet Spectral Atlas of Stars (EUVE)
- Library of IUE NEWSIPS SWP Echelle Spectra for White Dwarfs
- FOS Composite Quasar Spectrum (FOS)

Spectral Atlases: individual objects

- High S/N GHRS LSA G160M Observations of 10 Lacertae (HST)
- High S/N GHRS SSA Echelle Observations of chi Lupi (HST)
- High S/N GHRS SSA Observations of Chromospheric lines in Procyon (HST)
- High S/N GHRS LSA G270M Observations of alpha Ori (HST)

Time-Dependent Spectra

- Grayscale of Time Variations of gamma Cas near SiIV Doublet (HST)

Guidelines for authors of new prepared science products

For further information see: VizieR astronomical catalogs

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About the IUEDAC

IUEDAC User's Guide

The latest **IUEDAC User's Guide** was updated on February 5th, 1998, and is now available online. The changes primarily include more information on working with various file formats and analyzing NEWSIPS data. (Note the one major change since the User's guide was updated was that the program COADD is now compatible with NEWSIPS high dispersion files.)

The User's Guide is also available for downloading in either **Postscript (guide.ps)** , **LaTeX (guide.tex)** , or **PDF (guide.pdf)** format. A limited number of hardcopies are available on request.

IUEDAC IDL Software Libraries

Latest News: Chronological listing of the most recent changes to the IUEDAC software libraries.

The IUEDAC software libraries below (except the windows NT file which was updated March 16th, 2000), were last updated: 30 June 1999.

- **Macintosh**
- **Ultrix and DEC Unix**
- **Sun Unix**. May also be used for Linux (although this platform is not officially supported).
- **Vax VMS**. Please see this note concerning record attributes and recent IDL changes.
- **Windows**. Use win31_rdaf.exe for windows 3.1 systems, winNT_rdaf.zip for others.

Individual Procedures: Allows individual programs to be displayed or downloaded.
Beta software: Files for all platforms created or modified since the last library set was created.

IUEDAC Software Documentation

The primary source for documentation on individual programs is the procedure prologs. The **IUEDAC Software Documentation Search** page allows this information to be displayed for specific procedures. Since the IUEDAC prologs uses a standard format, searches can also be made of subheadings by specifying the particular keyword. For example, the "modification history" can be displayed to see when the last changes were made, or a summary of the progam or programs (wildcards are allowed) can be displayed by selecting the keyword "purpose".

Y2K Testing

The **Y2K-Testing** page describes a study to determine which if any of the IUEDAC programs may have problems in the year 2000. The study resulted in several program modifications, all of which have now been incorporated into the IUEDAC libraries. The compressed libraries are available for download from the **iuedac software** directory in the anonymous ftp area.

Related Sites

Research Systems Inc.
: WEB site for RSI, the company which markets IDL.

IDL Astronomy User's Library
: A library of IDL routines supported by Wayne Landsman at Goddard Space Flight Center.

More Links
: An extensive list of links to other IDL and Astronomy-related WEB sites also maintained by Wayne Landsman at Goddard Space Flight Center.

Data Analysis Software

- euve1.9.tar.Z for EUVE IRAF data analysis.
- ISM Hydrogen Column Density Search Tool:

  Program that searches for ISM columns from a database of columns from nearby stars.

HUT Related Software

- Reading HUT FITS data files.
- HUT IRAF data reduction package.

Data Analysis Software

Some of the data analysis software packages used for the MAST archived data are:

- Space Telescope Science Data Analysis System (STSDAS)
- IUE Data Analysis Center software package (in IDL)
- IRAF/STSDAS tools for IUE data analysis
- EUVE IRAF software package available from STScI
- HUT IRAF data reduction package links

Information on these and other available astronomical data reduction and analysis software packages may be found at the Astronomical Software and Documentation Service.

Definition of the Flexible Image Transport System (*FITS)*

March 29, 1999

NOST 100-2.0

NASA/Science Office of Standards and Technology
Code 633.2
NASA Goddard Space Flight Center
Greenbelt MD 20771
USA

The NASA/Science Office of Standards and Technology (NOST) of the National Space Science Data Center (NSSDC) of the National Aeronautics and Space Administration (NASA) has been established to serve the space science communities in evolving cost effective, interoperable data systems. The NOST performs a number of functions designed to facilitate the recognition, development, adoption, and use of standards by the space science communities.

Approval of a NOST standard requires verification by the NOST that the following requirements have been met: consensus of the Technical Panel, proper adjudication of the comments received from the targeted space and Earth science community, and conformance to the accreditation process.

A NOST standard represents the consensus of the Technical Panel convened by the NOST\@. Consensus is established when the NOST Accreditation Panel determines that substantial agreement has been reached by the Technical Panel. However, consensus does not necessarily imply that all members were in full agreement with every item in the standard. NOST standards are not binding as published; however, they may serve as a basis for mandatory standards when adopted by NASA or other organizations.

A NOST standard may be revised at any time, depending on developments in the areas covered by the standard. Also, within five years from the date of its issuance, this standard will be reviewed by the NOST to determine whether it should 1) remain in effect without change, 2) be changed to reflect the impact of new technologies or new requirements, or 3) be retired or canceled.

The Technical Panel that developed this version of the standard consisted of the following members:

- **Robert J. Hanisch**, Chair, Space Telescope Science Institute
- **William D. Pence**, Secretary, NASA Goddard Space Flight Center
- **Barry M. Schlesinger**, Past Secretary, Raytheon STX
- **Allen Farris** , Space Telescope Science Institute
- **Eric W. Greisen** , National Radio Astronomy Observatory
- **Peter J. Teuben** , University of Maryland
- **Randall W. Thompson**, Computer Sciences Corporation
- **Archibald Warnock**, A/WWW Enterprises

Members of the previous Technical Panels also included:

- **Lee E. Brotzman**, Hughes STX
- **Edward Kemper**, Hughes STX
- **Michael E. Van Steenberg**, NASA Goddard Space Flight Center
- **Wayne H. Warren Jr.**, Hughes STX
- **Richard A. White**, NASA Goddard Space Flight Center

This standard is published and maintained by the NOST. Send comments and orders for NOST documents to:

NOST, Code 633.2, NASA Goddard Space Flight Center
Greenbelt MD 20771
USA
electronic mail: nost@nssdca.gsfc.nasa.gov
+1-301-286-3575
http://ssdoo.gsfc.nasa.gov/nost/

Other information about FITS can be obtained from the FITS support office. The FITS Support Office can be contacted as follows:

FITS Support Office
Code 631, NASA Goddard Space Flight Center
Greenbelt MD 20771
USA
electronic mail: fits@fits.gsfc.nasa.gov
+1-301-286-6695
http://fits.gsfc.nasa.gov/

5/13/1999

ADF

NASA/GSFC Astrophysics Data Facility

A User's Guide for the Flexible Image Transport System (FITS)

Version 4.0

April 14, 1997

NASA/GSFC Astrophysics Data Facility
Code 631
NASA Goddard Space Flight Center
Greenbelt MD 20771
USA

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MAST Data Format Guidelines

Introduction

This document describes recommendations for formatting data sets using the **Flexible Image Transport System** (i.e. **FITS**) format for inclusion in the Multi-mission Archive at the Space Telescope Science Institute (MAST). It assumes the reader is already somewhat familiar with FITS format. The terminology used is that defined in the **NOST FITS Draft Standard** (Copies of the FITS standard can be downloaded from the **FITS Support Office.**)

Choosing the Appropriate FITS Format

FITS has evolved significantly during the past 5 years. As a result, there is usually more than one way to store the same information within a FITS file. Each mission must decide which FITS format is most appropriate for their own data sets. This may be influenced by the data analysis software currently in place at the users institutions, since not all FITS readers support all the currently available FITS formats. A summary of the FITS formats used by the missions currently supported by MAST can be found in the **FITS File Formats** table. The table shows that projects have used a variety of FITS formats for archiving data, including all the approved FITS extensions. The one FITS format not represented is the **"Random Groups Structure"**. Although this format is defined in the NOST FITS Draft Standard document and used for radio interferometry data, it has become a deprecated standard and is not recommended for MAST archival data sets.

The **HEASARC** FITS Working Group (HFWG) has adopted a set of **FITS file Recommendations** for the high-energy astrophysics community. The HEASARC documents describe detailed recommendations regarding: the use of specific project-defined keywords, recommended formats for particular types of data, the naming of table columns, and the use of particular physical units. Although aimed primarily at the high-energy astrophysics community, the recommendations should be useful for other projects as well.

Similiarly, the **AXAF Science Center** (ASC) has compiled the **ASC FITS File Designers Guide** which details the FITS conventions adopted by the AXAF project for its archival data sets. (Note the AXAF guidelines comply with the HFWG guidelines.)

FITS keyword conventions have also been adopted at the Solar Data Analysis Center (SDAC) at Goddard Space Flight Center for several solar missions.

Besides the **FITS Support Office** at Goddard Space Flight Center, another source for FITS documents, sample FITS files, and links to other FITS-related sites, is the **FITS Archive at NRAO** .

Spectral Data

In general, we suggest storing spectral data (i.e., data sets composed of one or more vectors) using **binary table extensions**. It is also possible to store vectors in a non-homogeneous primary array, (e.g., having a row of wavelengths followed by a row of fluxes, etc.) however it is usually more difficult to interpret the resulting data set. Some data analysis systems have however adopted conventions for handling these files (e.g., IRAF).

A binary table containing vector fields seems the most logical way to store this type of data although some FITS readers may not be able to read this format. Hopefully this will change in the near future. With vector fields, one row in the binary table could contain all the data for one spectrum (e.g., a vector of wavelengths, followed by a vector of fluxes, etc.). Additional spectra could be stored in the same manner in the following rows (assuming the vectors are of the same length and format). Currently, a more readable but less flexible format would be to store the data in scalar fields so that each row of the table contains all the data for one wavelength. This implies however that the table could not be used for storing multiple (e.g., echelle) spectra. FITS files could however contain multiple binary tables.

If multiple spectra are to be stored which have vectors of variable length, the project must decide between the following format options:

- pad the vectors with zeroes to a fixed length and store as vector fields in one table,
- use scalar fields and one spectrum per table with one wavelength/flux value per row in the table,
- use the **not-yet-approved** variable-length array facility described in the original binary table extension proposal and store all spectra in one table. (The Copernicus raw data sets are an example of this format.)

Although non-linear wavelength values must usually be stored as individual values, linear wavelengths can be stored as FITS keywords (i.e., a starting wavelength and a wavelength increment), or, if multiple spectra are to be stored within each binary table (e.g., one table row per spectra), the starting wavelength and wavelength increment can be stored as scalar data fields within the table. Note the IAU now approves the use of vacuum wavelengths above 2000 Angstroms, so UV data no longer need to contend with the vacuum-to-air correction which causes a non-linearity at 2000 Angstroms.

As mentioned before, not all processing systems support vector fields. Earlier versions of IRAF for example, do not support this format. Although the **variable-length array facility** is not yet an approved FITS standard, the use of vector fields in binary tables has been an approved format since 1994, so hopefully more FITS readers will support this format in the future. Projects must decide which format would best serve their user community.

Image Data

Image or multi-dimensional data can be stored as a **primary array**. This is the most basic FITS format and should be readable by most if not all FITS readers. Technically the Binary table extension can also be used to store **multi-dimensional arrays**, however most FITS viewers currently require primary array FITS files. Image data can also be scaled (using the BSCALE and BZERO keywords) to allow data to be stored as integers rather than (larger) floating point values, however unless disk space is an issue, it is preferable to store the data unscaled.

FITS extensions can be added for either additional image or spectral data. We recommend **image extensions** for additional image data, **binary tables** for storing mixtures of ASCII and binary data, and **ASCII tables** for purely ASCII data. Note ASCII tables are particularly useful for storing "catalog-type" information.

Keywords

Besides the **required FITS keywords**, the project-defined keywords should be sufficient to properly describe the included data. This information is also useful when included as a separate project catalog (see MAST Guidelines for Archiving Astrophysical Data). For processed data, it is useful to store the processing history using **FITS commentary keywords** (i.e., using the HISTORY, COMMENT, or blank keywords). It is also strongly recommended that the project-defined file name be stored using the FITS FILENAME keyword.

Data to be archived within MAST will be checked for proper syntax using various FITS verification programs. The reserved FITS keywords must follow the standard FITS conventions or they will be modified to conform. (Surprisingly, we have found several errors in the DATE and DATE-OBS keyword values.) Project-specific keywords will generally not be modified. It is suggested that the keyword comment fields be used to help define these keywords.

Keyword Inheritance

There has been some discussion lately about whether information contained in the primary header should be relevant to data stored in the extensions. In other words, should the extensions "inherit" the keywords contained in the primary header. Unfortunately, the FITS community has not reached a consensus on how this should be handled. Some feel the extensions should be self-contained and not linked in any way to the primary header information, while others assume the primary header information should be considered global and apply equally to all data in the file. Adding to the problem is the fact that numerous FITS files were created and archived before the issue was ever raised.

One suggestion has been to include the keyword INHERIT (with a value of either T (true) or F (false)) in the extension headers to indicate whether the primary header keywords apply to each particular extension. This would help avoid the ambiguity, however the INHERIT keyword has not been officially reserved for this purpose. This convention however has been adopted by the HST project and is described in the STScI User's Guide to the IRAF FITS kernel.

A survey of the existing (non-HST) MAST data sets found that inheritance was assumed in **all** FITS files containing extensions. In other words, **all** the MAST archived FITS files assume that project-defined keywords in the primary header apply to all the extensions contained within the file. In general, the convention has been to store all the observation information in the primary header, and store only a minimal number of FITS keywords in the extension headers. It may be the case however, that older missions tended to use simpler file formatsi.

It is therefore difficult to give future missions a recommendation regarding keyword inheritance. The choices are basically:

- assume no inheritance and duplicate all neccessary keywords in all extensions,
- assume keywords in the primary header are global and apply to all extensions, or
- use the HST convention of adding the keyword INHERIT to the extension headers indicating whether keyword inheritance should apply.

Perhaps the FITS community will adopt a convention for keyword inheritance in the near future which could apply to all future FITS files.

Units

Another recently discussed issue has been the use of standard units for data stored in FITS format. The current FITS standard states units "... should conform with the recommendations in the IAU style manual". The problem however is that most UV spectral data archived in MAST use Angstroms for wavelengths and ergs/cm2/s/A for absolute fluxes, both of which are listed in the IAU style manual. as "obsolete units". As with the "keyword inheritance" issue, there is not yet a consensus among the FITS community regarding the use of standard units and it is therefore difficult to make a recommendation for future missions.

Coordinate Keywords

It is recommended that data sets include the target coordinates using Right Ascension and Declination specified in decimal degrees. There is currently no consensus as to the keyword names to use, but this may be at least partly dictated by the spacecraft instrumentation. Some of the currently used keywords are shown in the FITS coordinates table.

File Naming Conventions

The only suggestions made for data set names are the following:

1. the name should be sufficient to uniquely identify each data set,
2. file names should be case-insensitive,
3. names should be no longer than necessary.

Historically file names following the ISO 9660 standard had a maximum of 8 characters for the name and 3 characters for the extension. This convention meant that files could be stored on DOS or Windows 3.1 16-bit computer systems without truncating the file name. Now that 32-bit computers are more common, this naming convention is less important and longer file names are common. However consider that many users may need to ftp files between systems, and have to manually type in the file names.

Flexible Image Transport System (FITS)

The astronomical community has adopted the **Flexible Image Transport System** (i.e. **FITS**) format as the default standard for the exchange of data between institutions. The FITS file format is platform independent, supported by many institutions, and endorsed by both NASA and the IAU. For these reasons FITS is the recommended file format for archiving data at STScI. A description of the MAST data format recommendations can be found in the **MAST Data Format Guidelines** document.

For the official description of the FITS format, see the **FITS Standard Document**.

The **FITS User's Guide** provides examples, infomation on the history of FITS as well as a thorough description of the format.

Related Sites

NASA Data Archive Centers

- High Energy Astrophysics Science Archive Research Center (HEASARC)
- Infrared Science Archive (IRSA)
- Astronomy & Astrophysics at the National Space Science Data Center (NSSDC)
- Astrophysics Data Facility (NASA/GSFC)

Other Data Archive Centers

- Canadian Astronomy Data Centre (CADC)
- Space Telescope European Coordinating Facility (ST-ECF)
- ST-ECF/ESO Science Archive Facility
- LEDAS - the Leicester Database and Archive Service
- NAOJ - National Astronomical Observatory of Japan

Integrating Services

- The NASA Astrophysics Data System
- Centre de Donnees astronomiques de Strasbourg (CDS)
- NASA/IPAC Extragalactic Database (NED)
- Astronomical Data Center (NASA/GSFC)
- Astronomical Software and Documentation Service

Mission Sites (past, present & related)

- Chandra X-ray Observatory (AXAF)
- Space Telescope Science Institute (STScI)
- Far Ultraviolet Spectroscopic Explorer (FUSE)
- OGLE (Princeton Site)
- GSFC Laboratory for Astronomy and Astrophysics (LASP)
- VILSPA (IUE)
- INES (IUE) STScI Server, software & data provided by VILSPA
- RAL Astrophysics STARLINK
- Ultraviolet Imaging Telescope (UIT)
- Hopkins Ultraviolet Telescope (HUT)
- Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE)
- Extreme Ultraviolet Explorer (EUVE)
- Infrared Space Observatory (ISO)
- BeppoSAX Mission
- Space Telescope European Coordinating Facility
- Energetic Gamma Ray Experiment Telescope (EGRET)
- ORFEUS - BEFS (also known as Berkeley Spectrometer and EUV instrument)
- ORFEUS - FUV at Tübingen
- ORFEUS-SPAS II project page at GSFC

Future Missions

- Next Generation Space Telescope (NGST)
- Galaxy Evolution Explorer (GALEX)
- Cosmic Hot Interstellar Plasma Spectrometer (CHIPS)
- Kepler Mission

Organizations

- National Aeronautics and Space Adminstration (NASA)
- European Space Agency (ESA)
- Space Science Data System (SSDS)
- Astrophysics Data Centers Coordination Council (ADCCC)

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- NASA's Goddard Space Flight Center (GSFC) Astrophysics Data Facility (ADF) staff for access to the IUE and UIT browse images, and copies of the IUE, UIT, WUPPE, and HUT datasets. ADF staff members provided background information and documentation about these datasets. Special thanks to the WISARD group for a copy of their UIT databases.

- GSFC's Laboratory for Astronomy and Solar Physics (LASP) IUE Project for the IUE Documentation, the IUEDAC web pages, the IUEDAC software package, and the initial copy of the database.

- EUVE Project for initial copy of the EUVE database and various web pages.

- WUPPE , UIT , and HUT projects for additional information, documentation, and data.

- High Energy Astrophysics Science Archive Research Center (HEASARC) for access to the on-line copies of the EUVE data

- Dr. George Sonneborn and other members of the GSFC LASP for the Copernicus data, database, and associated web pages.

We would also like to request that users acknowledge the use of data obtained from MAST in their publications. An example acknowledgment is shown below.

> "Some/all of the data presented in this paper were obtained from the Multimission Archive at the Space Telescope Science Institute (MAST). STScI is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555. Support for MAST for non-HST data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contracts."

Users wishing to use documents obtained from the MAST web site for other than personal use, should first contact the MAST staff at archive@stsci.edu regarding neccessary permissions and acknowledgements.

HST Archive Search

Archive Status

Other Mission Search Pages

Important Downtime Message

Object Name	Resolver			
	◉ SIMBAD ○ NED [Resolve] ○ Don't resolve			
RA	Dec	Radius (arcmin)	Equinox	
		10.0	J2000	
Observation Date	Exp Time (sec)	Observer	Program ID	Obset
Target Description		Dataset Name		

[SEARCH] [Clear form] [Reset to defaults] Help...

Imagers [ALL] [NONE]	Spectrographs [ALL] [NONE]	Other [ALL] [NONE]	Release Date
☐ WFPC2 ☐ STIS	☐ FOS ☐ STIS	☐ FGS ☐ HSP	Archive Date
☐ ACS ☐ NICMOS	☐ GHRS ☐ NICMOS		
☐ WF/PC ☐ FOC	☐ FOC		☐ Show calibration observations

Observation Band

Central wavelength falls in this range (Å .. Å):

Output Options

Output columns	Sort output by:		Maximum number of hits
◉ Default ○ Custom...	1. Ang Sep	☐ *reverse*	100
Mark Targname RA Dec Ang Sep Exp Time V3 Pos Angle	2. Targname	☐ *reverse*	Output Equinox
	3. Dataset Name	☐ *reverse*	J2000
			☐ Show SQL query

Fri Mar 22 07:20:12 2002

archive@stsci.edu

Archive Status & Staging Disk Capacity

Planned Archive Downtimes

These are scheduled downtimes which will affect access to the HST Archive. Note: Due to the nature of the archive systems, we cannot always report unscheduled downtimes.

```
Thu Mar 21 11:56:54 EST 2002

Searches may be unavailable for an hour starting at 1 PM EST
today, March 21st.

We apologize for the inconvenience.
```

Check on the status of your individual requests *here*.

Staging Disk Capacity

This is the most current capacity of the Archive host's (archive.stsci.edu) staging disk:

```
Fri Mar 22 07:20:15 EST 2002

Filesystem            kbytes    used   avail capacity  Mounted on
/dev/dsk/c4t124d0s6  846332414 388063019 449806071    47%    /stdatu/dads_stage
```

For Netscape-compatible browsers, this page will be refreshed every five minutes.

If the capacity is near 100%, then the staging disk is full, and HOST retrievals and retrivals submitted through the Web interface will fail. When that happens, you may either

- Wait until there is more space on the staging disk (every hour, files older than three days are swept from the staging disk), or
- you can select NET retrieval instead of HOST and have the data sent directly to your machine.

When the disk is full, and you have data on it you don't need, please let us know so we can delete it to make space for other retrievals.

HST Target Search

HST Home

Getting Started

Data Search & Retrieve

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What's New

FAQ

Data Reduction/Analysis

Proposal Support

GO / GTO Support

Science Products

Project Publications

Related Sites

Acknowledgments

HST Science Search Help

This page describes how to use the *new* **HST Science Search form** and describes the individual fields in that form.

> Features that are new in this release will be marked like this.

Use the HST Science Search form to search the HST Archive Catalog by object name, position, observation date, proposal ID, wavelength, and data type. You can also mark data for retrieval using this interface.

> This new interface can retrieve data either to the archive staging area or directly to the destination you specify, so you can now retrieve proprietary data (if you're priveleged to do so). To allow you to safely enter a destination username and password, we use the same security mechanism as many commercial sites.

Object Name

The name of the astronomical object you want to search for.

Resolver

The name resolver you want to use, if you want to get an object's coordinates. To resolve an object's name into its coordinates, enter the object name in the **Object Name** field, select either NED or SIMBAD for the resolver, and hit the **Resolve** button. The form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will *not* change any other choices made in the form.

> You don't *have* to hit the resolve button, though. If you enter an object name and select either SIMBAD or NED, and then hit the "Search" button, the script will get the coordinates before doing the search. A message will appear at the top of the results page showing you what coordinates were found for the object (or an error message if the name resolver didn't work for some reason).

We recommend that you use object-name resolution to find observations of fixed targets in the database. This is the most reliable way to look up observations, because the observer could have given the observation any name at all (for example, `NGC1976` instead of `M42`, or `PARALLEL-FIELD`). However, if you do know the name of the object, you can select HST Target Name, in which case, the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (Remember when you do this to *not* press the **Resolve** button.)

The SIMBAD and NED object name resolvers can only resolve the names of fixed astronomical object; they cannot compute the positions of moving objects (planets, comets, etc.).

Resolve

When you press this button, the HST Science form will be redrawn with the coordinates of the object name entered into the RA and Dec fields.

RA,Dec

The Right Ascension and Declination around which you want to search. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by
indicating a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you can delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

How far around the search position you would like to search, in arcminutes.

> This used to be the "radius" of a coordinate box, but we now compute the angular separation between each result dataset and the search center, so this really is a radius. (The results will be sorted on the angular separation by default.) So this really is a circular radius around the search position.
>
> One result is that you can do fancy stuff like searching for all observations between 2 and 8 arcminutes from the center of a galaxy (just give `2 .. 8` for the radius).

Equinox

The equinox of the RA and Dec you have entered, either B1950 or J2000. This only affects the input coordinates; the output coordinates will always be J2000.

> There's a selector for output coordinate types in the output options section, but it doesn't work yet.

Observation Date

The date of the observation. More specifically, the date and time, in GMT, on which the exposure was started. When specifying this date, you need to include a date and an optional time. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Jul 15 1994
Jul 1994 15
15 Jul 1994
1994 Jul 15
1994 15 Jul
7/15/1994
7-15-1994
7.15.1994
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "July 1994" will look for observations done on July 1 1994 00:00:00, *not* for observations done during July 1994. Note also that when entering a date with the month in numerical format, the American ordeing is used; i.e., the first number is the month.

If a time is omitted, then midnight (00:00:00) is assumed. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Jul 15 1994
< Jul 15 1994
```

You can use the .. operator to search on a range of dates:

```
Jul 1 1994 .. Aug 1 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Jul 1 1994 .. Jul 3 1994,
Dec 1 1995 .. Dec 6 1995
```

will search for observations done within either one of these date ranges.

Exposure Time

The commanded exposure time in seconds. You can use operators or ranges in this field; for example,

```
< 100
> 1000.0
100 .. 1000
```

You can *exclude* a range of exposures using a comma:

```
< 100, > 1000
```

Observer/PI Last Name

The last name of the principal investigator of the observation. We sometimes refer to this person as the "observer".

Program ID

The HST proposal number under which the observation was executed. This can be a numeric ID or a comma-separated list of numeric IDs. Any characters other than digits, commas, and spaces will cause an error message to be displayed. For example, instead of searching for `GO-5916`, simply specify `5916`. Or to search for observations from either proposal 5410 or proposal 5916, specify `5410, 5916`. **Note: when using the prop_form search script, only one program id can be entered at a time.**

Obset ID

The observation set within the program. This is usually the same as the visit number, though in a small number of cases it will be different. The obset ID is used as the fourth and fifth letters of a dataset name. You can enter a comman separated list here. If necessary, obset IDs will be padded with leading zeroes to two characters.

Target Description

A short description of the target, supplied by the observer. like target names, these may not always be reliable- one observer's CLUSTER OF GALAXIES may be another's ELLIPTICAL- but they are generally better than nothing (especially where solar system objects are concerned; planet, asteroid, and comet names are more likely to be spelled out in the target description than in the target name).

Every morning, we generate a list of all the target descriptions currently in use. This list is linked back to the HST Science Search page, so you can read through this list (or search it with your browser's find capability) and find datasets matching the description.

Dataset Name

The dataset name is the unique identifier for an HST observation. (For NICMOS and STIS, it can also represent an association of exposures.) This value can be wildcarded using a *. *When you specify a dataset name, any instrument or wavelength specification will be ignored.*

Observation Band

Use this selector to decide how you want to use wavelengths in your search. The selector has three settings:

"Observation falls in this range"

For this setting, give a range of wavelengths (in Angstroms), separated by `..`; for example, `5000 .. 6000` indicates a range from 5000 to 6000 Angstroms. Observations will match this qualification when their central wavelength is within this range.

"Observation bandwidth contains this wavelength"

For this selection, you give a single wavlength in Angstroms; for example, `5000`. An observation will match this qualification when this wavelength falls within the bandwidth of the observation.

"Observation used these filters"

For this qualification, enter an HST filter name; for example, `F606W`. An observation will match this qualification if it used a filter by that name.

It's important to understand what we mean by "central wavelength" and "bandwidth" in the above discussion. For an image, these terms describe the throughput of the filter or filters used. For spectra, they describe the actual spectral range of the observation. (The exception to this rule is the FOC; for FOC spectra, "central wavelength" and "bandwidth" mean the same as for an image. This is because FOC spectra are done using an objective prism, and a spectral range is not calculated for them when they are archived.)

Also, notice that all wavelengths should be given in Angstroms.

Instruments Here you select which instruments you want data from. We've divided the instruments into Imagers, Spectrographs, and Other, but instruments that are (or were) capable of producing either images or spectra will appear in both places. These buttons will help you select *only* images or spectra from a particular instrument.

As a convenience, users with Javascript enabled in their browsers will see two little buttons here labelled `ALL` and `NONE`. These buttons will select or deselect all of the checkboxes in the section, so you don't have to go through hitting lots of checkboxes if you only want one instrument.

Imagers

In this section, select the kind of images you want to search for by selecting the instrument.

Spectrographs

In this section, select the kind of spectra you want to search for by selecting the instrument.

Notice that some instruments are capable of producing both images and spectra. In this case, the query will be properly built to search for the selected observation type for that instrument.

Other

Here you can select data from instruments that produce neither images nor spectra: the Fine Guidance Sensors (which produce astrometric, usually interferometric, data) and the High Speed Photometer (which produced photometric data). These are not checked by default.

Release date

Select the release date for the data, in GMT. See the observation date for the entry format. HST data has a nominal proprietary period of one year (though in special cases, this may be shortened or extended). The Release Date field gives the end of the dataset's proprietary period.

This used to be just a pair of radio buttons that let you specify only public or all data. Now it's a fully qualifiable date. By default it searches for everything released before today (i.e., public data only). If you're going to retrieve proprietary data, don't forget to delete this date.

Both public *and* proprietary datasets now have mark buttons. (Proprietary datasets will have an at symbol, @, next to the mark button, and on most browsers, the background for proprietary mark buttons will be yellow.) Properly authorized users will be able to retrieve proprietary data through the Web interface.

Archive Date

This is the date on which a dataset was archived. If a dataset was archived more than once (for example, if it was reprocessed by the pipeline), then this will show the *latest* archive date.

About 75% of all science datasets are archived within 24 hours after the end of the observation. (delays longer than this are usually due to problems in pipeline calibration, or if the data stream gets backed up. Delays like this are rare, however, and are more likely to apply to the newer instruments early in their careers.)

The Archive Date was added to the HST Archive Search on 1998 Feb 19.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. (`Mark` is pre-selected for you.) The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. the rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning thousands of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output. *This doesn't work yet.*

Show SQL Query

Select this checkbox if you want to see the SQL query that the HST Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The HST Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

FUSE Archive Search

Archive Status

NEW Important Downtime Message NEW

Object Name	Resolver	
	◉ SIMBAD ○ NED ○ Don't resolve	Get coordinates

RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

FUSE Observation-level Information

Observation Date	Exp Time (sec)	Observer	Program

Archive Date	Release Date	Observation Name

SEARCH | Clear form | Reset to defaults | Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
Mark, Targname, Ra Targ, Dec Targ, Ang Sep, Ecl Lat	1. Ang Sep	☐ *reverse*	100
	2. Targname	☐ *reverse*	Output Equinox: J2000
	3. Observation Name	☐ *reverse*	☐ Show SQL query

Fri Mar 22 07:20:23 2002

archive@stsci.edu

EUVE Archive Search

Object Name	Get coordinates from		
	(•) SIMBAD ( ) NED ( ) Don't resolve	Resolve	
RA (J2000)	Dec (J2000)	Radius (arcmin)	
		10.0	J2000

Object Category	Observation Date	Exposure Time	[x] Day
CV EARLY EX GRB LATE LMXB NOID		kilosec	[x] Night
	Observer	Old filename	Release Date

SEARCH	Clear form	Reset to defaults	Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
(•) Default ( ) Custom...	1. Object Name	[ ] reverse	100
Object Name Observation Date Day/Night RA (J2000) Dec (J2000) ref Exposure Time	2. RA (J2000)	[ ] reverse	Output Equinox
	3. Dec (J2000)	[ ] reverse	J2000
			[ ] Show SQL query

Fri Mar 22 07:20:25 2002

archive@stsci.edu

UIT Archive Search

Archive Status

Object Name	Resolver	
	(•) SIMBAD ( ) NED ( ) Don't resolve	Get coordinates

RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

Ultraviolet Imaging Telescope

Object Category	Filter	
00 HUT CAMERA SENSITIVITY TARGETS 05 WUPPE APERTURE POSITION CALIBRATORS 06 CALIBRATION 11 COMETS 12 PLANETS 13 ASTEROIDS, ETC. 21 SUPERGIANTS	A1 A2 A3 A4 A5 A6 B1 B2 B3 B4 B5 B6	Entry ID / Exposure Time (s) Observation Date

SEARCH	Clear form	Reset to defaults	Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
Mark Entry ID Object Name RA (J2000) Dec (J2000) uit_ref Observation Date	1. Object Name 2. RA (J2000) 3. Dec (J2000)	☐ *reverse* ☐ *reverse* ☐ *reverse*	100 **Output Equinox** J2000 ☐ Show SQL query

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Fri Mar 22 07:20:28 2002

UIT previews are courtesy of the Astrophysics Data Facility

HUT Archive Search

Archive Status

Object Name	Resolver		
	(•) SIMBAD [Get coordinates] ( ) NED ( ) Don't resolve		
RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

Hopkins Ultraviolet Telescope

Object Category	Entry ID	Exposure Time (s)
00 HUT CAMERA SENSITIVITY TARGETS 01 HUT SPECTROMETER FOCUS TARGETS 05 WUPPE APERTURE POSITION CALIBRATORS 06 CALIBRATION 11 COMETS 12 PLANETS 13 ASTEROIDS, ETC		
	Observation Date	

[SEARCH] [Clear form] [Reset to defaults] Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
Mark Entry ID Object Name RA (J2000) Dec (J2000) RA (B1950) Dec (B1950)	1. Object Name	☐ reverse	100
	2. RA (J2000)	☐ reverse	Output Equinox
	3. Dec (J2000)	☐ reverse	J2000
			☐ Show SQL query

archive@stsci.edu
Fri Mar 22 07:20:31 2002

HUBBLE SPACE TELESCOPE MEDIUM DEEP SURVEY
WFPC2 CATALOG

Define Fields	Find Fields	Define Objects	Find Objects	OR	Define Image	Clear Form	ReStart

Please widen your Browser Screen till you see ReStart in the table above.

Select as required the Image format. If not FITS, define the range in GrayScale, and if JPG, define the Quality.

JPG GrayScale ADU : 0 to 20 JPG Quality : 30

This catalog of over 210,000 faint galaxies and stars is based on observations with the European Space Agency (ESA) and National Aeronautics and Space Administration (NASA) Hubble Space Telescope (HST).

The catalog contains data from 387 Wide Field Planetary Camera (WFPC2) fields taken in pure parallel mode for the Medium Deep Survey (MDS), Guaranteed Time Observations (GTO), and from the HST Data Archive primary observations of 54 galaxy cluster fields and 81 random fields which match the MDS survey criteria, including the Hubble Deep Field.

The data is obtained from the Space Telescope Science Institute (STScI), which is operated by the Association of Universities for Research in Astronomy inc. (AURA) under NASA contract NAS5-26555. The analysis is funded by the HST WFPC2 Science Team and STScI grants GO2684, GO6951, and GO7536 to Prof. Richard Griffiths and Dr Kavan Ratnatunga at Carnegie Mellon University (CMU).

The analysis uses automated maximum likelihood 2-Dimensional image analysis software developed by Dr. Kavan Ratnatunga. The MDS pipeline data reduction was done by Eric Ostrander, and continued by Adam Knudson. We gratefully acknowledge help from Dr Stefano Casertano, Dr Myungshin Im, Dr Avi Naim and Dr Lyman Neuschaefer who were for some years associated with the MDS pipeline.

Bibliography of MDS Science Publication

WFPC2 MDS Catalog Home-page at http://archive.stsci.edu/

Documentation (Preliminary draft)

Direct access to MDS Database on CDROM at http://archive.stsci.edu/

CMU MDS group Home-page

If you find the MDS catalog useful PLEASE introduce yourself and send comments or any questions to :

Kavan U. Ratnatunga

FUSE Target Search
FUSE Proposal Abstracts

FUSE Home
Getting Started
Data Search & Retrieval
Search Form
Exposure Search
Daily Data Reports
What's New
FAQ
Data Reduction/Analysis
Instrumentation/Operations
Related Sites
Papers
Gallery
Acknowledgments

FUSE Science Search Help

This page describes how to use the FUSE Science Search form and describes the individual fields in the form. For information about FUSE and its data, see the FUSE homepage at http://fuse.pha.jhu.edu/.

Use the FUSE Science Search form to locate and retrieve observations from the FUSE data archive at STScI. Both public and proprietary data may be retrieved through this interface.

The FUSE Science Search form offers a view of FUSE *observations*, which comprise one or more *exposures*. To locate individual exposures, use the FUSE Exposures Search page. More information about retrieving FUSE data may be found on the FUSE retrieval help page.

Object Name
The name of the astronomical object you want to search for.

Resolver
The name resolver you want to use, if you want to get an object's coordinates. To resolve an object's name into its coordinates, enter the object name in the **Object Name** field, select either NED or SIMBAD for the resolver, and hit the **Resolve** button. The form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will *not* change any other choices made in the form.

If you enter an object name and select either SIMBAD or NED, and then hit the "Search" button, the script will get the coordinates before doing the search. A message will appear at the top of the results page showing you what coordinates were found for the object (or an error message if the name resolver didn't work for some reason).

We recommend that you use object-name resolution to find observations of fixed targets in the database. This is the most reliable way to look up observations, because the observer could have given the observation any name at all (for example, `NGC1976` instead of `M42`). However, if you do know the name that the observer gave as the object, you can select FUSE Target Name. In that case, the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (Remember when you do this to *not* press the **Resolve** button.)

The SIMBAD and NED object name resolvers can only resolve the names of fixed astronomical object; they cannot compute the positions of moving objects (planets, comets, etc.).

Resolve
When you press this button, the FUSE Science form will be redrawn with the coordinates of the object name entered into the RA and Dec fields.

RA,Dec
The Right Ascension and Declination around which you want to search. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by indicating
a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you can delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius
How far around the search position you would like to search, in arcminutes. You can specify either a single number or a range. A single number means "all observations whose positions are less than this many arcminutes from the given position". A range can be given to get observations within a torus around a position; for example, "5 .. 20" will find observations between 5 and 20 arcminutes from the search position.

Equinox
The equinox of the RA and Dec you have entered, either B1950 or J2000. This only affects the input coordinates; the output coordinates will always be J2000.

Observation-level Information

Observation Date
The date of the observation. More specifically, the date and time, in GMT, on which the exposure was started. When specifying this date, you need to include a date and an optional time. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Jul 15 1994
Jul 1994 15
15 Jul 1994
1994 Jul 15
1994 15 Jul
7/15/1994
7-15-1994
7.15.1994
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "July 1994" will look for observations done on July 1 1994 00:00:00, *not* for observations done during July 1994. Note also that when entering a date with the month in numerical format, the American ordeing is used; i.e., the first number is the month.

If a time is omitted, then midnight (00:00:00) is assumed. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Jul 15 1994
< Jul 15 1994
```

You can use the .. operator to search on a range of dates:

```
Jul 1 1994 .. Aug 1 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Jul 1 1994 .. Jul 3 1994, Dec 1 1995 .. Dec 6 1995
```

will search for observations done within either one of these date ranges.

Exp Time
The total exposure time of the observation, in seconds. You can use operators or ranges in this field; for example,

```
< 100
> 1000.0
100 .. 1000
```

To exclude a range of exposures, use a comma:

```
< 100, > 1000
```

Observer
The last name of the principal investigator of the observation. We sometimes refer to this person as the "observer".

Program
The FUSE proposal identifier under which the observation was executed. This can be an alphanumeric ID or a comma-separated list of alphaumeric IDs.

Archive Date
This is the date on which a dataset was archived. If a dataset was archived more than once (for example, if it was reprocessed by the pipeline), then this will show the *latest* archive date.

Release date
Select the release date for the data. See the observation date for the entry format. FUSE data has a nominal proprietary period of one year (though in special cases, this may be shortened or extended). The Release Date field gives the end of the dataset's proprietary period.

When the results of a search query are displayed, both public and proprietary datasets will have mark buttons. Proprietary datasets will have an at symbol, @, next to the mark button, and on most browsers, the background for proprietary mark buttons will be yellow. Properly authorized users will be able to retrieve proprietary data through the Web interface.

Observation Name
The Observation name is the unique identifier for a FUSE observation. (For FUSE, an observation is an association of exposures.) This value can be wildcarded using a `*`.

Output Options

Output Columns
Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. (`Mark` is pre-selected for you.) The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. the rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning thousands of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Show SQL Query

Select this checkbox if you want to see the SQL query that the FUSE Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The FUSE Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

If you have problems retrieving your data, you can contact the help desk via the link at the bottom of this page.

FUSE Archive Search

Archive Status

NEW Important Downtime Message NEW

Object Name	Resolver	
	◉ SIMBAD ○ NED ○ Don't resolve	Get coordinates

RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

Observation-level Information

Observation Date	Exp Time (sec)	Observer	Program

Archive Date	Release Date	Observation Name

Exposure-level Information

Exposure Date	Exposure ID	Instrument Mode	Planned Aperture

Total Count Rate	FP Split?	FES Filter	FES Target Pos
	☐ yes ☐ no		

SEARCH | Clear form | Reset to defaults | Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
Mark Target Name RA Dec Ang Sep Ecl Lat	1. Ang Sep	☐ *reverse*	100
	2. Target Name	☐ *reverse*	Output Equinox: J2000
	3. ------	☐ *reverse*	☐ Show SQL query

Fri Mar 22 07:20:40 2002

archive@stsci.edu

FUSE Exposure Search Help

This page describes the FUSE Exposure Search form and the individual fields in the form. For information about FUSE and its data, see the FUSE homepage at http://fuse.pha.jhu.edu/.

Use the FUSE Exposure Search form to locate and retrieve observations from the FUSE data archive at STScI. Both public and proprietary data may be retrieved through this interface.

The FUSE Exposure Search form offers a view of FUSE *exposures*, which make up *observations*. To locate observations, use the FUSE Science Search page. More information about retrieving FUSE data may be found on the FUSE retrieval help page.

Object Name

The name of the astronomical object you want to search for.

Resolver

The name resolver you want to use, if you want to get an object's coordinates. To resolve an object's name into its coordinates, enter the object name in the **Object Name** field, select either NED or SIMBAD for the resolver, and hit the **Resolve** button. The form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will *not* change any other choices made in the form.

If you enter an object name and select either SIMBAD or NED, and then hit the "Search" button, the script will get the coordinates before doing the search. A message will appear at the top of the results page showing you what coordinates were found for the object (or an error message if the name resolver didn't work for some reason).

We recommend that you use object-name resolution to find observations of fixed targets in the database. This is the most reliable way to look up observations, because the observer could have given the observation any name at all (for example, `NGC1976` instead of `M42`). However, if you do know the name that the observer gave as the object, you can select FUSE Target Name. In that case, the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (Remember when you do this to *not* press the **Resolve** button.)

The SIMBAD and NED object name resolvers can only resolve the names of fixed astronomical object; they cannot compute the positions of moving objects (planets, comets, etc.).

Resolve

When you press this button, the search form will be redrawn with the coordinates of the object name entered into the RA and Dec fields.

RA,Dec

The Right Ascension and Declination around which you want to search. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by indicating
a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you can delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

How far around the search position you would like to search, in arcminutes. You can specify either a single number or a range. A single number means "all observations whose positions are less than this many arcminutes from the given position". A range can be given to get observations within a torus around a position; for example, "5 .. 20" will find observations between 5 and 20 arcminutes from the search position.

Equinox

The equinox of the RA and Dec you have entered, either B1950 or J2000. This only affects the input coordinates; the output coordinates will always be J2000.

Observation-level Information

Observation Date

The date of the observation. More specifically, the date and time, in GMT, on which the exposure was started. When specifying this date, you need to include a date and an optional time. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Jul 15 1994
Jul 1994 15
15 Jul 1994
1994 Jul 15
1994 15 Jul
7/15/1994
7-15-1994
7.15.1994
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "July 1994" will look for observations done on July 1 1994 00:00:00, *not* for observations done during July 1994. Note also that when entering a date with the month in numerical format, the American ordeing is used; i.e., the first number is the month.

If a time is omitted, then midnight (00:00:00) is assumed. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Jul 15 1994
< Jul 15 1994
```

You can use the .. operator to search on a range of dates:

```
Jul 1 1994 .. Aug 1 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Jul 1 1994 .. Jul 3 1994, Dec 1 1995 .. Dec 6 1995
```

will search for observations done within either one of these date ranges.

Exp Time

The total exposure time of the observation, in seconds. You can use operators or ranges in this field; for example,

```
< 100
> 1000.0
100 .. 1000
```

To exclude a range of exposures, use a comma:

```
< 100, > 1000
```

Observer

The last name of the principal investigator of the observation. We sometimes refer to this person as the "observer".

Program
The FUSE proposal identifier under which the observation was executed. This can be an alphanumeric ID or a comma-separated list of alphaumeric IDs.

Archive Date
This is the date on which a dataset was archived. If a dataset was archived more than once (for example, if it was reprocessed by the pipeline), then this will show the *latest* archive date.

Release date
Select the release date for the data. See the observation date for the entry format. FUSE data has a nominal proprietary period of one year (though in special cases, this may be shortened or extended). The Release Date field gives the end of the dataset's proprietary period.

When the results of a search query are displayed, both public and proprietary datasets will have mark buttons. Proprietary datasets will have an at symbol, @, next to the mark button, and on most browsers, the background for proprietary mark buttons will be yellow. Properly authorized users will be able to retrieve proprietary data through the Web interface.

Observation Name
The Observation name is the unique identifier for a FUSE observation. (For FUSE, an observation is an association of exposures.) This value can be wildcarded using a *.

Exposure-level Information

Exposure Date
The date of the start of the exposure. (Note that one observation can include several expoosures.) See observation date entry above for information on formatting date entry.

Exposure ID
Exposure ID from data header. This 3-digit number uniquely defines each exposure obtained during a single observation. The exposure ID plus the association ID is equivalent to the exposure name (otherwise known as the rootname). To search for a particular exposure (e.g. A0030102006) by name, one must specify both a value for the observation name (e.g., A0030102000) and the exposure ID (e.g., 006).

Instrument Mode
Instrument mode (either TTAG or HIST).

Planned Aperture Name
planned target aperture (PINH, HIRS, MDRS, or LWRS).

Total Count Rate
The total count rate (in counts/sec), specified as a real number, for a particular exposure.

FP Split?
Number of FP split positions (?).

FES Filter
FES filter wheel position (CLR=Clear, COL=color, ND=Neutral Density)

FES Target Pos
FES target position: (IN or OUT)

Output Options

Output Columns
Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. (`Mark` is pre-selected for you.) The output columns will be in the order in which they appear in this list.

Sort output by:
Choose how you want the output rows sorted. You can select up to three fields to sort on. the rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits
Some queries will be capable of returning thousands of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Show SQL Query
Select this checkbox if you want to see the SQL query that the FUSE Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The FUSE Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

---

 archive@stsci.edu

IUE Search Help

Use the **IUE search form** to search the IUE Archive Catalog by object name, position, observation date, program ID, etc. and to specify the output format. You can also mark data for retrieval using this interface.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include gam Gem, NGC 1068, JUPITER, and hd 45677.

When you search on the object name in the database (i.e. without using the name resolver), case will be ignored. The object name will *not* be wildcarded at the front and back automatically (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can however wildcard the object name using `*` (for example, `*IO*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

Object Resolver

The name resolver you want to use, if you want to resolve an object into its coordinates. You can resolve an object name either before a search, or you can redraw the form with the resolved coordinates in place. You can also elect not to resolve the object name when doing the search, but to search the IUE database on the object name given.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `NED` or `SIMBAD` for the resolver, and hit the **Search** button. NED is the NASA Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France. The object name will be sent to the chosen resolver, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD or NED services, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the IUE database, along with whatever other query qualifications you have given.

You can also hit the **Get coordinates** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since both the SIMBAD and NED resolvers return J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`, or `PARALLEL-FIELD`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

The SIMBAD and NED object name resolvers can resolve only fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

Resolve

When you select either `NED` of `SIMBAD` for the resolver and then press the "Get coordinates" button, the IUE Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98       29 53 45.55
    12h22m31.98s      29d53m45.55s
    12:22:31.98      +29:53:45.55
    12h22'31.98"      29d53'45.55"
    12h 22m 31.98s    29d 53m 45.55s
    12h 22' 31.98"    29d 53' 45.55"
    12h 22' 31.98"   -29d 53' 45.55"
    12h22'31".98     -29d53'45".55
    12h22m31s.98     -29o53m45s.55
    12h 22' 31".98   -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22      29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by indicating
a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you can delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an IUE search: the coordinates are coordinates of the *object* as given by the Guest Observer, and since acquisitions were made in real time, these coordinates may not reflect the precise pointing of IUE at the time of the observation.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Exp. Time

The commanded exposure time, in seconds. You can use operators or ranges in this field; for example,

```
< 100
> 1000
100 .. 1000
```

You can *exclude* a range of exposure times using a comma:

```
< 100, > 1000
```

Observation Date

The date and time, in GMT, on which the exposure was started. When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Jul 15 1994
Jul 1994 15
15 Jul 1994
1994 Jul 15
1994 15 Jul
7/15/1994
7-15-1994
7.15.1994
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "July 1994" will look for observations done on July 1 1994 00:00:00, *not* for observations done during July 1994. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Jul 15 1994
< Jul 15 1994
```

You can use the .. operator to search on a range of dates:

```
Jul 1 1994 .. Aug 1 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Jul 1 1994 .. Jul 3 1994, Dec 1 1995 .. Dec 6 1995
```

will search for observations done within either one of these date ranges.

Program ID

An alphanumeric code identifying the IUE observing program under which the observation was made; for example, `KQ120`. The program IDs were assigned for each episode of observing proposals. NASA, ESA, and SERC followed different naming conventions.

This field may be wildcarded using `*` to match any character.

Class

IUE Object Class code. An IUE classification system used for categorizing IUE observations. The object class was specified by the Guest Observer; thus, one object may be archived under more than one object class.

Object Classes 98 (Wavelength Calibration Lamp) and 99 (Nulls and Flat Fields) are excluded from the search results unless they are explicitly selected.

Multiple object classes may be searched at one time.

Camera

The camera used in the observation. Approximate wavelength ranges for absolutley calibrated data:

Camera	Wavelength Range (Å)
SWP	1150 - 1975
LWP	1850 - 3350
LWR	1850 - 3350

Data may be available for extracted "net flux" files over more extended wavelength ranges.

SWR was rarely used due to malfunction.

Dispersion

High dispersion (`High`) mode produces a two-dimensional echelle spectrum containing approximately 60 orders, with a resolution of roughly 0.2 Å. Low dispersion (`Low`) mode produces a single spectrum, or two if both apertures were used, with lower spectral resolution, approximately 6 Å.

Aperture

The aperture used in the observation.

Each spectrograph has a pair of entrance apertures, consisting of a large approximately 10 x 20 arcsecond oval and a small 3 arcsecond diameter circle. The image size at the focal plane is typically about 3 arcseconds for a point source. Spectra may be trailed along the large aperture. In addition, multiple exposures may be offset within in the large aperture to create a pseudo-trailed spectrum or series of time resolved spectra. The throughput of the small aperture varied significantly depending on the object centering and tracking, with a maximum throughput of about 60%. Thus most point-source spectra were taken using the large aperture. The aperture field is left blank only when the dispersion is not applicable (e.g., flat field images).

Image ID

The camera name plus a sequential number used to distinguish each image within the data set for that camera; for example, `LWP01408`. The image number will always be five digits, with leading zeros if necessary. However, if you enter something like `LWP1408`, the IUE Search engine will fill in the leading zeroes for you and search for `LWP01408`. If you want anything starting with LWP1408, then use a wildcard, like this: `LWP1408*`.

The numbering began at 1000, but a handful of images with duplicated image numbers were reassigned with numbers in the 500's. Some image numbers were accidentally skipped as well.

If you enter a qualification in this field, then the **Camera**, **Dispersion**, and **Aperture** qualifications in the form will be ignored. HOWEVER other qualifications such as object class will NOT be ignored.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The default set of columns is:

```
Mark
Object Name
Image ID
Disp
Aper
Obs Date
RA (J2000)
Dec (J2000)
Exp Length
Program
Class
More info
```

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. (`Mark` is pre-selected for you.) The output columns will be in the order in which they appear in this list. Note: Window users need to hold down the Ctrl key while clicking specific columns to be displayed. For selecting a group of columns, press the shift key and click the first and last entries.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. The rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning thousands of rows or more. such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the IUE Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used used by most relational database systems for retrieving information from database tables. The IUE Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

EUVE Search Help

The search pages basically contain 3 parts. The top of the page lists the input search fields. Entering values (as described below) for one or more of these fields will define the selection criteria for the database search. The middle of the form contains buttons to initiate various actions including:

1. perform the search using the specified search criteria and output format,
2. clear the search form and reset values to the original defaults,
3. reset entries to the set of (default) values used the previous time the search page was drawn, and
4. display this help page.

The bottom portion of the page deals with formatting the table of found entries that appears after the search is completed. The format options include specifying which columns appear in the output list, the order of the entries, the maximum number of returned entries, the epoch of the output coordinates, and the option to display the actual SQL command used to retrieve the database entries. First time users may want to run the search using the default output options.

After selecting search criteria, output options, and clicking the search button, a second page will appear listing the returned database entries. From this table, one may click on the data file entries to download the selected FITS file.

> **Note** Currently all the data requested through this interface will be retrieved from HEASARC at Goddard Space Flight Center.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include NGC 1360, PN LOTR 5, and JUPITER. This is the official name under which targets were processed for the EUVE Archive. It is not necessarily the name under which the target was originally proposed or observed. A single name was consistently used thoughout the archive for targets which were observed more than once.

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*IO*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

The SIMBAD and NED object name resolvers can only resolve fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

Object Resolver

The name resolver will let you resolve an object name into its coordinates. This is useful particularly for searching for objects that may be known by different names. You can resolve an object name either before a search, or you can redraw the form with the the resolved coordinates in place. If you don't elect to to resolve the object name, the EUVE database will be searched on the object name given.

The SIMBAD and NED object name resolvers can only resolve fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `SIMBAD` or `NED` for the resolver, and hit the **Search** button. (NED is the Nasa Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to SIMBAD, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD service, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the EUVE database, along with whatever other query qualifications you have given.

You can also hit the **Resolve** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since the SIMBAD resolver returns J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

Resolve

When you press this button and select `SIMBAD` for the resolver, the EUVE Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. These fields give the J2000 equatorial coordinates used as the coordinates of the source when processing the data. These are not necessarily the same as the coordinates used to point the spacecraft during the observation. They are typically either taken from SIMBAD (with proper motions applied) or were supplied by the Guest Observer. We have the same coordinates throughout the archive for multiple observations of the same source except in certain special cases. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by
indicating a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an EUVE search.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Object Category

This is a broad category for the target. Values include:

- **wd** - white dwarfs
- **late** - late-type stars
- **early** - early-type stars
- **cv** - cataclysmic variables
- **ex** - extragalactic objects
- **ss** - solar system objects
- **pulsar** - pulsars
- **pn** - planetary nebulae
- **noid** - unidentified
- **lmxb** - low-mass X-ray binaries
- **snr** - supernova remnants
- **grb** - gamma-ray bursters
- **other** - none of the above

Observation Start Date

This is the GMT time, to the nearest second, of the start of the observation. The target name and observation date together serve to uniquely identify each EUVE observation. (Note the first EUVE observation was obtained in June, 1992.)

When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Jul 15 1994
Jul 1994 15
15 Jul 1994
1994 Jul 15
1994 15 Jul
7/15/1994
7-15-1994
7.15.1994
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "July 1994" will look for observations done on July 1 1994 00:00:00, *not* for observations done during July 1994. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Jul 15 1994
< Jul 15 1994
```

You can use the .. operator to search on a range of dates:

```
Jul 1 1994 .. Aug 1 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Jul 1 1994 .. Jul 3 1994,
Dec 1 1995 .. Dec 6 1995
```

will search for observations done within either one of these date ranges.

Exposure Time

This is the median exposure for a given observation. There are four EUVE detectors which normally collect data simultaneously during an observation. Each detector will have a different exposure time. In this field, we have listed the median of the exposures of the individual detectors, in units of kiloseconds and rounded off to the nearest kilosecond. Note that sometimes one detector can be way off from the others and skew this number, or an observation can be very short producing an exposure time of zero. For the true exposure times you need to look in the headers of the images.fit extensions. The units can optionally be specified in seconds, although kiloseconds is the default used by the project.

Day/Night

Entries will contain either the word "night" or "day" indicating which part of the observation is being cataloged. Some observations will have both parts, others will only have a night part. Sometimes the night and day parts appear on different volumes. By default, both day and night observations will be returned. To not retrieve one or the other, click on the entry not desired.

Observer

The name of the PI of the proposal which has been associated with this observation in the CEA database. This is not always a very meaningful field, because many times multiple proposals (and PIs) were given simultaneous data rights to the target in the same observing cycle. In that case, only one of the PIs is listed here. The observer is listed as "EUVE" for targets which were scheduled as calibration targets. However, for most calibration targets, there was also a PI to whom the data was proprietary; unfortunately, our archive does not contain these PI names for calibration targets.

Old Filename

Old EUVE Archive ID number (gonum): this is the old ID number the target was assigned in the now obsolete EUVE spectral browser and archive. Notice that there is not a one-to-one correspondence between the old archive and the new one, so some targets have more than one ID number associated with them and other IDs are used by multiple targets. The old ID might be of use for historical purposes or for users who know the old ID of a target they want. EUVE has stopped assigning ID numbers to publically released targets as of the Feb. 1, 1998 release.

Note wildcards can be used in the filename specification.

Public Date

This is the date on which an observation becomes public. If this field is blank, the target is already public. If there is a date present, the target is still proprietary to its Guest Observer and should not be made public until the indicated date. EUVE releases data on monthly intervals. Targets observed in Cycles 1-4 of the EUVE Guest Observer program have one year proprietary periods. In Cycle 5 (which began in 1997) and later, the period is six months. The period begins when the data is delivered, not when it was observed, and we sometimes make exceptions if there was a problem with the data delivery, etc., so the public dates cannot be inferred from the data itself. Also, some EUVE observations are done in parts over an extended period of time; the proprietary period is determined from the delivery date of the last part.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The default set of columns for raw data sets is (in the order displayed):

```
Object Name
Observation Date
Day/Night
RA (J2000)
Dec (J2000)
Exposure Time
Observer
TOtal Size
Object Category
Spectral Type
Old Filename
Release Date
More info
```

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. the rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning hundreds of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the EUVE Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used used by most relational database systems for retrieving information from database tables. The EUVE Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

Copernicus Raw Data

Object Name	Get Coordinates From	
	◉ SIMBAD ○ Don't resolve	Resolve

RA (J2000)	Dec (J2000)	Radius (arcmin)	Equinox
		10.0	J2000

IUE Class	Spectral Class	Filename
01 EARTH 03 PLANET 06 COMET 10 W C 11 WN 12 MAIN SEQUENCE O 13 SUPERGIANT O 14 Oe 20 B0-B2 V-IV 21 B3-B5 V-IV 22 B6-B9.5 V-IV	O4 O5 O6 O7 O8 O9 B0 B1 B2 B3 B4	

SEARCH | Clear form | Reset to defaults | Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
◉ Default ○ Custom...	1. Object Name	☐ *reverse*	100
Object Name RA (J2000) Dec (J2000) Filename Scans Spectral Class IUE Class	2. RA (J2000)	☐ *reverse*	Output Equinox: J2000
	3. Dec (J2000)	☐ *reverse*	☐ Show SQL query

Fri Mar 22 07:20:56 2002
archive@stsci.edu

Copernicus Coadded Scans

Raw Data...

HST||IUE||Copernicus||FIRST||MDS||DSS

Object Name

Get Coordinates From

SIMBAD
Don't resolve

Resolve

RA (J2000) **Dec (J2000)** **Radius (arcmin)** **Equinox**

10.0 J2000

IUE Class

01 EARTH
03 PLANET
06 COMET
10 W C
11 WN
12 MAIN SEQUENCE O
13 SUPERGIANT O
14 Oe
20 B0-B2 V-IV
21 B3-B5 V-IV
22 B6-B9.5 V-IV

Min Wave **Max Wave** **Detector**

U1
U2

Start Date **Filename**

SEARCH Clear form Reset to defaults **Help...**

Output Options

Output columns

Default Custom...

Object Name
Detector
Filename
Min Wave
Max Wave
Start Date
RA (J2000)

Sort output by:

1. Object Name *reverse*
2. Start Date *reverse*
3. Min Wave *reverse*

Maximum number of hits

100

Output Equinox

J2000

Show SQL query

Fri Mar 22 07:21:00 2002

Copyright notice

archive@stsci.edu

Search Help

There are two search pages for Copernicus data: the Raw Data Search page and the Coadded Scan Search page. Since most of the search fields are identical on the two pages, this help page applies to both.

The search pages basically contain 3 parts. The top of the page lists the input search fields. Entering values (as described below) for one or more of these fields will define the selection criteria for the database search. The middle of the form contains buttons to initiate various actions including:

1. perform the search using the specified search criteria and output format,
2. clear the search form and reset values to the original defaults,
3. reset entries to the set of (default) values used the previous time the search page was drawn, and
4. display this help page.

The bottom portion of the page deals with formatting the table of found entries that appears after the search is completed. The format options include specifying which columns appear in the output list, the order of the entries, the maximum number of returned entries, the epoch of the output coordinates, and the option to display the actual SQL command used to retrieve the database entries. First time users may want to run the search using the default output options.

After selecting search criteria, output options, and clicking the search button, a second page will appear listing the returned database entries. From this table, one may click on the object name to either display the FITS header for a raw data search, or display a plot of coadded counts versus wavelength for a coadded scan search. Clicking on the filenames for either catalog will download the selected FITS file.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include ZETA OPH, JUPITER, and HD 14633. The object names were obtained from the Princeton University Observatory, presumably as specified by the observer.

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*IO*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

Object Resolver

The name resolver will let you resolve an object name into its coordinates. This is useful particularly for searching for objects that may be known by different names. You can resolve an object name either before a search, or you can redraw the form with the the resolved coordinates in place. If you don't elect to to resolve the object name, the Copernicus database will be searched on the object name given.

To resolve an object name before a search, enter the object name in the **Object Name** field, select `SIMBAD` for the resolver, and hit the **Search** button. SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to SIMBAD, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD service, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the Copernicus database, along with whatever other query qualifications you have given.

You can also hit the **Resolve** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since the SIMBAD resolver returns J2000 coordinates).

We recommend that you use object name resolution to find observations of specific object in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

Resolve

When you press this button and select `SIMBAD` for the resolver, the Copernicus Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by indicating
a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an Copernicus search. Note most of the coordinates contained in the Copernicus catalog were obtained from the Bright Star Catalog (BSC5).

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Start Date

The date and time, in GMT, on which the first exposure of a coadded scan was started. More precisely, it is the time in which the satellite crosses the longitude of the ascending node (LAN) for the orbit in which the earliest exposure was taken. (The actual start time is obtained by adding the FIRST SET time to the OBSERVATION TIME entry as described in **Observation Time Correction** .) The Copernicus satellite operated roughly from August, 1972 to February, 1981.

When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Jul 15 1994
Jul 1994 15
15 Jul 1994
1994 Jul 15
1994 15 Jul
7/15/1994
7-15-1994
7.15.1994
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "July 1994" will look for observations done on July 1 1994 00:00:00, *not* for observations done during July 1994. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Jul 15 1994
< Jul 15 1994
```

You can use the .. operator to search on a range of dates:

```
Jul 1 1994 .. Aug 1 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Jul 1 1994 .. Jul 3 1994, Dec 1 1995 .. Dec 6 1995
```

will search for observations done within either one of these date ranges.

IUE_Class

IUE Object class code. The IUE classification system used for categorizing Copernicus observations. The object class was originally specified by the IUE Guest Observer. Only those object classes appropriate for Copernicus observations are listed (i.e., classes 1 through 83). Note more than one object class can be specified for the search by clicking on multiple entries from the object class table.

Min Wave

The minimum wavelength in the coadded scan, specified in Angstroms. Note coadded scan wavelengths are resampled to 0.01 Angstrom intervals.

Max Wave

The maximum wavelength contained in the coadded scan, specified in Angstroms. Note coadded scans are resampled to 0.01 Angstrom intervals.

Detector

Coadded scans have been generated for the U1 and U2 detectors. The U1 detector covers the 710-1500 A range at 0.05 A resolution, while U2 covers 750-1645 A at 0.2 A resolution.

Note the raw data sets contain data for all six detectors (i.e., u1,u2,u3,v1,v2,v3). V1 and V2 cover roughly the 1550-3200 A region at 0.1 and 0.4 A resolution respectively, while U3 and V3 are fixed in wavelength and used only for monitoring spacecraft pointing.

Spectral_Type

The spectral type of the observed star as derived from the Yale Bright Star Catalog (YBS5). Generally the spectral type is a measure of the star's temperature. Spectral type is designated using the Morgan-Keenan spectral classification system, and is specified as one of ten letters (OBAFGKMRNS) followed by a number from 0 to 9 designating subdivisions. The hottest stars observed are generally around type O3. Only those spectral types found in the Copernicus catalog however, are listed in the seach page. Spectral type is not appropriate for non-stellar objects (e.g., galaxies, planets, etc.), so the field may be left blank. Note the returned catalog listing will display the full spectral classification including the spectral type and the luminosity class.

Filename

The assigned file name. The raw data sets file names use the naming convention Cnnn.PEP where nnn is the 3-digit observation number assigned by Princeton Observatory describing the order in which targets were observed (i.e., the first observed target is named C001.PEP and the last target is C558.PEP).

The coadded scan file names are defined as Cnnn-###.ext where ### is a 3-digit number describing the order in which the scans were coadded (i.e., the maximum is 297), and ext is either .uu1 for unblocked u1 scans, .bu1 for blocked u1 scans, or .u2 for u2 scans.

Note wildcards can be used in the filename specification.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The default set of columns for raw data sets is (in the order displayed):

```
Object Name
RA (J2000)
Dec (J2000)
Filename
scans
Spectral Class
IUE Class
More info
```

The default set of columns for coadded scans files is (in the order displayed):

```
Object Name
Detector
Filename
Min Wave
Max Wave
Start Date
RA (J2000)
Dec (J2000)
Object Class
Points
scans
Start Scan
Last Scan
```

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. the rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning thousands of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the Copernicus Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used used by most relational database systems for retrieving information from database tables. The Copernicus Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

ROSAT Archive Search

This page queries the ROSAT MASTER catalog at HEASARC

Object Name	Resolver	
	(•) SIMBAD ( ) NED ( ) Don't resolve	Get coordinates

RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

ROSAT Master Catalog at HEASARC

Category	ROR	Exp Time	PI Last Name
AGN CATACLYSMIC VARIABLES CLUSTERS OF GALAXIES DIFFUSE X-RAY EMISSION NEUTRON STARS AND BLACK HOLES NORMAL GALAXIES NORMAL STARS OTHER SUPERNOVA REMNANTS WHITE DWARFS	Begin Date		
	Instrument: ☐ HRI ☐ PSPC		Complete: ☐ T ☐ F

Gal Lon

Gal Lat

SEARCH | Clear form | Reset to defaults | Help...

Output Options

Output columns	Sort output by:	Maximum number of hits
Mark ROR Object Name PI Number Exp Time Instrument Status	RA ☐ *reverse*	100
		Output Equinox: J2000
		☐ Show W3Browse query

archive@stsci.edu

Fri Mar 22 07:21:09 2002

Access to ROSAT catalogs and data are courtesy of HEASARC

ROSAT Search & Retrieval Help

This page describes the parameters for MAST's ROSAT search form which are sent to HEASARC's HEASARC ROSAT master catalog (ROSMASTER).

More information is available about the MAST/HEASARC query syntax.

Fields for Data Search

ROR
The ROSAT observation request sequence number.

Object Name
The name of the target, as given by the PI.

Resolver
The name resolver to use. Either SIMBAD or NED may be used to get the coordinates of a target name. Alternatively, by selecting `Don't resolve`, you can use match the target name against that given by the PI. (Note: Since observer-chosen target names can vary wildly, it is in general better to search on a position for fixed targets. Searching on a target name without resolving should be used only for moving objects and when you know what the observer called the target.)

Radius
The search radius, in arcminutes.

PI_Number
The Principal Investigator number.

R_Day_Beg
The ROSAT day number at the start of the pointing. ROSAT Day #1 was June 2, 1990. ROSAT day numbers between 1 and 60 are from the performance verification (PV) phase, while day numbers greater than about 256 are from the AO1 phase.

R_Day_End
The ROSAT day number at the end of the pointing. ROSAT Day #1 was June 2, 1990. ROSAT day numbers between 1 and 60 are from the performance verification (PV) phase, while day numbers greater than ~256 are from the AO1 phase.

Exposure
The exposure time of the pointing, in seconds. **PLEASE NOTE** The `exposure` shown here indicates only the length of time that the telescope pointed in a certain direction; it is *not* a total observation time. Operational or other problems may have occurred during the pointing which could cause the total observation time to be less than the `exposure` given here.

Instrument
The instrument used for the pointing, either `HRI` or `PSPC`.

Status
The Status of the observation. Valid values of status are `distributed`, `ob_completed`, `ob_running`, `ob_scheduled`, and `public`.

Complete
Completion flag. `T` is complete, `F` is incomplete.

Priority
The priorty of the observation: `A`, `B`, or `C`.

Roll
The roll angle of the spacecraft during the pointing.

Observation Number
The observation number.

Begin Date
The date at the beginning of the observation. This field contains only the date (i.e., the Modifed Julian Day number), not the time. See the syntax help page for information about how to qualify date fields for data held at HEASARC.

End Date
The date at the end of the observation. This field contains only the date (i.e., the Modifed Julian Day number), not the time. See the syntax help page for information about how to qualify date fields for data held at HEASARC.

Begin Second
The seconds of the day at the beginning of the observation.

End Second
The seconds of the day at the end of the observation.

SC Begin
The spacecraft clock at the beginning of the observation.

SC End
The spacecraft clock at the end of the observation.

Cycle
The annual cycle of the observation (0-7).

Proposal Number
The number correspondant to a given proposal.

Time Req
The requested time of the observation. (ksec)

Time Done
The time completed. (ksec)

ra
Right ascension in default equinox.

dec
Declination in default equinox.

RA_J2000
The average MEASURED right ascension of the pointing in J2000 coordinates.

Dec_J2000
The average MEASURED declination of the pointing in J2000 coordinates.

Gal Lat
Galactic longitude.

Gal Lon
Galactic latitude.

Targ Num
The target number.

Country
The originating country for this ROSAT Observation Request.

RDay Begin
ROSAT day number at the beginning of the pointing.

RDay End
ROSAT day number at the end of the pointing.

Category
The major catagory of the object observed. More than one category may be selected.
Note: Object categories should be used with care. The assignment of categories themselves is more of an art than a science. Also, the categories are those of the object that the PI was interested in. For example, selecting `Normal Stars` will not show all observations in which a normal star appears serendipitously (which would be jsut about all ROSAT observations).

class
BROWSE classification flag. The value of this field is always `UNIDENTIFIED`.

Site
The location at which the data was processed, either `MPE` or `GSFC`.

Rev
The processing revision number of the sequence.

Distribution Date
The data distribution date. This field contains only the date (i.e., the Modifed Julian Day number), not the time. See the MAST/HEASARC Syntax page for information about how to qualify date fields.

Release Date
The date on which the data were made publicly available. HEASARC distributes only public data. This field contains only the date (i.e., the Modifed Julian Day number), not the time. See the MAST/HEASARC Syntax page for information about how to qualify date fields.

Seq ID
The sequence identification number (i.e. `rp123456n00`).

PI Last Name
The last name of the Principal Investigator for the ROSAT Observation Request associated with this pointing.

PI First Name
The first name of the Principal Investigator for the ROSAT Observation Request associated with this pointing.

Retrievals

ROSAT data may be retrieved from HEASARC through the MAST's retrieval forms. After executing a search, a results page will be presented. At the bottom of the page a selection of retrieval options will be presented. You can list the available data for selected datasets, then download your choices file by file, or you may elect to build a single tar file containing all the selected files. After you make your selections and click on "submit," a separate browser window will pop up on HEASARC's retrieval pages.

HUT Archive Status

Data from the Hopkins Ultraviolet Telescope (HUT) is currently kept on magnetic disk at STScI, so there shouldn't be a long wait or much downtime.

HUT Search Help

Use the HUT Search form to search the HUT Catalog by object name, position, observation date, etc. and to specify the output format. You can then view preview data and mark data for retrieval using this interface.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include GAM-GEM, NGC1068, JUPITER, and HD45677. (Note no spaces are used in HUT target names.)

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*1987*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

Object Resolver

The name resolver will let you resolve an object name into its coordinates. This is useful particularly for searching for objects that may be known by different names. You can resolve an object name either before a search, or you can redraw the form with the resolved coordinates in place. If you don't elect to resolve the object name, the HUT database will be searched on the object name given.

The SIMBAD and NED object name resolvers can resolve only fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `SIMBAD` or `NED` for the resolver, and hit the **Search** button. (NED is the Nasa Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to SIMBAD, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD service, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the HUT database, along with whatever other query qualifications you have given.

You can also hit the **Resolve** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since the SIMBAD resolver returns J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

Resolve

When you press this button and select `SIMBAD` for the resolver, the HUT Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. These fields give the J2000 equatorial coordinates for the center of the image. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by
indicating a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an HUT search.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Object Category

This is a broad category for the target. One or more values may be selected. Clicking "reset to defaults" or "clear form" (described below) will erase previous selections.

Observation Start Date

This is the GMT time, to the nearest second, of the start of the observation. (Note the HUT1 observations were all obtained during December 2-10, 1990 and HUT2 observations were obtained during March 2-18, 1995.)

When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Dec 15 1990
Dec 1990 15
15 Dec 1990
1990 Dec 15
1990 15 Dec
7/15/1990
7-15-1990
7.15.1990
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "Dec 1990" will look for observations done on Dec 1 1990 00:00:00, *not* for observations done during Decy 1990. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Dec 10 1990
< Dec 10 1990
```

You can use the .. operator to search on a range of dates:

```
Mar 2 1995 .. Mar 5 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Mar 10 1995 .. Mar 11 1995,
Mar 15 1995 .. Mar 16 1995
```

will search for observations done within either one of these date ranges.

Exposure Time

The total exposure times in seconds. Note the times do not reflect pointing problems. In many cases, the target was not in the aperture.

Entry ID

The HUT entry_id uniquely defines each HUT observation. The name is of the form **object_id-nnn** where

- **object-id** = the target name
- **nnn** = a unique three-digit number based on the Mission Elapsed Time (MET) in tenths of hours.

As an example, entry_id P-CYG_087 designates a P Cygni observation taken 8.7 hours into the mission.

Note that for each observation, several data sets may be produced representing different stages of processing.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The default set of columns for raw data sets is (in the order displayed):

```
Object Name
RA (J2000)
Dec (J2000)
Observation Date
Exposure Time
Daytime
Nighttime
```

```
Object Category
Comments
Entry_ID
More info
```

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. The rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning hundreds of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the HUT Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The HUT Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

About MAST
Cross-Mission Search Tools
MAST Scrapbook
What's New
FAQ
Science Products
Software
FITS
Related Sites
ADS
HEASARC
IRSA
NED
NSSDC
Acknowledgments

MAST Jukebox Status

Planned Archive Downtimes

These are scheduled downtimes which will affect access to the MAST CDROM jukeboxes. Note: Due to the nature of the archive systems, we cannot always report *un*scheduled downtimes.

No currently scheduled downtimes.

UIT Search Help

Use the UIT Search form to search the UIT Catalog by object name, position, observation date, filter, etc., and to specify the output format. You can then view preview data and mark data for retrieval using this interface.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include AX-PER, NGC0185, MARS, and HD269810. (Note that no spaces are used in UIT target names.)

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*IO*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

Object Resolver

The name resolver will let you resolve an object name into its coordinates. This is useful particularly for searching for objects that may be known by different names. You can resolve an object name either before a search, or you can redraw the form with the resolved coordinates in place. If you don't elect to resolve the object name, the UIT database will be searched on the object name given.

The SIMBAD and NED object name resolvers can resolve only fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `SIMBAD` or `NED` for the resolver, and hit the **Search** button. (NED is the Nasa Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to SIMBAD, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD service, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the UIT database, along with whatever other query qualifications you have given.

You can also hit the **Resolve** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since the SIMBAD resolver returns J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

Resolve

When you press this button and select `SIMBAD` for the resolver, the UIT Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

The SIMBAD and NED object name resolvers can resolve only fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

RA, Dec

The Right Ascension and Declination around which you want to search. These fields give the J2000 equatorial coordinates for the center of the image. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98       29 53 45.55
    12h22m31.98s      29d53m45.55s
    12:22:31.98      +29:53:45.55
    12h22'31.98"      29d53'45.55"
    12h 22m 31.98s    29d 53m 45.55s
    12h 22' 31.98"    29d 53' 45.55"
    12h 22' 31.98"   -29d 53' 45.55"
    12h22'31".98     -29d53'45".55
    12h22m31s.98     -29o53m45s.55
    12h 22' 31".98   -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22      29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by
indicating a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an UIT search.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This affects only the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Object Category

This is a broad category for the target. One or more values may be selected. Clicking "reset to defaults" or "clear form" (described below) will erase previous selections.

Observation Start Date

This is the GMT time, to the nearest second, of the start of the observation. (Note the UIT1 observations were all obtained during December 2-10, 1990, and UIT2 observations were obtained during March 2-18, 1995.)

When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Dec 15 1990
Dec 1990 15
15 Dec 1990
1990 Dec 15
1990 15 Dec
7/15/1990
7-15-1990
7.15.1990
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "Dec 1990" will look for observations done on Dec 1 1990 00:00:00, *not* for observations done during December 1990. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Dec 10 1990
< Dec 10 1990
```

You can use the .. operator to search on a range of dates:

```
Mar 2 1995 .. Mar 5 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Mar 10 1995 .. Mar 11 1995,
Mar 15 1995 .. Mar 16 1995
```

will search for observations done within either one of these date ranges.

Exposure Time

The exposure times annotated on the film by the Dedicated Experiment Processor (DEP) were found to be incorrect by known amounts. The corrected exposure times used in the batch data processing (BDR) are stored in the database and in the FITS headers using the keyword EXPTIME (uncorrected times are stored in the FITS header using the keyword FEXPTIME.)

The corrected exposure length was computed from

- (a) the exposure time written onto film (if it had no hex digits) plus 0.5 seconds, or
- (b) if the exposure time written onto film had hex digits (i.e., it was the first frame in the exposure sequence), then the value from the previous film frame was used after subtracting 0.3 seconds, or
- (c) telemetry plus 0.5 seconds.

Null entries imply a raw density image was obtained. The uncertainty in the corrected exposure times for the majority of exposures is of the order of 0.04 seconds (Stecker et al, PASP 109,584 1997).

Entry ID

The UIT entry_id uniquely defines each UIT observation. The name is of the form **CuvMnnn** where

- **C** = "N" for the near-UV camera (which failed during the ASTRO-2 mission), or "F" for the far-UV camera,
- **M** = "0" for ASTRO-1 data, "1" for ASTRO-2 data before a Dedicated Experiment Processor (DEP) memory change reset the frame counter, or "2" for ASTRO-2 data after the DEP memory change.
- **nnn** = a three-digit number designating the order in which the UIT observations were obtained for a particular camera.

As an example, entry_id FUV2349 designates the 349th exposure with the Far-UV camera during the ASTRO-2 mission.

Note that for each observation, several data sets may be produced representing different stages of processing. The final linearized, undistorted data set may be stored using a file name such as fuv2349g.fits.

Filter

The UIT instrument included two six-position filter wheels. The "A" filters were sensitive in the near-UV while the "B" filters were sensitive in the Far-UV. The near-UV camera was operational only for the ASTRO-1 flight. The effective wavelengths and FWHM's are listed on the Instrument page.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The default set of columns for raw data sets is (in the order displayed):

```
Object Name
RA (J2000)
Dec (J2000)
Entry_ID
Observation Date
Exposure Time
Object Category
Filter
More info
```

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. The rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning hundreds of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the UIT Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The UIT Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

WUPPE Archive Search

Archive Status

Object Name	Resolver	
	(•) SIMBAD ( ) NED ( ) Don't resolve	Get coordinates

RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

Wisconsin Ultraviolet Photo-Polarimetry Experiment

Obj Category	Exp Time	Entry ID
00 HUT CAMERA SENSITIVITY TARGETS 01 HUT SPECTROMETER FOCUS TARGETS 06 CALIBRATION 09 JOINT FOCUS AND ALIGNMENT TARGETS 12 PLANETS 13 ASTEROIDS, ETC.		
	Observation Date	

SEARCH	Clear form	Reset to defaults	Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
Mark Entry ID Object Name RA (J2000) Dec (J2000) gal. Long.	1. Object Name	[ ] reverse	100
	2. RA (J2000)	[ ] reverse	Output Equinox
	3. Dec (J2000)	[ ] reverse	J2000
			[ ] Show SQL query

Fri Mar 22 07:21:25 2002

archive@stsci.edu

WUPPE Archive Status

Data from the Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) is currently kept on magnetic disk at STScI, so there shouldn't be a long wait or much downtime.

WUPPE Target Search

WUPPE Home
Getting Started
Search and Retrieve
Data Search
Catalog
What's New
FAQ
Data Reduction/Analysis
Instrumentation/Operations
Project Publications
Related Sites
Gallery
About Astro
Acknowledgements

WUPPE Search Help

Use the WUPPE Search form to search the WUPPE Catalog by object name, position, observation date, etc., and to specify the output format. You can then view preview data and mark data for retrieval using this interface.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include GAM-GEM, NGC1068, JUPITER, and HD45677. (Note no spaces are used in WUPPE target names.)

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*1987*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

Object Resolver

The name resolver will let you resolve an object name into its coordinates. This is useful particularly for searching for objects that may be known by different names. You can resolve an object name either before a search, or you can redraw the form with the resolved coordinates in place. If you don't elect to resolve the object name, the WUPPE database will be searched on the object name given.

The SIMBAD and NED object name resolvers can resolve only fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `SIMBAD` or `NED` for the resolver, and hit the **Search** button. (NED is the Nasa Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to SIMBAD, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD service, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the WUPPE database, along with whatever other query qualifications you have given.

You can also hit the **Resolve** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since the SIMBAD resolver returns J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

Resolve

When you press this button and select `SIMBAD` for the resolver, the WUPPE Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. These fields give the J2000 equatorial coordinates for the center of the image. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by
indicating a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an WUPPE search.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Object Category

This is a broad target category also known as the ASTRO Science Classes. The categories were choosen by the project and used for all the ASTRO instruments (i.e., HUT, UIT, and WUPPE). Categories for which no data is available have been removed from the selection. One or more categories may be selected for the search. Clicking "reset to defaults" or "clear form" (described below) will erase previous selections.

Observation Start Date

This is the GMT time, to the nearest second, of the start of the observation. (Note the WUPPE1 observations were all obtained during December 2-10, 1990 and WUPPE2 observations were obtained during March 2-18, 1995.)

When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Dec 15 1990
Dec 1990 15
15 Dec 1990
1990 Dec 15
1990 15 Dec
7/15/1990
7-15-1990
7.15.1990
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "Dec 1990" will look for observations done on Dec 1 1990 00:00:00, *not* for observations done during Decy 1990. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Dec 10 1990
< Dec 10 1990
```

You can use the .. operator to search on a range of dates:

```
Mar 2 1995 .. Mar 5 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Mar 10 1995 .. Mar 11 1995,
Mar 15 1995 .. Mar 16 1995
```

will search for observations done within either one of these date ranges.

Exposure Time

The total useable exposure times in seconds.

Entry ID

The WUPPE entry_id uniquely defines each WUPPE observation. The name is of the form **MISSION-OBJECTID-nnnnnn** where

- **MISSION** = either WUPPE1 or WUPPE2
- **OBJECTID** = object name (e.g., GAM-GEM or NGC4151), identical to the entries under "Target Name",
- **nnnnnn** = a unique six-digit number (also known as the PointingID), based on the 2-digit ASTRO Science Class, a 2-digit preassigned target number for a given science class (although some targets have more than one target number), and a 2-digit pointing number (i.e., jotfid) for a particular target. The first digit of the pointing number is a sequential number indicating the nth observation at a particular roll angle, and the second digit is the nth exposure at that roll angle.

As an example, entry_id WUPPE1_HD5980_226911 designates an observation of HD5980, which is in science class 22, was the 69th selected target in class 22, the first observation at a given roll angle, and the first observation at that roll angle. Within the ASTRO project, the number 226911 would be referred to as the PointingID and the jotfid is 11.

Wild cards may be used for searching by entry_id. For example, to find all observations of HD5980, specify *HD5980*. To see all the WUPPE1 entries, search on WUPPE1*.

Note that for each observation, several data sets may be produced representing different stages of processing.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The entire set of columns, with the default items marked with a "*", includes the following (in the order displayed):

```
* Object Name
* RA (J2000)
* Dec (J2000)
* Mean % Polarization
* Mean Error in % Polarization
* Polarizarion Position Angle
* Observation Date
* Exposure Time
* Object Category
* Comments
* Mission
  References
  Aperture
  Day/Night flag
  Filter
  Spectral Type
  Visual magnitude
  Polarization Quality
  Flux Quality
  Image Motion Compensation
  MET Start Time
  Prime
* Entry_ID
* More info
```

NOTE: If the % Polarization, % Error, and Pos Angle are all set to 0.000, the dataset does not include any polarization data, only the UV spectrum.

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. The output columns will be in the order in which they appear in this list. (Note the default set will be included in custom mode unless they are deselected.)

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. The rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning hundreds of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the WUPPE Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The WUPPE Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

BEFS Archive Search

Object Name

Resolver

SIMBAD Get coordinates

NED

Don't resolve

RA | Dec | Radius (arcmin) | Equinox

10.0 | J2000

Berkeley Extreme & Far-UV Spectrometer

Object Category

Binaries
Cataclysmic Variable
Coronae/Late Stars
Early Type Stars
Extragalactic Object
Other

Entry ID

Exposure Time (s)

Observation Date

SEARCH | Clear form | Reset to defaults | Help...

Output Options

Output columns

Mark
Entry ID
Object Name
Alt Object ID
RA (J2000)
Dec (J2000)

Sort output by:

1. Object Name reverse
2. RA (J2000) reverse
3. Dec (J2000) reverse

Maximum number of hits

100

Output Equinox

J2000

Show SQL query

BEFS Search Help

The MAST search pages basically contain three parts. The top of the page lists the input search fields. Entering values (as described below) for one or more of these fields will define the selection criteria for the database search. The middle of the form contains buttons to initiate various actions including:

1. perform the search using the specified search criteria and output format,
2. clear the search form and reset values to the original defaults,
3. reset entries to the set of (default) values used the previous time the search page was drawn, and
4. display this help page.

The bottom portion of the page deals with formatting the table of found entries that appears after the search is completed. The format options include specifying which columns appear in the output list, the order of the entries, the maximum number of returned entries, the epoch of the output coordinates, and the option to display the actual SQL command used to retrieve the database entries. First time users may want to run the search using the default output options.

After selecting search criteria, output options, and clicking the search button, a second page will appear listing the returned database entries. From this table, clicking on the filenames will submit a request to download the selected FITS file.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include GAM-GEM, NGC1068, JUPITER, and HD45677. (Note no spaces are used in BEFS target names.)

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*1987*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

The SIMBAD and NED object name resolvers can only resolve fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

Object Resolver

The name resolver will let you resolve an object name into its coordinates. This is useful particularly for searching for objects that may be known by different names. You can resolve an object name either before a search, or you can redraw the form with the the resolved coordinates in place. If you don't elect to to resolve the object name, the BEFS database will be searched on the object name given.

The SIMBAD and NED object name resolvers can only resolve fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `SIMBAD` or `NED` for the resolver, and hit the **Search** button. (NED is the Nasa Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to SIMBAD, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD service, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the BEFS database, along with whatever other query qualifications you have given.

You can also hit the **Resolve** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since the SIMBAD resolver returns J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

Resolve

When you press this button and select `SIMBAD` for the resolver, the BEFS Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. These fields give the J2000 equatorial coordinates for the center of the image. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22     29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees
by indicating a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an BEFS search.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Object Category

This is a broad category for the target. One or more values may be selected. Clicking "reset to defaults" or "clear form" (described below) will erase previous selections.

Observation Start Date

This is the GMT time, to the nearest second, of the start of the observation. (Note the BEFS1 observations were all obtained during December 2-10, 1990 and BEFS2 observations were obtained during March 2-18, 1995.)

When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Dec 15 1990
Dec 1990 15
15 Dec 1990
1990 Dec 15
1990 15 Dec
7/15/1990
7-15-1990
7.15.1990
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "Dec 1990" will look for observations done on Dec 1 1990 00:00:00, *not* for observations done during Decy 1990. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Dec 10 1990
< Dec 10 1990
```

You can use the .. operator to search on a range of dates:

```
Mar 2 1995 .. Mar 5 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Mar 10 1995 .. Mar 11 1995,
Mar 15 1995 .. Mar 16 1995
```

will search for observations done within either one of these date ranges.

Exposure Time

The total exposure times in seconds. Note the times do not reflect pointing problems. In many cases, the target was not in the aperture.

Entry ID

The BEFS observation reference number uniquely defines each BEFS observation. The name is of the form **BEFSnnnn** where nnnn is a unique 4-digit number assigned sequentially in the order in which the observation was made, starting at 1000.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The default set of columns for raw data sets is (in the order displayed):

```
Object Name
Entry_ID
RA (J2000)
Dec (J2000)
Observation Date
Exposure Time
Gratings
Object Category
Comments
More info
```

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. the rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning hundreds of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the BEFS Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The BEFS Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

Data Search / Missions / Contacts / STScI / MAST

Site Search

IMAPS Interstellar Medium Absorption Profile Spectrograph

IMAPS-1 Search Table

Below is the finding list for IMAPS-1 targets. Clicking on an entry in the table will display the appropriate section of the **raw** or **coadded** image tables from which the files can be downloaded (by clicking on the filename), or the FITS headers displayed (by clicking on HD number). Omitted from the list below are the background exposures although all background exposures are available in the raw image table. Note the Eta Uma exposures are divided into several groups based on changes in the exposure times (which are shown in parentheses).

The coadded images are usually comprised of 2 to 5 raw images which are coadded and corrected for various detector artifacts. The FITS files contain the coadded image as a primary array with wavelength information stored in a binary table. (see note on **Wavelength Accuracy**). The numbers listed below for the coadded files represent the range of exposure numbers used in each group of coadded images. As shown, coadded images do not exist for all of the observed targets. Although some raw images were not suitable for coadding, we expect more coadded files will become available in the near future.

Object Name	Raw Image Numbers	Coadded Image Numbers
gamma2 Vel	89-108 239-251 323-330	89-108
zeta Ori	109-124 195-214 378-408	109-124 195-214 378-402
zeta Pup	125-140 276-294 440-445	125-139 276-294 440-445
gamma Cas	141-148 220-238 331-355	141-146 220-238 331-355
epsilon Ori	150-173 296-322	150-172 296-322
alpha Eri	175-194 253-274 416-424 715-721	
beta Cru	356-375 410-415	
eta UMa (atmos. probe)	446-454(511) 455-514(255) 515-522(511) 525-532(511) 533-592(255) 594-601(511)	
kappa Ori	602-652 653-700	
beta Cen	702-713	705-713

Getting Started

The Interstellar Absorption Profile Spectrograph (IMAPS) is a very high-resolution (R ~ 240,000) spectrograph used to observe several bright, hot stars over the spectral region 950-1150Å. The instrument is especially well-suited for studies of interstellar absorption lines. IMAPS flew on on two shuttle missions, in September 1993 and November 1996, in conjuction with the ORFEUS mission.

Currently only data from the first mission, IMAPS-1, are available. This archive includes about 600 spectral images of 10 hot stars. The data are available in two forms, raw images and coadded images corrected for various detector artifacts. Six of the stars currently have coadded, corrected images available: gamma-2 Vel, zeta Ori, zeta Pup, gamma Cas, epsilon Ori, and beta Cen. The images are listed in the **search table**.

The data are available as spectral images in FITS format (see **Data Products**). The files may be read using software packages such IRAF or IDL (see **How to Read IMAPS Files**), although the software to extract the echelle spectra from these images is not yet available. Wavelength calibration information is furnished with the spectral image files.

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Mission/category: IMAPS all Go

List all changes for IMAPS

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

Target Search Error
2001 June 12
An error was discovered in the target search available from the main MAST page. Searches would fail for object names containing special characters (such as a "+" symbol as in BD +28 4211). The error was fixed on the above date.

Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

Cross Correlations with Sky2000 Catalog
2000 August 16
Cross correlations of MAST missions with the SKYMAP Sky2000 catalog (version 3) are now possible from the MAST Cross Correlation page.

New Copyright Notice
2000 May 12
STScI has adopted a new Copyright statement. Most, if not all, MAST web pages should now include a link to the new page.

Coadded IMAPS-1 Files now Accessible
1999 September 22
The available corrected and coadded IMAPS-1 files are now accessible from the IMAPS-1 search table. A description of the wavelength calibration procedure used is also available.

Revised IMAPS-1 FITS Files
1999 September 21
Comments were added to some IMAPS-1 files describing known problems with the images.

Revised IMAPS-1 FITS Files
1999 August 2
Dates listed in the IMAPS-1 raw image files are now given in GMT rather than days since launch.

IMAPS 1
1999 July 20
The raw data from the first IMAPS mission is now available through MAST.

IMAPS-1 Target List
1999 June 21
Target list page now includes links to display FITS headers of raw files.

More Documentation
1999 June 09
WEB pages were added on reading IMAPS files , and IMAPS file formats.

IMAPS-1 Search Table and Target List online
1999 April 30

IMAPS-1 Raw Data Available online
1999 April 12

Acknowledgments Page added
1999 February 5

New Documentation
1998 December 10
The paper "High Resolution Spectroscopy in the Far UV: Observations of the Interstellar Medium by IMAPS on Orfeus-SPAS" by Jenkins, Reale, Zucchino, Sofia (1996,Ap&SS,239,315J) was put online (with permission from Kluwer Academic Publishers).

FAQ Page
1998 August 5
An IMAPS "Frequently Asked Questions" (FAQ) page is now available. Users should send additional questions to archive@stsci.edu.

Frequently Asked Questions

Data Requests

- Where do I get IMAPS archival data?

Data Analysis

- How do I read a IMAPS FITS file?
- How do I extract data from IMAPS images?

Data Requests

- ***Where do I get IMAPS archival data?***
  At the end of the mission, Princeton provided the raw IMAPS-1 data to the National Space Science Data Center (**NSSDC**) in the form of IDL unformatted data sets. NSSDC staff converted these files to FITS format. The FITS headers were later modified by personnel from the **Laboratory for Astronomy and Solar Physics** (LASP) at Goddard Space Flight Center and the modified FITS files are now available from the **Multi-mission Archive at the Space Telescope Science Institute (MAST)**. Princeton also produced IDL data sets of coadded and corrected IMAPS-1 data. These data sets have been converted to FITS format by LASP personnel and will be available from MAST.

  IMAPS-2 data has not yet become available to the general community.

Data Analysis

- ***How do I read a IMAPS FITS file?***
  The raw data sets are basic FITS primary array files and should be readable by any FITS reader or FITS viewer. The corrected, coadded files contain a primary array, but also have wavelengths stored in a binary table, and the image filter in an image extension. See **Reading IMAPS Files** for more information.

- ***How do I extract data from IMAPS images?***
  An IDL routine called EXTRACT5 was written for extracting spectral data from the corrected IMAPS FITS files. More information on EXTRACT5 will be available soon.

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Data Reduction/Analysis

- IMAPS-1 Data Reduction - from Jenlins,Reale,Zucchino,& Sofia paper.
- Reading IMAPS Files - reading IMAPS-1 files using various FITS readers.
- Wavelength Calbration- wavelength accuracy of IMAPS-1 data.

Instrumentation/Operations

- Introduction, Description and History of IMAPS-1 - from the paper "High Resolution Spectroscopy in the Far-UV: Observations of the Interstellar Medium by IMAPS on ORFEUS-SPAS by Jenkins,Reale, Zucchino,Sofia (1996, Kluwer Academic Publishers).
- Instrument Description - from above paper
- Preparations for IMAPS-2 - from above paper

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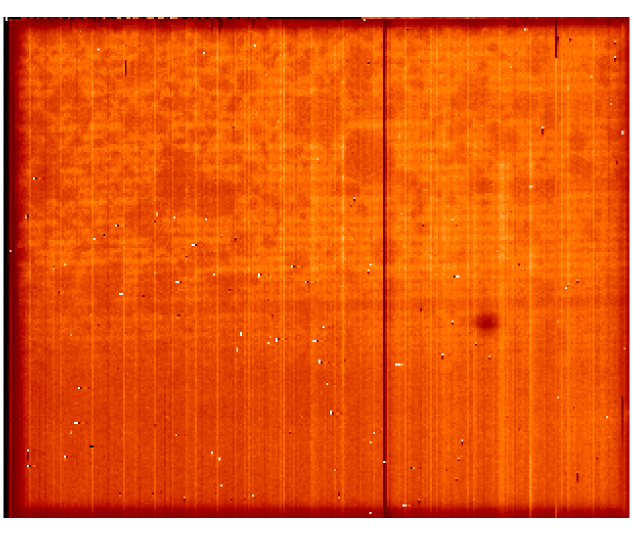
Related Sites

- NASA's ORFEUS-SPAS II Web Site
- Astrophysics Data Facility (ADF) ORFEUS holdings (see also ADF Ultraviolet/Optical Missions page)
- Berkeley ORFEUS Site
- Tuebingen Web Site

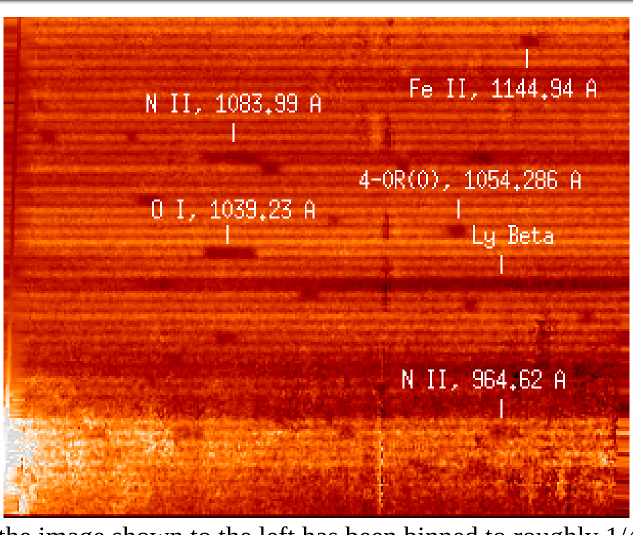
IMAPS Sample Images

The following are examples of IMAPS-1 spectral images:



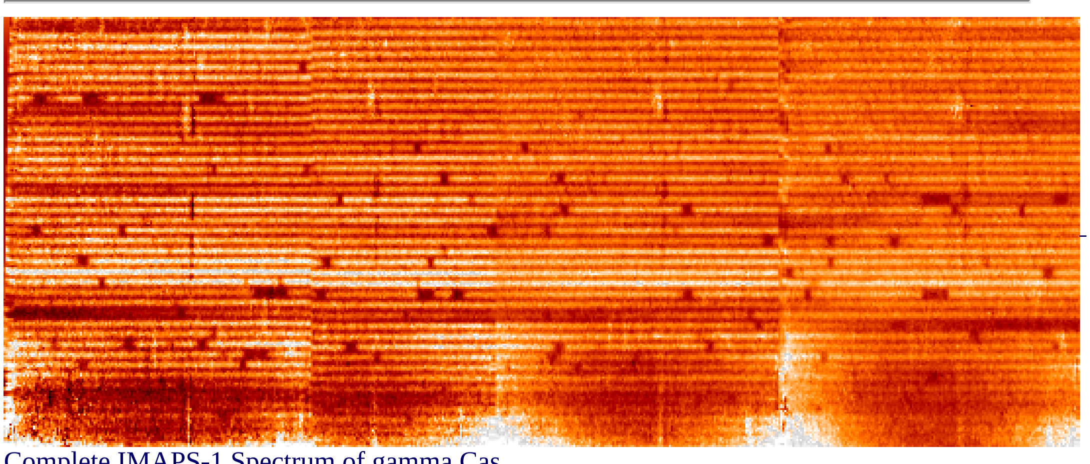
Raw image of gamma Cas - 16kb

This figure shows a raw image of gamma Cas (imaps1_0340.fits). Most of the prominent features are artifacts. The echelle spectral orders are barely discernable as light-colored horizontal lines. All raw images are 320x256 byte arrays, so each raw image FITS file is roughly 16 Kb.



Corrected & coadded image of gamma Cas - 2.6 MB

This figure represents one of the corrected and coadded images of gamma Cas (imaps1_340-342.fits). Most of the artifacts have been removed, and some of the more prominent features are labelled. The corrected IMAPS1 images are 640x512 floating point arrays (1.3 MB) although with the wavelength arrays and noise filter image, the complete corrected and coadded FITS file is roughly 2.6 MB. (Note the image shown to the left has been binned to roughly 1/4th of its original size. Clicking on the image will show the full size image.)



Complete IMAPS-1 Spectrum of gamma Cas

Four coadded, & corrected images of gamma Cas were spliced together to display the entire IMAPS-1 spectral coverage. The image shown was then rebinned to be about 1/8th the original size. (Clicking on the image will show a file binned to 1/4th original size.)

Acknowledgments

The MAST staff would like to thank the following groups and individuals for help in making the IMAPS data, documentation, and WEB site available to the public:

- **Ed Jenkins** (Princeton University Observatory), principal investigator for IMAPS 1 and IMAPS-2, for invaluable advice, documentation, and information in general on the IMAPS project,
- **George Sonneborn** (Goddard Space Flight Center, LASP) for assistance in creating the IMAPS archive, providing the data reduction software, amd explaining the IMAPS data format,
- the **Raytheon/STX ADF** staff including **Derck Massa,** and **Jeff Silvis**, for creating the original IMAPS-1 raw data FITS files,
- **Kluwer Academic Publishers**, publishers of "Astrophysics and Space Sciences" and "Experimental Astronomy", for permission to reprint the article "High Resolution Spectroscopy in the Far UV: Observations of the Interstellar Medium by IMAPS on ORFEUS-SPAS by Jenkins, Reale, Zucchino, and Sofia (1996 Ap&SS,239,315J). Special thanks go to **Berendina Schermers-van Straalen**, Rights and Permissions Manager for Kluwer Academic Publishers.

IMAPS-1 Raw Image Table

Below is the finding list for IMAPS-1 targets shown in the order in which the observations were obtained.
Clicking on the file name entry will download the selected raw data FITS file.
Clicking on the HD number will display the FITS file header.

File Name	Object Name	HD #	Echelle Pos.	Observation Date
imaps1_0079.fits	BACKGROUND	10144	B	Sep 16 1993 16:08
imaps1_0080.fits	BACKGROUND	10144	B	Sep 16 1993 16:09
imaps1_0081.fits	BACKGROUND	10144	B	Sep 16 1993 16:11
imaps1_0082.fits	BACKGROUND	10144	B	Sep 16 1993 16:13
imaps1_0083.fits	BACKGROUND	10144	B	Sep 16 1993 16:14
imaps1_0084.fits	BACKGROUND	10144	B	Sep 16 1993 16:16
imaps1_0085.fits	BACKGROUND	10144	B	Sep 16 1993 16:18
imaps1_0086.fits	ALPHA ERI	10144	4	Sep 16 1993 16:33
imaps1_0087.fits	ALPHA ERI	10144	4	Sep 16 1993 16:34
imaps1_0088.fits	ALPHA ERI	10144	4	Sep 16 1993 16:36
imaps1_0089.fits	GAMMA2 VEL	68273	4	Sep 16 1993 16:50
imaps1_0090.fits	GAMMA2 VEL	68273	4	Sep 16 1993 16:52
imaps1_0091.fits	GAMMA2 VEL	68273	4	Sep 16 1993 16:53
imaps1_0092.fits	GAMMA2 VEL	68273	4	Sep 16 1993 16:55
imaps1_0093.fits	GAMMA2 VEL	68273	4	Sep 16 1993 16:57
imaps1_0094.fits	GAMMA2 VEL	68273	1	Sep 16 1993 16:58
imaps1_0095.fits	GAMMA2 VEL	68273	1	Sep 16 1993 17:00
imaps1_0096.fits	GAMMA2 VEL	68273	1	Sep 16 1993 17:02
imaps1_0097.fits	GAMMA2 VEL	68273	1	Sep 16 1993 17:03
imaps1_0098.fits	GAMMA2 VEL	68273	1	Sep 16 1993 17:05
imaps1_0099.fits	GAMMA2 VEL	68273	2	Sep 16 1993 17:07
imaps1_0100.fits	GAMMA2 VEL	68273	2	Sep 16 1993 17:08
imaps1_0101.fits	GAMMA2 VEL	68273	2	Sep 16 1993 17:10
imaps1_0102.fits	GAMMA2 VEL	68273	2	Sep 16 1993 17:12
imaps1_0103.fits	GAMMA2 VEL	68273	2	Sep 16 1993 17:13
imaps1_0104.fits	GAMMA2 VEL	68273	3	Sep 16 1993 17:15
imaps1_0105.fits	GAMMA2 VEL	68273	3	Sep 16 1993 17:17
imaps1_0106.fits	GAMMA2 VEL	68273	3	Sep 16 1993 17:19
imaps1_0107.fits	GAMMA2 VEL	68273	3	Sep 16 1993 17:20
imaps1_0108.fits	ETA UMA	120315	3	Sep 16 1993 17:22
imaps1_0109.fits	ZETA ORI A	37742	1	Sep 16 1993 17:54
imaps1_0110.fits	ZETA ORI A	37742	1	Sep 16 1993 17:56
imaps1_0111.fits	ZETA ORI A	37742	1	Sep 16 1993 17:57
imaps1_0112.fits	ZETA ORI A	37742	1	Sep 16 1993 17:59
imaps1_0113.fits	ZETA ORI A	37742	2	Sep 16 1993 18:01
imaps1_0114.fits	ZETA ORI A	37742	2	Sep 16 1993 18:02
imaps1_0115.fits	ZETA ORI A	37742	2	Sep 16 1993 18:04
imaps1_0116.fits	ZETA ORI A	37742	2	Sep 16 1993 18:06
imaps1_0117.fits	ZETA ORI A	37742	3	Sep 16 1993 18:07
imaps1_0118.fits	ZETA ORI A	37742	3	Sep 16 1993 18:11
imaps1_0119.fits	ZETA ORI A	37742	3	Sep 16 1993 18:11
imaps1_0120.fits	ZETA ORI A	37742	3	Sep 16 1993 18:12
imaps1_0121.fits	ZETA ORI A	37742	4	Sep 16 1993 18:14
imaps1_0122.fits	ZETA ORI A	37742	4	Sep 16 1993 18:16
imaps1_0123.fits	ZETA ORI A	37742	4	Sep 16 1993 18:17
imaps1_0124.fits	ZETA ORI A	37742	4	Sep 16 1993 18:19
imaps1_0125.fits	ZETA PUP	66811	1	Sep 16 1993 18:27
imaps1_0126.fits	ZETA PUP	66811	1	Sep 16 1993 18:29
imaps1_0127.fits	ZETA PUP	66811	1	Sep 16 1993 18:30
imaps1_0128.fits	ZETA PUP	66811	1	Sep 16 1993 18:32
imaps1_0129.fits	ZETA PUP	66811	2	Sep 16 1993 18:34
imaps1_0130.fits	ZETA PUP	66811	2	Sep 16 1993 18:35
imaps1_0131.fits	ZETA PUP	66811	2	Sep 16 1993 18:37
imaps1_0132.fits	ZETA PUP	66811	2	Sep 16 1993 18:39
imaps1_0133.fits	ZETA PUP	66811	3	Sep 16 1993 18:41
imaps1_0134.fits	ZETA PUP	66811	3	Sep 16 1993 18:42
imaps1_0135.fits	ZETA PUP	66811	3	Sep 16 1993 18:44
imaps1_0136.fits	ZETA PUP	66811	3	Sep 16 1993 18:45
imaps1_0137.fits	ZETA PUP	66811	4	Sep 16 1993 18:47
imaps1_0138.fits	ZETA PUP	66811	4	Sep 16 1993 18:49
imaps1_0139.fits	ZETA PUP	66811	4	Sep 16 1993 18:51
imaps1_0140.fits	ZETA PUP	66811	4	Sep 16 1993 18:52
imaps1_0141.fits	GAMMA CAS	5394	1	Sep 16 1993 19:09
imaps1_0142.fits	GAMMA CAS	5394	1	Sep 16 1993 19:11
imaps1_0143.fits	GAMMA CAS	5394	2	Sep 16 1993 19:13
imaps1_0144.fits	GAMMA CAS	5394	2	Sep 16 1993 19:14
imaps1_0145.fits	GAMMA CAS	5394	3	Sep 16 1993 19:16
imaps1_0146.fits	GAMMA CAS	5394	3	Sep 16 1993 19:18
imaps1_0147.fits	GAMMA CAS	5394	4	Sep 16 1993 19:19
imaps1_0148.fits	GAMMA CAS	5394	4	Sep 16 1993 19:21
imaps1_0149.fits	BACKGROUND	5394	B	Sep 16 1993 19:23
imaps1_0150.fits	EPSILON ORI	37128	1	Sep 16 1993 19:28
imaps1_0151.fits	EPSILON ORI	37128	1	Sep 16 1993 19:30
imaps1_0152.fits	EPSILON ORI	37128	1	Sep 16 1993 19:31
imaps1_0153.fits	EPSILON ORI	37128	2	Sep 16 1993 19:33
imaps1_0154.fits	EPSILON ORI	37128	2	Sep 16 1993 19:35
imaps1_0155.fits	EPSILON ORI	37128	2	Sep 16 1993 19:36
imaps1_0156.fits	EPSILON ORI	37128	3	Sep 16 1993 19:38
imaps1_0157.fits	EPSILON ORI	37128	3	Sep 16 1993 19:40
imaps1_0158.fits	EPSILON ORI	37128	3	Sep 16 1993 19:41
imaps1_0159.fits	EPSILON ORI	37128	4	Sep 16 1993 19:43
imaps1_0160.fits	EPSILON ORI	37128	4	Sep 16 1993 19:45
imaps1_0161.fits	EPSILON ORI	37128	4	Sep 16 1993 19:46
imaps1_0162.fits	EPSILON ORI	37128	1	Sep 16 1993 19:48
imaps1_0163.fits	EPSILON ORI	37128	1	Sep 16 1993 19:50
imaps1_0164.fits	EPSILON ORI	37128	1	Sep 16 1993 19:52
imaps1_0165.fits	EPSILON ORI	37128	2	Sep 16 1993 19:53
imaps1_0166.fits	EPSILON ORI	37128	2	Sep 16 1993 19:55
imaps1_0167.fits	EPSILON ORI	37128	2	Sep 16 1993 19:57
imaps1_0168.fits	EPSILON ORI	37128	3	Sep 16 1993 19:59
imaps1_0169.fits	EPSILON ORI	37128	3	Sep 16 1993 20:00
imaps1_0170.fits	EPSILON ORI	37128	3	Sep 16 1993 20:02
imaps1_0171.fits	EPSILON ORI	37128	4	Sep 16 1993 20:04
imaps1_0172.fits	EPSILON ORI	37128	4	Sep 16 1993 20:05
imaps1_0173.fits	EPSILON ORI	37128	4	Sep 16 1993 20:07
imaps1_0174.fits	BACKGROUND	37128	B	Sep 16 1993 20:09
imaps1_0175.fits	ALPHA ERI	10144	1	Sep 16 1993 20:16
imaps1_0176.fits	ALPHA ERI	10144	1	Sep 16 1993 20:18
imaps1_0177.fits	ALPHA ERI	10144	1	Sep 16 1993 20:19
imaps1_0178.fits	ALPHA ERI	10144	1	Sep 16 1993 20:21
imaps1_0179.fits	ALPHA ERI	10144	1	Sep 16 1993 20:22
imaps1_0180.fits	ALPHA ERI	10144	2	Sep 16 1993 20:24
imaps1_0181.fits	ALPHA ERI	10144	2	Sep 16 1993 20:26
imaps1_0182.fits	ALPHA ERI	10144	2	Sep 16 1993 20:28
imaps1_0183.fits	ALPHA ERI	10144	2	Sep 16 1993 20:29
imaps1_0184.fits	ALPHA ERI	10144	2	Sep 16 1993 20:31
imaps1_0185.fits	ALPHA ERI	10144	3	Sep 16 1993 20:33
imaps1_0186.fits	ALPHA ERI	10144	3	Sep 16 1993 20:34
imaps1_0187.fits	ALPHA ERI	10144	3	Sep 16 1993 20:36
imaps1_0188.fits	ALPHA ERI	10144	3	Sep 16 1993 20:38
imaps1_0189.fits	ALPHA ERI	10144	3	Sep 16 1993 20:39
imaps1_0190.fits	ALPHA ERI	10144	4	Sep 16 1993 20:41
imaps1_0191.fits	ALPHA ERI	10144	4	Sep 16 1993 20:43
imaps1_0192.fits	ALPHA ERI	10144	4	Sep 16 1993 20:44
imaps1_0193.fits	ALPHA ERI	10144	4	Sep 16 1993 20:46
imaps1_0194.fits	ALPHA ERI	10144	3	Sep 16 1993 20:48
imaps1_0195.fits	ZETA ORI A	37742	1	Sep 16 1993 20:58
imaps1_0196.fits	ZETA ORI A	37742	1	Sep 16 1993 21:00
imaps1_0197.fits	ZETA ORI A	37742	1	Sep 16 1993 21:01
imaps1_0198.fits	ZETA ORI A	37742	2	Sep 16 1993 21:03
imaps1_0199.fits	ZETA ORI A	37742	2	Sep 16 1993 21:05
imaps1_0200.fits	ZETA ORI A	37742	3	Sep 16 1993 21:06
imaps1_0201.fits	ZETA ORI A	37742	3	Sep 16 1993 21:08
imaps1_0202.fits	ZETA ORI A	37742	4	Sep 16 1993 21:10
imaps1_0203.fits	ZETA ORI A	37742	4	Sep 16 1993 21:12
imaps1_0204.fits	ZETA ORI A	37742	4	Sep 16 1993 21:13
imaps1_0205.fits	ZETA ORI A	37742	1	Sep 16 1993 21:21
imaps1_0206.fits	ZETA ORI A	37742	1	Sep 16 1993 21:23
imaps1_0207.fits	ZETA ORI A	37742	2	Sep 16 1993 21:24
imaps1_0208.fits	ZETA ORI A	37742	4	Sep 16 1993 21:26
imaps1_0209.fits	ZETA ORI A	37742	2	Sep 16 1993 21:28
imaps1_0210.fits	ZETA ORI A	37742	3	Sep 16 1993 21:29
imaps1_0211.fits	ZETA ORI A	37742	3	Sep 16 1993 21:31
imaps1_0212.fits	ZETA ORI A	37742	3	Sep 16 1993 21:33
imaps1_0213.fits	ZETA ORI A	37742	4	Sep 16 1993 21:35
imaps1_0214.fits	ZETA ORI A	37742	4	Sep 16 1993 21:36
imaps1_0215.fits	ZETA ORI A	37742	3	Sep 16 1993 21:38
imaps1_0216.fits	ZETA ORI A	37742	1	Sep 16 1993 21:45
imaps1_0217.fits	ZETA ORI A	37742	2	Sep 16 1993 21:47
imaps1_0218.fits	ZETA ORI A	37742	3	Sep 16 1993 21:48
imaps1_0219.fits	ZETA ORI A	37742	4	Sep 16 1993 21:50
imaps1_0220.fits	GAMMA CAS	5394	1	Sep 16 1993 22:05
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imaps1_0222.fits	GAMMA CAS	5394	1	Sep 16 1993 22:08
imaps1_0223.fits	GAMMA CAS	5394	2	Sep 16 1993 22:10
imaps1_0224.fits	GAMMA CAS	5394	2	Sep 16 1993 22:12
imaps1_0225.fits	GAMMA CAS	5394	3	Sep 16 1993 22:13
imaps1_0226.fits	GAMMA CAS	5394	3	Sep 16 1993 22:15
imaps1_0227.fits	GAMMA CAS	5394	4	Sep 16 1993 22:17
imaps1_0228.fits	GAMMA CAS	5394	4	Sep 16 1993 22:19
imaps1_0229.fits	GAMMA CAS	5394	4	Sep 16 1993 22:20
imaps1_0230.fits	GAMMA CAS	5394	1	Sep 16 1993 22:25
imaps1_0231.fits	GAMMA CAS	5394	1	Sep 16 1993 22:27
imaps1_0232.fits	GAMMA CAS	5394	2	Sep 16 1993 22:28
imaps1_0233.fits	GAMMA CAS	5394	2	Sep 16 1993 22:30
imaps1_0234.fits	GAMMA CAS	5394	3	Sep 16 1993 22:32
imaps1_0235.fits	GAMMA CAS	5394	3	Sep 16 1993 22:33
imaps1_0236.fits	GAMMA CAS	5394	3	Sep 16 1993 22:35
imaps1_0237.fits	GAMMA CAS	5394	4	Sep 16 1993 22:37
imaps1_0238.fits	GAMMA CAS	5394	4	Sep 16 1993 22:39
imaps1_0239.fits	GAMMA2 VEL	68273	1	Sep 16 1993 22:50
imaps1_0240.fits	GAMMA2 VEL	68273	1	Sep 16 1993 22:52
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imaps1_0244.fits	GAMMA2 VEL	68273	3	Sep 16 1993 22:58
imaps1_0245.fits	GAMMA2 VEL	68273	4	Sep 16 1993 23:00
imaps1_0246.fits	GAMMA2 VEL	68273	4	Sep 16 1993 23:02
imaps1_0247.fits	GAMMA2 VEL	68273	1	Sep 16 1993 23:06
imaps1_0248.fits	GAMMA2 VEL	68273	2	Sep 16 1993 23:08
imaps1_0249.fits	GAMMA2 VEL	68273	3	Sep 16 1993 23:10
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imaps1_0251.fits	GAMMA2 VEL	68273	4	Sep 16 1993 23:13
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imaps1_0254.fits	ALPHA ERI	10144	1	Sep 16 1993 23:24
imaps1_0255.fits	ALPHA ERI	10144	1	Sep 16 1993 23:25
imaps1_0256.fits	ALPHA ERI	10144	2	Sep 16 1993 23:27
imaps1_0257.fits	ALPHA ERI	10144	2	Sep 16 1993 23:29
imaps1_0258.fits	ALPHA ERI	10144	2	Sep 16 1993 23:30
imaps1_0259.fits	ALPHA ERI	10144	3	Sep 16 1993 23:32
imaps1_0260.fits	ALPHA ERI	10144	3	Sep 16 1993 23:34
imaps1_0261.fits	ALPHA ERI	10144	3	Sep 16 1993 23:35
imaps1_0262.fits	ALPHA ERI	10144	4	Sep 16 1993 23:37

imaps1_0263.fits	ALPHA ERI	10144	4	Sep 16 1993 23:39
imaps1_0264.fits	ALPHA ERI	10144	4	Sep 16 1993 23:41
imaps1_0265.fits	ALPHA ERI	10144	1	Sep 16 1993 23:46
imaps1_0266.fits	ALPHA ERI	10144	1	Sep 16 1993 23:48
imaps1_0267.fits	ALPHA ERI	10144	1	Sep 16 1993 23:49
imaps1_0268.fits	ALPHA ERI	10144	2	Sep 16 1993 23:51
imaps1_0269.fits	ALPHA ERI	10144	2	Sep 16 1993 23:53
imaps1_0270.fits	ALPHA ERI	10144	3	Sep 16 1993 23:54
imaps1_0271.fits	ALPHA ERI	10144	3	Sep 16 1993 23:56
imaps1_0272.fits	ALPHA ERI	10144	4	Sep 16 1993 23:58
imaps1_0273.fits	ALPHA ERI	10144	4	Sep 17 1993 0:00
imaps1_0274.fits	ALPHA ERI	10144	4	Sep 17 1993 0:01
imaps1_0275.fits	BACKGROUND	10144	B	Sep 17 1993 0:03
imaps1_0276.fits	ZETA PUP	66811	1	Sep 17 1993 0:10
imaps1_0277.fits	ZETA PUP	66811	1	Sep 17 1993 0:12
imaps1_0278.fits	ZETA PUP	66811	2	Sep 17 1993 0:13
imaps1_0279.fits	ZETA PUP	66811	2	Sep 17 1993 0:15
imaps1_0280.fits	ZETA PUP	66811	2	Sep 17 1993 0:17
imaps1_0281.fits	ZETA PUP	66811	3	Sep 17 1993 0:18
imaps1_0282.fits	ZETA PUP	66811	3	Sep 17 1993 0:20
imaps1_0283.fits	ZETA PUP	66811	3	Sep 17 1993 0:22
imaps1_0284.fits	ZETA PUP	66811	4	Sep 17 1993 0:24
imaps1_0285.fits	ZETA PUP	66811	4	Sep 17 1993 0:25
imaps1_0286.fits	ZETA PUP	66811	1	Sep 17 1993 0:29
imaps1_0287.fits	ZETA PUP	66811	1	Sep 17 1993 0:31
imaps1_0288.fits	ZETA PUP	66811	1	Sep 17 1993 0:32
imaps1_0289.fits	ZETA PUP	66811	2	Sep 17 1993 0:34
imaps1_0290.fits	ZETA PUP	66811	2	Sep 17 1993 0:36
imaps1_0291.fits	ZETA PUP	66811	3	Sep 17 1993 0:37
imaps1_0292.fits	ZETA PUP	66811	3	Sep 17 1993 0:39
imaps1_0293.fits	ZETA PUP	66811	4	Sep 17 1993 0:41
imaps1_0294.fits	ZETA PUP	66811	4	Sep 17 1993 0:43
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imaps1_0296.fits	EPSILON ORI	37128	1	Sep 17 1993 14:51
imaps1_0297.fits	EPSILON ORI	37128	1	Sep 17 1993 14:53
imaps1_0298.fits	EPSILON ORI	37128	1	Sep 17 1993 14:54
imaps1_0299.fits	EPSILON ORI	37128	1	Sep 17 1993 14:56
imaps1_0300.fits	EPSILON ORI	37128	2	Sep 17 1993 14:58
imaps1_0301.fits	EPSILON ORI	37128	2	Sep 17 1993 14:59
imaps1_0302.fits	EPSILON ORI	37128	2	Sep 17 1993 15:01
imaps1_0303.fits	EPSILON ORI	37128	3	Sep 17 1993 15:03
imaps1_0304.fits	EPSILON ORI	37128	3	Sep 17 1993 15:04
imaps1_0305.fits	EPSILON ORI	37128	3	Sep 17 1993 15:06
imaps1_0306.fits	EPSILON ORI	37128	4	Sep 17 1993 15:08
imaps1_0307.fits	EPSILON ORI	37128	4	Sep 17 1993 15:10
imaps1_0308.fits	EPSILON ORI	37128	4	Sep 17 1993 15:11
imaps1_0309.fits	EPSILON ORI	37128	4	Sep 17 1993 15:13
imaps1_0310.fits	EPSILON ORI	37128	1	Sep 17 1993 15:18
imaps1_0311.fits	EPSILON ORI	37128	1	Sep 17 1993 15:20
imaps1_0312.fits	EPSILON ORI	37128	1	Sep 17 1993 15:21
imaps1_0313.fits	EPSILON ORI	37128	2	Sep 17 1993 15:23
imaps1_0314.fits	EPSILON ORI	37128	2	Sep 17 1993 15:25
imaps1_0315.fits	EPSILON ORI	37128	2	Sep 17 1993 15:26
imaps1_0316.fits	EPSILON ORI	37128	3	Sep 17 1993 15:28
imaps1_0317.fits	EPSILON ORI	37128	3	Sep 17 1993 15:30
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imaps1_0319.fits	EPSILON ORI	37128	3	Sep 17 1993 15:33
imaps1_0320.fits	EPSILON ORI	37128	4	Sep 17 1993 15:35
imaps1_0321.fits	EPSILON ORI	37128	4	Sep 17 1993 15:36
imaps1_0322.fits	EPSILON ORI	37128	4	Sep 17 1993 15:38
imaps1_0323.fits	GAMMA2 VEL	68273	1	Sep 17 1993 15:47
imaps1_0324.fits	GAMMA2 VEL	68273	1	Sep 17 1993 15:49
imaps1_0325.fits	GAMMA2 VEL	68273	2	Sep 17 1993 15:50
imaps1_0326.fits	GAMMA2 VEL	68273	2	Sep 17 1993 15:52
imaps1_0327.fits	GAMMA2 VEL	68273	3	Sep 17 1993 15:54
imaps1_0328.fits	GAMMA2 VEL	68273	3	Sep 17 1993 15:55
imaps1_0329.fits	GAMMA2 VEL	68273	4	Sep 17 1993 15:57
imaps1_0330.fits	GAMMA2 VEL	68273	4	Sep 17 1993 15:59
imaps1_0331.fits	GAMMA CAS	5394	1	Sep 17 1993 16:10
imaps1_0332.fits	GAMMA CAS	5394	1	Sep 17 1993 16:12
imaps1_0333.fits	GAMMA CAS	5394	1	Sep 17 1993 16:13
imaps1_0334.fits	GAMMA CAS	5394	2	Sep 17 1993 16:15
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imaps1_0336.fits	GAMMA CAS	5394	2	Sep 17 1993 16:18
imaps1_0337.fits	GAMMA CAS	5394	3	Sep 17 1993 16:20
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imaps1_0339.fits	GAMMA CAS	5394	3	Sep 17 1993 16:23
imaps1_0340.fits	GAMMA CAS	5394	4	Sep 17 1993 16:25
imaps1_0341.fits	GAMMA CAS	5394	4	Sep 17 1993 16:27
imaps1_0342.fits	GAMMA CAS	5394	4	Sep 17 1993 16:28
imaps1_0343.fits	GAMMA CAS	5394	1	Sep 17 1993 16:33
imaps1_0344.fits	GAMMA CAS	5394	1	Sep 17 1993 16:35
imaps1_0345.fits	GAMMA CAS	5394	1	Sep 17 1993 16:36
imaps1_0346.fits	GAMMA CAS	5394	1	Sep 17 1993 16:38
imaps1_0347.fits	GAMMA CAS	5394	2	Sep 17 1993 16:40
imaps1_0348.fits	GAMMA CAS	5394	2	Sep 17 1993 16:41
imaps1_0349.fits	GAMMA CAS	5394	2	Sep 17 1993 16:43
imaps1_0350.fits	GAMMA CAS	5394	3	Sep 17 1993 16:45
imaps1_0351.fits	GAMMA CAS	5394	3	Sep 17 1993 16:46
imaps1_0352.fits	GAMMA CAS	5394	3	Sep 17 1993 16:48
imaps1_0353.fits	GAMMA CAS	5394	4	Sep 17 1993 16:50
imaps1_0354.fits	GAMMA CAS	5394	4	Sep 17 1993 16:52
imaps1_0355.fits	GAMMA CAS	5394	4	Sep 17 1993 16:53
imaps1_0356.fits	BETA CRU	111123	1	Sep 17 1993 17:06
imaps1_0357.fits	BETA CRU	111123	1	Sep 17 1993 17:08
imaps1_0358.fits	BETA CRU	111123	1	Sep 17 1993 17:10
imaps1_0359.fits	BETA CRU	111123	2	Sep 17 1993 17:11
imaps1_0360.fits	BETA CRU	111123	2	Sep 17 1993 17:13
imaps1_0361.fits	BETA CRU	111123	3	Sep 17 1993 17:15
imaps1_0362.fits	BETA CRU	111123	3	Sep 17 1993 17:16
imaps1_0363.fits	BETA CRU	111123	4	Sep 17 1993 17:18
imaps1_0364.fits	BETA CRU	111123	4	Sep 17 1993 17:20
imaps1_0365.fits	BETA CRU	111123	4	Sep 17 1993 17:22
imaps1_0366.fits	BETA CRU	111123	1	Sep 17 1993 17:25
imaps1_0367.fits	BETA CRU	111123	1	Sep 17 1993 17:27
imaps1_0368.fits	BETA CRU	111123	2	Sep 17 1993 17:28
imaps1_0369.fits	BETA CRU	111123	2	Sep 17 1993 17:30
imaps1_0370.fits	BETA CRU	111123	2	Sep 17 1993 17:32
imaps1_0371.fits	BETA CRU	111123	3	Sep 17 1993 17:33
imaps1_0372.fits	BETA CRU	111123	3	Sep 17 1993 17:35
imaps1_0373.fits	BETA CRU	111123	3	Sep 17 1993 17:37
imaps1_0374.fits	BETA CRU	111123	4	Sep 17 1993 17:39
imaps1_0375.fits	BETA CRU	111123	4	Sep 17 1993 17:40
imaps1_0376.fits	BACKGROUND	111123	B	Sep 17 1993 17:42
imaps1_0377.fits	BACKGROUND	111123	B	Sep 17 1993 17:44
imaps1_0378.fits	ZETA ORI A	37742	1	Sep 17 1993 17:51
imaps1_0379.fits	ZETA ORI A	37742	1	Sep 17 1993 17:53
imaps1_0380.fits	ZETA ORI A	37742	1	Sep 17 1993 17:54
imaps1_0381.fits	ZETA ORI A	37742	1	Sep 17 1993 17:56
imaps1_0382.fits	ZETA ORI A	37742	2	Sep 17 1993 17:58
imaps1_0383.fits	ZETA ORI A	37742	2	Sep 17 1993 17:59
imaps1_0384.fits	ZETA ORI A	37742	2	Sep 17 1993 18:01
imaps1_0385.fits	ZETA ORI A	37742	2	Sep 17 1993 18:03
imaps1_0386.fits	ZETA ORI A	37742	3	Sep 17 1993 18:04
imaps1_0387.fits	ZETA ORI A	37742	3	Sep 17 1993 18:06
imaps1_0388.fits	ZETA ORI A	37742	3	Sep 17 1993 18:08
imaps1_0389.fits	ZETA ORI A	37742	3	Sep 17 1993 18:09
imaps1_0390.fits	ZETA ORI A	37742	4	Sep 17 1993 18:11
imaps1_0391.fits	ZETA ORI A	37742	4	Sep 17 1993 18:13
imaps1_0392.fits	ZETA ORI A	37742	4	Sep 17 1993 18:14
imaps1_0393.fits	ZETA ORI A	37742	4	Sep 17 1993 18:16
imaps1_0394.fits	ZETA ORI A	37742	4	Sep 17 1993 18:18
imaps1_0395.fits	ZETA ORI A	37742	1	Sep 17 1993 18:23
imaps1_0396.fits	ZETA ORI A	37742	1	Sep 17 1993 18:25
imaps1_0397.fits	ZETA ORI A	37742	1	Sep 17 1993 18:26
imaps1_0398.fits	ZETA ORI A	37742	1	Sep 17 1993 18:28
imaps1_0399.fits	ZETA ORI A	37742	2	Sep 17 1993 18:30
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imaps1_0401.fits	ZETA ORI A	37742	2	Sep 17 1993 18:33
imaps1_0402.fits	ZETA ORI A	37742	2	Sep 17 1993 18:35
imaps1_0403.fits	ZETA ORI A	37742	3	Sep 17 1993 18:36
imaps1_0404.fits	ZETA ORI A	37742	3	Sep 17 1993 18:38
imaps1_0405.fits	ZETA ORI A	37742	3	Sep 17 1993 18:40
imaps1_0406.fits	ZETA ORI A	37742	4	Sep 17 1993 18:42
imaps1_0407.fits	ZETA ORI A	37742	4	Sep 17 1993 18:43
imaps1_0408.fits	ZETA ORI A	37742	4	Sep 17 1993 18:45
imaps1_0409.fits	ZETA ORI A	37742	B	Sep 18 1993 13:00
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imaps1_0411.fits	BETA CRU	111123	1	Sep 18 1993 13:03
imaps1_0412.fits	BETA CRU	111123	2	Sep 18 1993 13:05
imaps1_0413.fits	BETA CRU	111123	3	Sep 18 1993 13:09
imaps1_0414.fits	BETA CRU	111123	4	Sep 18 1993 13:13
imaps1_0415.fits	BETA CRU	111123	4	Sep 18 1993 13:15
imaps1_0416.fits	ALPHA ERI	10144	1	Sep 18 1993 13:22
imaps1_0417.fits	ALPHA ERI	10144	1	Sep 18 1993 13:24
imaps1_0418.fits	ALPHA ERI	10144	1	Sep 18 1993 13:25
imaps1_0419.fits	ALPHA ERI	10144	2	Sep 18 1993 13:27
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imaps1_0421.fits	ALPHA ERI	10144	3	Sep 18 1993 13:31
imaps1_0422.fits	ALPHA ERI	10144	3	Sep 18 1993 13:32
imaps1_0423.fits	ALPHA ERI	10144	4	Sep 18 1993 13:34
imaps1_0424.fits	ALPHA ERI	10144	4	Sep 18 1993 13:36
imaps1_0425.fits	BACKGROUND	66811	B	Sep 18 1993 13:38
imaps1_0426.fits	BACKGROUND	66811	B	Sep 18 1993 13:44
imaps1_0427.fits	BACKGROUND	66811	B	Sep 18 1993 13:46
imaps1_0428.fits	BACKGROUND	66811	B	Sep 18 1993 13:47
imaps1_0429.fits	BACKGROUND	66811	B	Sep 18 1993 13:49
imaps1_0430.fits	BACKGROUND	66811	B	Sep 18 1993 13:50
imaps1_0431.fits	BACKGROUND	66811	B	Sep 18 1993 13:52
imaps1_0432.fits	BACKGROUND	66811	B	Sep 18 1993 13:54
imaps1_0433.fits	BACKGROUND	66811	B	Sep 18 1993 13:56
imaps1_0434.fits	BACKGROUND	66811	B	Sep 18 1993 13:57
imaps1_0435.fits	BACKGROUND	66811	B	Sep 18 1993 13:59
imaps1_0436.fits	BACKGROUND	66811	B	Sep 18 1993 14:01
imaps1_0437.fits	BACKGROUND	66811	B	Sep 18 1993 14:03
imaps1_0438.fits	BACKGROUND	66811	B	Sep 18 1993 14:05
imaps1_0439.fits	ZETA PUP	66811	4	Sep 18 1993 14:07
imaps1_0440.fits	ZETA PUP	66811	1	Sep 18 1993 14:17
imaps1_0441.fits	ZETA PUP	66811	1	Sep 18 1993 14:19
imaps1_0442.fits	ZETA PUP	66811	1	Sep 18 1993 14:20
imaps1_0443.fits	ZETA PUP	66811	2	Sep 18 1993 14:22
imaps1_0444.fits	ZETA PUP	66811	2	Sep 18 1993 14:24
imaps1_0445.fits	ZETA PUP	66811	2	Sep 18 1993 14:26
imaps1_0446.fits	BACKGROUND	120315	B	Sep 18 1993 14:40
imaps1_0447.fits	ETA UMA	120315	3	Sep 18 1993 14:41
imaps1_0448.fits	ETA UMA	120315	3	Sep 18 1993 14:42
imaps1_0449.fits	ETA UMA	120315	3	Sep 18 1993 14:42
imaps1_0450.fits	ETA UMA	120315	3	Sep 18 1993 14:43
imaps1_0451.fits	ETA UMA	120315	3	Sep 18 1993 14:44
imaps1_0452.fits	ETA UMA	120315	3	Sep 18 1993 14:44
imaps1_0453.fits	ETA UMA	120315	3	Sep 18 1993 14:45
imaps1_0454.fits	ETA UMA	120315	3	Sep 18 1993 14:45
imaps1_0455.fits	ETA UMA	120315	3	Sep 18 1993 14:46
imaps1_0456.fits	ETA UMA	120315	3	Sep 18 1993 14:46
imaps1_0457.fits	ETA UMA	120315	3	Sep 18 1993 14:47
imaps1_0458.fits	ETA UMA	120315	3	Sep 18 1993 14:47
imaps1_0459.fits	ETA UMA	120315	3	Sep 18 1993 14:47
imaps1_0460.fits	ETA UMA	120315	3	Sep 18 1993 14:48
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imaps1_0462.fits	ETA UMA	120315	3	Sep 18 1993 14:48
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imaps1_0464.fits	ETA UMA	120315	3	Sep 18 1993 14:49
imaps1_0465.fits	ETA UMA	120315	3	Sep 18 1993 14:49
imaps1_0466.fits	ETA UMA	120315	3	Sep 18 1993 14:49
imaps1_0467.fits	ETA UMA	120315	3	Sep 18 1993 14:50

imaps1_0468.fits	ETA UMA	120315	3	Sep 18 1993 14:50
imaps1_0469.fits	ETA UMA	120315	3	Sep 18 1993 14:50
imaps1_0470.fits	ETA UMA	120315	3	Sep 18 1993 14:51
imaps1_0471.fits	ETA UMA	120315	3	Sep 18 1993 14:51
imaps1_0472.fits	ETA UMA	120315	3	Sep 18 1993 14:51
imaps1_0473.fits	ETA UMA	120315	3	Sep 18 1993 14:52
imaps1_0474.fits	ETA UMA	120315	3	Sep 18 1993 14:52
imaps1_0475.fits	ETA UMA	120315	3	Sep 18 1993 14:52
imaps1_0476.fits	ETA UMA	120315	3	Sep 18 1993 14:53
imaps1_0477.fits	ETA UMA	120315	3	Sep 18 1993 14:53
imaps1_0478.fits	ETA UMA	120315	3	Sep 18 1993 14:53
imaps1_0479.fits	ETA UMA	120315	3	Sep 18 1993 14:53
imaps1_0480.fits	ETA UMA	120315	3	Sep 18 1993 14:54
imaps1_0481.fits	ETA UMA	120315	3	Sep 18 1993 14:54
imaps1_0482.fits	ETA UMA	120315	3	Sep 18 1993 14:54
imaps1_0483.fits	ETA UMA	120315	3	Sep 18 1993 14:55
imaps1_0484.fits	ETA UMA	120315	3	Sep 18 1993 14:55
imaps1_0485.fits	ETA UMA	120315	3	Sep 18 1993 14:55
imaps1_0486.fits	ETA UMA	120315	3	Sep 18 1993 14:56
imaps1_0487.fits	ETA UMA	120315	3	Sep 18 1993 14:56
imaps1_0488.fits	ETA UMA	120315	3	Sep 18 1993 14:56
imaps1_0489.fits	ETA UMA	120315	3	Sep 18 1993 14:57
imaps1_0490.fits	ETA UMA	120315	3	Sep 18 1993 14:57
imaps1_0491.fits	ETA UMA	120315	3	Sep 18 1993 14:57
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imaps1_0718.fits	ALPHA ERI	10144	4	Sep 19 1993	4:32
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IMAPS-1 Coadded, Corrected File Table

Below is the list of IMAPS-1 coadded, corrected files.
Clicking on the file name entry will download the selected FITS file.
Clicking on the HD number will display the FITS file header.

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imaps1_089-093.fits	GAMMA2 VEL	68273	4	16-SEP-1993 16:50:31.93
imaps1_094-098.fits	GAMMA2 VEL	68273	1	16-SEP-1993 16:58:54.93
imaps1_099-103.fits	GAMMA2 VEL	68273	2	16-SEP-1993 17:07:20.93
imaps1_104-108.fits	GAMMA2 VEL	68273	3	16-SEP-1993 17:15:44.93
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imaps1_113-116.fits	ZETA ORI A	37742	2	16-SEP-1993 18:01:09.93
imaps1_117-120.fits	ZETA ORI A	37742	3	16-SEP-1993 18:07:55.93
imaps1_121-122.fits	ZETA ORI A	37742	4	16-SEP-1993 18:14:40.93
imaps1_121-124.fits	ZETA ORI A	37742	4	16-SEP-1993 18:14:40.93
imaps1_125-128.fits	ZETA PUP	66811	1	16-SEP-1993 18:27:30.93
imaps1_129-132.fits	ZETA PUP	66811	2	16-SEP-1993 18:34:14.93
imaps1_134-136.fits	ZETA PUP	66811	3	16-SEP-1993 18:42:40.93
imaps1_138-139.fits	ZETA PUP	66811	4	16-SEP-1993 18:49:26.93
imaps1_141-142.fits	GAMMA CAS	5394	1	16-SEP-1993 19:09:35.93
imaps1_143-144.fits	GAMMA CAS	5394	2	16-SEP-1993 19:13:02.93
imaps1_145-146.fits	GAMMA CAS	5394	3	16-SEP-1993 19:16:30.93
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imaps1_153-155.fits	EPSILON ORI	37128	2	16-SEP-1993 19:33:27.93
imaps1_156-158.fits	EPSILON ORI	37128	3	16-SEP-1993 19:38:32.93
imaps1_159-161.fits	EPSILON ORI	37128	4	16-SEP-1993 19:43:37.93
imaps1_162-164.fits	EPSILON ORI	37128	1	16-SEP-1993 19:48:48.93
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imaps1_168-170.fits	EPSILON ORI	37128	3	16-SEP-1993 19:59:02.93
imaps1_171-172.fits	EPSILON ORI	37128	4	16-SEP-1993 20:04:08.93
imaps1_195-197.fits	ZETA ORI A	37742	1	16-SEP-1993 20:58:22.93
imaps1_198-199.fits	ZETA ORI A	37742	2	16-SEP-1993 21:03:30.93
imaps1_200-201.fits	ZETA ORI A	37742	3	16-SEP-1993 21:06:58.93
imaps1_202-204.fits	ZETA ORI A	37742	4	16-SEP-1993 21:10:25.93
imaps1_205-206.fits	ZETA ORI A	37742	1	16-SEP-1993 21:21:22.93
imaps1_207-209.fits	ZETA ORI A	37742	2	16-SEP-1993 21:24:51.93
imaps1_210-212.fits	ZETA ORI A	37742	3	16-SEP-1993 21:29:58.93
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imaps1_223-224.fits	GAMMA CAS	5394	2	16-SEP-1993 22:10:31.93
imaps1_225-226.fits	GAMMA CAS	5394	3	16-SEP-1993 22:13:59.93
imaps1_227-229.fits	GAMMA CAS	5394	4	16-SEP-1993 22:17:26.93
imaps1_230-231.fits	GAMMA CAS	5394	1	16-SEP-1993 22:25:24.93
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imaps1_234-236.fits	GAMMA CAS	5394	3	16-SEP-1993 22:32:18.93
imaps1_237-238.fits	GAMMA CAS	5394	4	16-SEP-1993 22:37:25.93
imaps1_276-277.fits	ZETA PUP	66811	1	17-SEP-1993 0:10:23.93
imaps1_278-280.fits	ZETA PUP	66811	2	17-SEP-1993 0:13:51.93
imaps1_286-288.fits	ZETA PUP	66811	1	17-SEP-1993 0:29:23.93
imaps1_289-290.fits	ZETA PUP	66811	2	17-SEP-1993 0:34:30.93
imaps1_291-292.fits	ZETA PUP	66811	3	17-SEP-1993 0:37:58.93
imaps1_293-294.fits	ZETA PUP	66811	4	17-SEP-1993 0:41:25.93
imaps1_296-299.fits	EPSILON ORI	37128	1	17-SEP-1993 14:51:24.93
imaps1_300-302.fits	EPSILON ORI	37128	2	17-SEP-1993 14:58:09.93
imaps1_303-305.fits	EPSILON ORI	37128	3	17-SEP-1993 15:03:17.93
imaps1_306-309.fits	EPSILON ORI	37128	4	17-SEP-1993 15:08:24.93
imaps1_310-312.fits	EPSILON ORI	37128	1	17-SEP-1993 15:18:24.93
imaps1_313-315.fits	EPSILON ORI	37128	2	17-SEP-1993 15:23:30.93
imaps1_316-319.fits	EPSILON ORI	37128	3	17-SEP-1993 15:28:37.93
imaps1_320-322.fits	EPSILON ORI	37128	4	17-SEP-1993 15:35:20.93
imaps1_331-333.fits	GAMMA CAS	5394	1	17-SEP-1993 16:10:23.93
imaps1_334-336.fits	GAMMA CAS	5394	2	17-SEP-1993 16:15:28.93
imaps1_337-339.fits	GAMMA CAS	5394	3	17-SEP-1993 16:20:33.93
imaps1_340-342.fits	GAMMA CAS	5394	4	17-SEP-1993 16:25:38.93
imaps1_343-346.fits	GAMMA CAS	5394	1	17-SEP-1993 16:33:24.93
imaps1_347-349.fits	GAMMA CAS	5394	2	17-SEP-1993 16:40:09.93
imaps1_350-352.fits	GAMMA CAS	5394	3	17-SEP-1993 16:45:16.93
imaps1_353-355.fits	GAMMA CAS	5394	4	17-SEP-1993 16:50:23.93
imaps1_378-381.fits	ZETA ORI A	37742	1	17-SEP-1993 17:51:24.93
imaps1_382-385.fits	ZETA ORI A	37742	2	17-SEP-1993 17:58:09.93
imaps1_386-389.fits	ZETA ORI A	37742	3	17-SEP-1993 18:04:55.93
imaps1_390-394.fits	ZETA ORI A	37742	4	17-SEP-1993 18:11:41.93
imaps1_395-398.fits	ZETA ORI A	37742	1	17-SEP-1993 18:23:24.93
imaps1_399-402.fits	ZETA ORI A	37742	2	17-SEP-1993 18:30:09.93
imaps1_440-442.fits	ZETA PUP	66811	1	18-SEP-1993 14:17:40.93
imaps1_443-445.fits	ZETA PUP	66811	2	18-SEP-1993 14:22:47.93
imaps1_705-705.fits	BETA CEN A	122451	2	19-SEP-1993 4:01:21.93
imaps1_706-707.fits	BETA CEN A	122451	2	19-SEP-1993 4:03:00.93
imaps1_708-710.fits	BETA CEN A	122451	3	19-SEP-1993 4:06:28.93
imaps1_711-712.fits	BETA CEN A	122451	4	19-SEP-1993 4:11:35.93
imaps1_711-713.fits	BETA CEN A	122451	4	19-SEP-1993 4:11:35.93

IMAPS-1 Wavelength Calibration

The IMAPS-1 wavelengths were generated using an IDL routine (wave1.pro) which requires as input, the x and y pixel location, and the order number and wavelength, of one spectral feature identified in the IMAPS image. Based on this one fiducial wavelength, the program generates a wavelength array for each order. The starting wavelength and wavelength increment are then stored in the binary table extension contained in the coadded image FITS file.

The table below shows the wavelength (in Å), order number, echelle position (1-4), x & y position (in pixels), and the line identification for the fiducial spectral feature used in each of the coadded, corrected IMAPS-1 images. Since these line identifications are the basis for the IMAPS-1 wavelength calibrations, any errors in these values would affect the wavelength calibration for that particular image.

Note that no other wavelength corrections have been applied to the IMAPS-1 files, and the source of the absorption line used determines the wavelength reference frame. For example, since most of the files use interstellar lines, the wavelength assignments would correspond to an interstellar reference frame. Note telluric lines were used for a few files.

File	Wavelength (A)	Order	Pos	X,Y Values (pixels)	Element
089_093	1063.1760	213	4	126,317	Fe II
094_098	1134.1650	199	1	114,463	N I
099_103	1096.8770	206	2	286,375	Fe II
104_108	1066.6600	212	3	75,318	Ar I
109_112	1064.9930	212	1	307,339	3,0 R(2)
113_116	1051.0341	215	2	284,287	4,0 P(1)
117_120	1077.6980	210	3	443,339	2,0 R(1)
121_122	1063.4611	213	4	251,315	3,0 R(1)
121_124	1063.4611	213	4	251,315	3,0 R(1)
125_128	1134.1650	199	1	112,468	N I
129_132	1096.8770	206	2	285,377	Fe II
134_136	1066.6600	212	3	67,321	Ar I
138_139	1048.2190	216	4	61,286	Ar I
141_142	1064.9950	212	1	217,335	3,0 R(2) ?
143_144	1051.4990	215	2	470,286	4,0 R(2)
145_146	1066.9010	212	3	117,318	4,0 R(6)
150_152	1040.3669	217	1	241,335	5,0 P(2)
153_155	1081.2650	209	2	310,348	2,0 P(2)
156_158	1038.1560	218	3	432,260	5,0 P(1)
159_161	1078.9250	210	4	366,349	2,0 P(1)
File	Wavelength (A)	Order	Pos	X,Y Values (pixels)	Element
162_164	1064.9950	212	1	257,337	3,0 R(2) ?
165_167	1081.2650	209	2	330,348	2,0 P(2)
168_170	1092.7321	207	3	184,369	1,0 R(1)
171_172	1078.9250	210	4	375,348	2,0 P(1)
195_197	1064.6050	212	1	141,335	3,0 P(1)
198_199	1051.0341	215	2	353,286	4,0 P(1)
200_201	1038.1560	218	3	505,258	5,0 P(1)
202_204	1078.9250	210	4	441,353	2,0 P(1)
205_206	1049.9630	215	1	64,401	4,0 R(1)
207_209	1051.0341	215	2	282,354	4,0 P(1)
210_212	1038.1560	218	3	431,327	5,0 P(1)
213_214	1078.9250	210	4	358,408	2,0 P(1)
220_222	1064.9950	212	1	284,333	3,0 R(2) ?
223_224	1051.4990	215	2	536,284	4,0 R(2)
225_226	1066.9010	212	3	184,314	4,0 R(6)
227_229	1078.9250	210	4	407,341	2,0 P(1)
230_231	1064.9950	212	1	206,400	3,0 R(2) ?
232_233	1051.4990	215	2	453,356	4,0 R(2)
234_236	1066.9010	212	3	103,385	4,0 R(6)
237_238	1063.4600	213	4	203,380	3,0 R(1)
File	Wavelength (A)	Order	Pos	X,Y Values (pixels)	Element
276_277	1134.1650	199	1	173,465	N I
278_280	1096.8770	206	2	334,379	Fe II
286_288	1012.5010	223	1	252,300	S III ?
289_290	1096.8770	206	2	258,441	Fe II
291_292	1066.6600	212	3	46,383	Ar I
293_294	1063.1760	213	4	123,379	Fe II?
296_299	1064.9950	212	1	301,338	3,0 R(2) ?
300_302	1081.2650	209	2	378,347	2,0 P(2)
303_305	1077.6980	210	3	500,339	2,0 R(1)
306_309	1078.9250	210	4	442,344	2,0 P(1)
310_312	1064.9950	212	1	334,403	3,0 R(2) ?
313_315	1081.2650	209	2	307,411	2,0 P(2)
316_319	1092.7321	207	3	171,443	1,0 R(1)
320_322	1078.9250	210	4	367,409	2,0 P(1)
331_333	1064.9950	212	1	152,336	3,0 R(2) ?
334_336	1051.0341	215	2	190,289	4,0 P(1)
337_339	1066.9010	212	3	53,321	4,0 R(6)
340_342	1078.9250	210	4	273,348	2,0 P(1)
343_346	1064.9950	212	1	245,270	3,0 R(2) ?
347_349	1051.4990	215	2	505,216	4,0 R(2)
File	Wavelength (A)	Order	Pos	X,Y Values (pixels)	Element
350_352	1066.9010	212	3	156,250	4,0 R(6)
353_355	1078.9250	210	4	379,279	2,0 P(1)
378_381	1064.9930	212	1	173,339	3,0 R(2) ?
382_385	1051.4990	215	2	430,290	4,0 R(2)
386_389	1038.1560	218	3	365,261	5,0 P(1)
390_394	1078.9250	210	4	300,347	2,0 P(1)
395_398	1049.9630	215	1	195,238	4,0 R(1)
399_402	1051.4990	215	2	537,215	4,0 R(2)
440_442	1039.2300	218	4	168,278	O I
443_445	1134.1650	199	1	198,441	N I
705_705	1134.9800	199	1	549,437	N I
706_707	1134.9800	199	1	550,436	N I
708_710	1066.6600	212	2	535,306	Ar I
711_712	1048.2190	216	3	525,270	Ar I
711_713	1048.2190	216	3	525,271	Ar I

IMAPS Search Help

There are two types of IMAPS-1 data: raw images, and corrected, coadded images. Only the coadded files have assigned wavelengths. To download an IMAPS file, click on any of the listed image numbers for the desired target. This will display a list of links to individual files that can then be downloaded.

Object Name
: The common name of the astronomical object. (All the observed objects are listed in the table.)

Image Numbers
: The IMAPS image number (or exposure sequence number) listed in the table and contained in the file names, desribes the order in which the IMAPS observations were obtained. Exposure numbers ran from 0000 to 0721, however the first 79 were test exposures and not archived. The IMAPS-2 sequnce numbers will begin where IMAPS-1 left off.

With IMAPS-1, a series of observations were usually taken of a particular star. The series would usually include 2-4 exposures from each of the 4 echelle positions, plus a background exposure which involved leaving the aperture open and the telescope pointed toward the object but turning off the high voltage. Exposures within these series taken at the same echelle position were possible candidates for coadding.

Mid Start Time
: The average start date and time, in GMT, for the coadded images, based on the observation start dates calculated for the raw image files. Since the coadded exposures were usually taken consecutively, the observing times generally differ by only a few minutes.

Observation Start Date
: The start date and time, in GMT, for the particular IMAPS image. These times were determined by subtracting the exposure times from the observation end times recorded in the IMAPS-1 exposure log.

Echelle Position
: This entry describes either the position of the echelle grating (a number from 1 to 4) or whether a background exposure was obtained (a value of "B"). Each grating position covers 1/4 of each echelle order, so a series of four exposure is needed to cover the entire echelle spectrum.

HD Number
: The Henry Draper catalog number.

Filename
: The assigned file name. The raw data sets file names use the naming convention imaps1_0nnn.fits where nnn is the 3-digit exposure sequence number assigned by Princeton Observatory describing the order in which targets were observed (i.e., the first archived observation is imaps1_0079.fits and the last target is imaps1_0721.fits. Clicking on the raw file name in the IMAPS-1 finding list table will download the selected raw data FITS file.

The coadded scan file names are defined as imaps1_nnn-mmm.fits where nnn is the first coadded observation number and mmm is the last.

IMAPS-1 Search Table

Below is the finding list for IMAPS-1 targets. Clicking on an entry in the table will display the appropriate section of the **raw** or **coadded** image tables from which the files can be downloaded (by clicking on the filename), or the FITS headers displayed (by clicking on HD number). Omitted from the list below are the background exposures although all background exposures are available in the raw image table. Note the Eta Uma exposures are divided into several groups based on changes in the exposure times (which are shown in parentheses).

The coadded images are usually comprised of 2 to 5 raw images which are coadded and corrected for various detector artifacts. The FITS files contain the coadded image as a primary array with wavelength information stored in a binary table. (see note on **Wavelength Accuracy**). The numbers listed below for the coadded files represent the range of exposure numbers used in each group of coadded images. As shown, coadded images do not exist for all of the observed targets. Although some raw images were not suitable for coadding, we expect more coadded files will become available in the near future.

Object Name	Raw Image Numbers	Coadded Image Numbers
gamma2 Vel	**89-108** **239-251** **323-330**	**89-108**
zeta Ori	**109-124** **195-214** **378-408**	**109-124** **195-214** **378-402**
zeta Pup	**125-140** **276-294** **440-445**	**125-139** **276-294** **440-445**
gamma Cas	**141-148** **220-238** **331-355**	**141-146** **220-238** **331-355**
epsilon Ori	**150-173** **296-322**	**150-172** **296-322**
alpha Eri	**175-194** **253-274** **416-424** **715-721**	
beta Cru	**356-375** **410-415**	
eta UMa (atmos. probe)	**446-454(511)** **455-514(255)** **515-522(511)** **525-532(511)** **533-592(255)** **594-601(511)**	
kappa Ori	**602-652** **653-700**	
beta Cen	**702-713**	**705-713**

TUES Archive Search

Object Name	Resolver	
	◉ SIMBAD ○ NED ○ Don't resolve	Get coordinates

RA	Dec	Radius (arcmin)	Equinox
		10.0	J2000

Tübingen Ultraviolet Echelle Spectrometer

Class	Entry ID	Exposure Time (s)
10 W C 11 WN 12 MAIN SEQUENCE O 13 SUPERGIANT O 15 OF 16 SO O		
	Observation Start Date	

SEARCH | Clear form | Reset to defaults | Help...

Output Options

Output columns	Sort output by:		Maximum number of hits
Mark Entry ID Object Name RA (J2000) Dec (J2000) tues_reference	1. Object Name	☐ *reverse*	100
	2. RA (J2000)	☐ *reverse*	Output Equinox
	3. Dec (J2000)	☐ *reverse*	J2000
			☐ Show SQL query

archive@stsci.edu

Fri Mar 22 07:22:33 2002

TUES Search Help

The MAST search pages basically contain three parts. The top of the page lists the input search fields. Entering values (as described below) for one or more of these fields will define the selection criteria for the database search. The middle of the form contains buttons to initiate various actions including:

1. perform the search using the specified search criteria and output format,
2. clear the search form and reset values to the original defaults,
3. reset entries to the set of (default) values used the previous time the search page was drawn, and
4. display this help page.

The bottom portion of the page deals with formatting the table of found entries that appears after the search is completed. The format options include specifying which columns appear in the output list, the order of the entries, the maximum number of returned entries, the epoch of the output coordinates, and the option to display the actual SQL command used to retrieve the database entries. First time users may want to run the search using the default output options.

After selecting search criteria, output options, and clicking the search button, a second page will appear listing the returned database entries. From this table, clicking on the filenames will submit a request to download the selected FITS file.

Object Name

The name of the astronomical object you want to search for. Examples of valid names include GAM-GEM, NGC1068, JUPITER, and HD45677.

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*1987*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

The SIMBAD and NED object name resolvers can only resolve fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

Object Resolver

The name resolver will let you resolve an object name into its coordinates. This is useful particularly for searching for objects that may be known by different names. You can resolve an object name either before a search, or you can redraw the form with the the resolved coordinates in place. If you don't elect to to resolve the object name, the TUES database will be searched on the object name given.

The SIMBAD and NED object name resolvers can only resolve fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `SIMBAD` or `NED` for the resolver, and hit the **Search** button. (NED is the Nasa Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to SIMBAD, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD service, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the TUES database, along with whatever other query qualifications you have given.

You can also hit the **Resolve** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since the SIMBAD resolver returns J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

Resolve

When you press this button and select `SIMBAD` for the resolver, the TUES Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. These fields give the J2000 equatorial coordinates for the center of the image. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98       29 53 45.55
    12h22m31.98s      29d53m45.55s
    12:22:31.98      +29:53:45.55
    12h22'31.98"      29d53'45.55"
    12h 22m 31.98s    29d 53m 45.55s
    12h 22' 31.98"    29d 53' 45.55"
    12h 22' 31.98"   -29d 53' 45.55"
    12h22'31".98     -29d53'45".55
    12h22m31s.98     -29o53m45s.55
    12h 22' 31".98   -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22      29 53
    12h22m    +29d53m
    12h22m     29d53m
    12:22m     29:53m
    12h22'     29d53'
    12h 22m    29d 53m
    12h 22'    29d 53'
    12h 22'   -29d 53'

The RA may be given in decimal degrees
by indicating a D or d after the degrees:
    12d 22m    29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an TUES search.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Object Category

This is a broad category for the target. One or more values may be selected. Clicking "reset to defaults" or "clear form" (described below) will erase previous selections.

Observation Start Date

This is the GMT time, to the nearest second, of the start of the observation. (Note the TUES1 observations were all obtained during December 2-10, 1990 and TUES2 observations were obtained during March 2-18, 1995.)

When specifying this date, you need to include at least a date; a time is optional. The date can have any of the following formats (the month name can be spelled out or abbreviated to three letters; case is not significant):

```
Dec 15 1990
Dec 1990 15
15 Dec 1990
1990 Dec 15
1990 15 Dec
7/15/1990
7-15-1990
7.15.1990
```

If the day is omitted, the first day of the month is assumed. This means that a specification like "Dec 1990" will look for observations done on Dec 1 1990 00:00:00, *not* for observations done during Decy 1990. Note also that when entering a date with the month in numerical format, the American ordering is used; i.e., the first number is the month.

If a time is omitted, then any time for that day will match. Otherwise, you can specify a time in any of these formats:

```
14:30
14:30:20
14:30:20:999
14:30:20.9
4am
4 PM
04:30:20 AM
```

To search for observations before a given date, use <, and for observations after a given date, use >. For example,

```
> Dec 10 1990
< Dec 10 1990
```

You can use the .. operator to search on a range of dates:

```
Mar 2 1995 .. Mar 5 1995
```

This operator is inclusive on the first date and exclusive on the second.

Finally, you can search on a list of dates or date ranges. For example,

```
Mar 10 1995 .. Mar 11 1995,
Mar 15 1995 .. Mar 16 1995
```

will search for observations done within either one of these date ranges.

Exposure Time

The total exposure times in seconds. Note the times do not reflect pointing problems.

Entry ID

The TUES observation reference number uniquely defines each TUES observation. The name is of the form **TUESid_obs** where id = a special ORFEUS target identification number (4 digits), and obs = the observation number for this target, sometimes followed by an underline character and the number of the pointings during this observation. Several pointings during a single observation were carried out sometimes to improve the alignment of the telescope ("grid search"). This resulted partially in very short integrations. "_PH" denotes an integration from single photon events recorded onboard but integrated after the mission.

Output Columns

Your choice of what columns you want to see in the output. There are two radio buttons that let you select either the default set of columns, or choose your own set of columns.

The default set of columns for raw data sets is (in the order displayed):

```
Object Name
Entry_ID
RA (J2000)
Dec (J2000)
Observation Date
Exposure Time
Object Category
Comments
More info
```

You can select your own output columns by pressing the `custom...` radio button and selecting the columns from the list below it. The output columns will be in the order in which they appear in this list.

Sort output by:

Choose how you want the output rows sorted. You can select up to three fields to sort on. the rows will be sorted in the order of the first sort field; if two rows have the same sort field, they will be sorted in order of the second sort field, and so on.

For each field, you can select that the rows be sorted in *reverse* order on that field by selecting the `reverse` checkbox. For example, you can sort the rows with the most recent observations first by selecting `Observation Date` for the first sort field and selecting the `reverse` checkbox next to it.

Maximum number of hits

Some queries will be capable of returning hundreds of rows or more. Such large search results tend to use up memory on both the client and server sides, and aren't usually useful. By default, we limit the number of rows displayed to 100 rows, but you can increase (or decrease) this limit as needed.

Output equinox

Just what you'd think: the equinox of the coordinates displayed in the output.

Show SQL Query

Select this checkbox if you want to see the SQL query that the TUES Search engine constructs from your query qualifications. The query will be shown at the end of the search results.

SQL (Standard Query Language, pronounced either "ess cue ell" or "sequel") is a language used by most relational database systems for retrieving information from database tables. The TUES Search Page takes your search specifications and converts them to an SQL query to run on our database. Viewing the generated query is often useful for debugging, and may also be useful for SQL-literate users who want to see what logic was used in the query. (In fact, this may be useful for most people, since SQL is pretty easy to understand.)

The STScI Digitized Sky Survey

DSS Mini-Window * Form with Tables

NOTE: This page should *not* be used to obtain target coordinates for HST Phase 2 proposals. Instead, use the Phase 2 form to make sure you're extracting from the right plates.

Get an Object's Coordinates

Object name [ ] GET COORDINATES Clear

Get coordinates from (•) SIMBAD ( ) NED

Retrieve an Image

Retrieve from

- First Generation Survey
- Second Generation Red (95% complete)
- Second Generation Blue (50% complete)

RA [ ] **Dec** [ ] J2000

Note: The maximum scan size for 2nd-Generation scans is now 30x30 arcminutes. First-generation scans are still 60x60 arcminutes.

Height 15.0 **Width** 15.0 **arcminutes; max 60 (30 for 2nd-Generation)**

File format FITS **Compression (FITS only)** None

☐ **Save file to disk (instead of displaying)**

HST Field of View Overlay (1st generation GIF only): NONE

Roll angle (V3): [ ]

RETRIEVE IMAGE | Reset values to defaults

archive@stsci.edu

Object name	Name resolver	
[ ]	(•) SIMBAD ( ) NED	Resolve

RA	DEC	Equinox
[ ]	[ ]	J2000
RETRIEVE IMAGE	Reset	Close
Version	**Format**	**FITS comp.**
(•) First generation	( ) FITS	(•) None
( ) Second generation	(•) GIF	( ) gzip
( ) Second or First		( ) Unix
Size (arcmin; max 60)	**Height** 15.0	**Width** 15.0
FOV Overlay (GIF) None	**Roll angle (V3)**	
[ ] **Save to disk instead of displaying**		

Scientific citations of this data must include information given in the acknowledgements.

archive@stsci.edu

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HST Phase 2

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The STScI Digitized Sky Survey

DSS Extractions for Phase 2 Proposal Submission

Use this form to extract an image for the appropriate survey for determining positions for Phase 2 of HST proposal submission.

RA [ ] Dec [ ] J2000

Height 5.0 Width 5.0 arcminutes (max 60)

Compression None

RETRIEVE IMAGE | Clear the form

Extractions will be from the Quick V survey for northern declinations, and from the 1st generation scans for southern declinations. This will ensure that your submitted positions are in the HST Guide Stars frame.

All images will be in FITS format. Your browser should attempt to save the file to disk instead of trying to display it.

Scientific citations of this data must include information given in the acknowledgments.

Search Help

How to use the CGI script directly

Get an Object's Coordinates

To get an image from the Digitized Sky Survey, you will need the right ascension and declination of the area you're interested in. However, if all you know is the name of an object and don't have its coordinates handy, you can use this section to get the coordinates for you.

The coordinates will come from either the SIMBAD database in Strasbourg, France, or the NASA Extragalactic Database (NED) in Pasadena, California. SIMBAD contains comprehensive lists of all kinds of objects from all the major astronomical catalogs, while NED concentrates on objects outside our galaxy. (Neither can return coordinates for solar system objects.)

To get an object's coordinates, enter its name, select a resolver, and hit the "GET COORDINATES" button. The form will redraw itself with the object's coordinates filled in.

Getting an object's coordinates may take a moment if the networks are busy, so please be patient.

Retrieve an Image

This is the section where you specify what kind of image you want.

NOTE: *Any entries you make in this section of the form will be erased if you use the "GET COORDINATES" feature!*

Generation

Here, you select which generation of the Sky Survey you want. The First Generaton comprises the older surveys, scanned at about 1.7 arcsec per pixel. The Second Generation is from a newer ongoing survey, scanned at about 1 arcsec per pixel. Consequently, the images from the Second Generation scans will be larger than from the First: a 15'x15' Second Generation FITS image will be about 1.5 megabytes (a First Generation scan of the same size is about 570 kilobytes), so you may want to select smaller scan sizes when getting images from the Second Generation survey.

Not all of the Second Generation DSS scans have been loaded; here is a list of Second Generation scans currently available.

Coordinates (RA, Dec, and Equinox)

Enter the Right Ascension and Declination on which you would like the scan to be centered (you won't need to enter it if you use the Target Name Resolver), and select either J2000 or B1950 for the equinox of the coordinates.

A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98       29 53 45.55
    12h22m31.98s      29d53m45.55s
    12:22:31.98      +29:53:45.55
    12h22'31.98"      29d53'45.55"
    12h 22m 31.98s    29d 53m 45.55s
    12h 22' 31.98"    29d 53' 45.55"
    12h 22' 31.98"   -29d 53' 45.55"
    12h22'31".98     -29d53'45".55
    12h22m31s.98     -29o53m45s.55
    12h 22' 31".98   -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22      29 53
    12h22m    +29d53m
    12h22m     29d53m
    12:22m     29:53m
    12h22'     29d53'
    12h 22m    29d 53m
    12h 22'    29d 53'
    12h 22'   -29d 53'

The RA may be given in decimal degrees by indicating
a D or d after the degrees:
    12d 22m    29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you can delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Image size

Specify a field size for the for the returned image by entering a hieght and width in arcminutes. The default size is 15' x 15', which yields a FITS file of about 530 kbytes, or a GIF image of usually around 160 kbytes. (The maximum size, 60 arcminutes, produces an 8-megabyte FITS file.)

Format

Select either FITS or GIF.

FITS files will be delivered with a MIME type of `image/fits`;
GIF files will be delivered with a MIME type of `image/gif`.

If you are using a graphical Web browser (Mosaic, Netscape, etc), you may be able to configure your browser to display the FITS images returned by this form instead of saving them to disk. Here is an example, showing how to configure a Unix-based browser for displaying the images in SAOimage.

Compression

Select a compression method. This will only be applied if you select FITS as the image format.

- NONE - the FITS file will be delivered uncompressed.
- Unix - The FITS file will be compressed with the Unix `compress` command.
- gzip - The FITS file will be compressed with the `gzip` command.

Field of View Overlay

If you would like the HST field of view (FOV) overlaid onto a GIF image from the First Generation scans, you can select that here. The FOV shows the placement within the field of the apertures of HST's science instruments for a given spacecraft roll angle. Select:

- NONE - No FOV will be drawn on the image.
- LAUNCH - After launch of HST in Apr 1990 and before the First Servicing Mission in Dec 1993 (the pre-COSTAR era).
- SM93 - After the First Servicing Mission, Dec 1993, and before the Second Servicing Mission, Feb 1997 (post-COSTAR, but before STIS and NICMOS).
- SM97 - After the Second Servicing Mission, Feb 1997, showing STIS and NICMOS apertures.

and enter the desired Roll Angle. (This is the V3 roll angle, 180 degrees from the U3 roll angle.)

HST's total field of view is about 30 arcminutes across, so to get the entire FOV in the image, you will need to select a height and width of about 30' x 30'. (A 25'x25' field will also show the FOV will a little clipping at the edges.)

Remember, FOVs may only be drawn on GIF-formatted images from the First Generation Survey. If you select FITS, or if you select another survey, then your FOV selection will be ignored.

DSS Digitized Sky Survey

Produced under Contract No. NAS5-26555 with the National Aeronautics and Space Administration.

See also acknowledgements

DSS Digitized Sky Survey

Investigators using these scans are requested to include these acknowledgments in any publications as appropriate.

The Digitized Sky Surveys were produced at the Space Telescope Science Institute under U.S. Government grant NAG W-2166. The images of these surveys are based on photographic data obtained using the Oschin Schmidt Telescope on Palomar Mountain and the UK Schmidt Telescope. The plates were processed into the present compressed digital form with the permission of these institutions.

The National Geographic Society - Palomar Observatory Sky Atlas (POSS-I) was made by the California Institute of Technology with grants from the National Geographic Society.

The Second Palomar Observatory Sky Survey (POSS-II) was made by the California Institute of Technology with funds from the National Science Foundation, the National Geographic Society, the Sloan Foundation, the Samuel Oschin Foundation, and the Eastman Kodak Corporation.

The Oschin Schmidt Telescope is operated by the California Institute of Technology and Palomar Observatory.

The UK Schmidt Telescope was operated by the Royal Observatory Edinburgh, with funding from the UK Science and Engineering Research Council (later the UK Particle Physics and Astronomy Research Council), until 1988 June, and thereafter by the Anglo-Australian Observatory. The blue plates of the southern Sky Atlas and its Equatorial Extension (together known as the SERC-J), as well as the Equatorial Red (ER), and the Second Epoch [red] Survey (SES) were all taken with the UK Schmidt.

Supplemental funding for sky-survey work at the ST ScI is provided by the European Southern Observatory.

DSS Digitized Sky Survey

There are several Web sites around the world offering the Digitized Sky Survey. If your site offers a public access to the Digitized Sky Survey, let us know and we'll add it here.

UNITED STATES

STScI Digitized Sky Survey
Space Telescope Science Institute, Baltimore, Maryland
http://archive.stsci.edu/dss/

That's us. Our site features access to both the First and Second Generation sky surveys, and can overlay HST's field of view onto GIF images.

SkyView
Goddard Space Flight Center, Greenbelt, Maryland
http://skyview.gsfc.nasa.gov/

A muli-wavelength virtual observatory. Features the 1st Generation DSS along with high energy, ultraviolet, infrared, and radio surveys. Can plot grids on images. There are several forms to choose from, including a new Java interface.

CANADA

Canadian Astronomy Data Centre
Dominion Astrophysical Observatory, Victoria, British Columbia
http://cadcwww.dao.nrc.ca/dss/

Features access to both First and Generation surveys and a batch mode.

EUROPE

Aladin
Centre de donnees astronomiques de Strasbourg (CDS)
http://aladin.u-strasbg.fr/aladin.gml

Aladin is an interactive software sky atlas allowing the user to visualize digitized images of any part of the sky, to superimpose entries from astronomical catalogs or personal user data files, and to interactively access related data and information from the SIMBAD, NED, VizieR, or other archives for all known objects in the field.

ESO Online Digitized Sky Survey
European Southern Observatory, Garching, Germany
http://archive.eso.org/dss/dss/

SkyEye
Instituto di Radioastronomia, Bologna, Italy
http://terra.bo.cnr.it/skyeye/gb/

This site offers the files in FITS, GIF, GEIS, or JPEG, and features a batch queue and email interface. It also has a feature to make the FITS files compatible with AIPS. (Access from the US may be slow.)

SkyEye is part of the Astronomical Virtual Observatory.

LEDAS Digitized Sky Survey Image Browser
Leicester Database and Archive Service, University of Leicester, UK
http://ledas-www.star.le.ac.uk/DSSimage/

An experimental service offering a simple and quick interface.

ASIA

Digitized Sky Survey Online
National Astronomical Observatory of Japan, Tokyo, Japan
http://dss.mtk.nao.ac.jp/

NAOJ offers access to both the 1st and 2nd Generation Digitized Sky Surveys, a batch email interface, and access to the IRAS Sky Survey Atlas (ISSA) and the Green Bank Sky Map (GBSM). (Access from outside Asia may be slow.)

SDSS Query

Target Name	Resolver	
	(•) SIMBAD ( ) NED	Get Coordinates

RA (J2000)	Dec (J2000)	Radius (arcmin)
		10.0

SEARCH	Clear Form	Reset Form	Help...

Object Type	Magnitudes		Colors	
Select zero or more; none = all	e.g, `21 .. 22`		e.g., `-0.5 .. 0.5`	
GALAXY STAR SKY KNOWNOBJECT UNKNOWN	u:		u-g	
	g:		g-r	
	r:		r-i	
	i:		i-z	
	z:			

SDSS Version 0.02

SDSS Catalog Search Help

Use the SDSS Catalog Search form to search the SDSS Catalog by object name, position, object type, or simple selections by magnitude for each of the photometric bands.

Object Name

The name of the astronomical object you want to search for.

Object Resolver

The name resolver you want to use, if you want to resolve an object into its coordinates. You can resolve an object name either before a search, or you can redraw the form with the resolved coordinates in place. You can also elect not to resolve the object name when doing the search, but to search the IUE database on the object name given.

To resolve an object name before a search, enter the object name in the **Object Name** field, select either `NED` or `SIMBAD` for the resolver, and hit the **Search** button. (NED is the Nasa Extragalactic Database at Caltech in Pasadena, California, and SIMBAD is the Set of Identifications, Measurements, and Bibliography for Astronomical Data at the Centre de Données astronomiques in Strasbourg, France.) The object name will be sent to the chosen resolver, which will send back the coordinates. (If the object name is not recognized by the resolver, or there is some other problem with the SIMBAD or NED services, then the search form will be redrawn with an error message at the top.) These coordinates will then be used to search the SDSS Catalog, along with whatever other query qualifications you have given.

You can also hit the **Get coordinates** button instead of the **Search** button. In that case, the search form will be redrawn with the object's right ascension and declination entered as defaults in the **RA** and **Dec** fields. Resolving an object name will not change any other choices made in the form, except for the equinox, which will be reset to J2000 (since both the SIMBAD and NED resolvers return J2000 coordinates).

We recommend that you use object name resolution to find observations of specific objects in the database. This is the most reliable way to look up observations, because the observer could have given any object name at all (for example, `NGC1976` instead of `M42`, or `PARALLEL-FIELD`). However, if you do know the object name that the observer used, you can select `Don't resolve`, in which case the object name will not be resolved into coordinates, but will be used as a search qualification in the database. (This will happen only when you press the **Search** button.)

When you search on the object name in the database, case will be ignored. The object name will *not* be wildcarded at the front and back (that's so if you innocently enter `IO`, you don't match things like `ORION`). You can wildcard the object name using `*`, however (for example, `*IO*`). You can also enter a comma-separated list; for example, `*JUP*,*SAT*` would match object names containing either `JUP` or `SAT`.

The SIMBAD and NED object name resolvers can only resolve fixed objects; they cannot compute the positions of moving objects (planets, comets, etc.). To find moving objects, try selecting the appropriate object class, entering an object name that could match what you're looking for, and selecting `Don't resolve` for the name resolver. NED is an extragalactic database, and generally won't resolve object names within the Milky Way galaxy.

Resolve

When you select either `NED` of `SIMBAD` for the resolver and then press the "Get coordinates" button, the IUE Search form will be redrawn with the coordinates for the given object entered into the RA and Dec fields. If you then press **Search**, the search will be conducted on that position. (The resolver will *not* be re-run for the search, unless you change either the object name or the resolver).

RA, Dec

The Right Ascension and Declination around which you want to search. A number of formats are accepted for the RA and Dec. Here are some examples:

```
Decimal Degrees
    185.63325 29.8959861111111

Hours, minutes and Seconds
    12 22 31.98      29 53 45.55
    12h22m31.98s     29d53m45.55s
    12:22:31.98     +29:53:45.55
    12h22'31.98"     29d53'45.55"
    12h 22m 31.98s   29d 53m 45.55s
    12h 22' 31.98"   29d 53' 45.55"
    12h 22' 31.98"  -29d 53' 45.55"
    12h22'31".98    -29d53'45".55
    12h22m31s.98    -29o53m45s.55
    12h 22' 31".98  -29d 53' 45".55

Hours/Degrees and Minutes (no seconds)
    12 22      29 53
    12h22m   +29d53m
    12h22m    29d53m
    12:22m    29:53m
    12h22'    29d53'
    12h 22m   29d 53m
    12h 22'   29d 53'
    12h 22'  -29d 53'

The RA may be given in decimal degrees by indicating
a D or d after the degrees:
    12d 22m   29d 53m
```

Spacing is not important, as long as the value is unambiguous, and that you can delimit the hours/degrees, minutes, and (optional) seconds with letters, colons, spaces, or any character that's not a digit or a decimal point.

Note also that seconds of the form 31".98 or 31s.98 are accepted. This should make it easy to cut and paste values into these fields from electronic publications.

Radius

The radius of the search box around the RA and Dec, in floating-point arcminutes (e.g., `5.0`). You should be careful about giving too restrictive a search radius in an IUE search: the coordinates are coordinates of the *object* as given by the Guest Observer, and since acquisitions were made in real time, these coordinates may not reflect the precise pointing of IUE at the time of the observation.

Equinox

The equinox of the RA and Dec you have entered, either `B1950` or `J2000`. This only affects the input coordinates; there is a separate selector for the equinox of the output coordinates.

If you hit the **Resolve** button to get an object's coordinates and redraw the form, the equinox will be set to `J2000`, since that's the equinox of the coordinates returned by the object name resolvers.

Object Type

Searches may be qualified for the following object types:

- GALAXY
- STAR
- SKY
- COSMIC RAY
- KNOWNOBJECT
- TRAIL
- GHOST
- UNKNOWN
- NOTATYPE

More information on the objects classes can be found in the Photo Object documentation.

Magnitudes

Magnitude ranges may be specified in each of the different filters to qualify a search by position.
ranges such as:
21 .. 22 can be specified

A quick summary of the filters can be found in the User's Guide .

Colors

Differences in colors may be specified by range in bands:.
such as -0.5 .. 0.5, for the colors (to qulaify a positional search):

- u-g
- g-r
- r-i
- i-z

As a starting point, more information on color ranges can be found in the photometric accuracy pages of the User's Guide.

SDSS Relevant Software

---

1. SDSS Science Archive Query Tool (sdssQT)

sdssQT v2.3.2 is available.

The SDSS Query Tool (sdssQT) is a Graphical User Interface (GUI) that provides the functionality necessary for SDSS users to prepare and submit simple or complex queries to the Science Archive. The current interface is a Tcl/Tk client application that allows you to connect to the SDSS Catalog Archive Server and run queries on the Catalog Archive. You will need Tcl/Tk version 8.0 or later installed on your machine, and have a "wish" executable in your path that runs a wish8.0 or later. Many platforms have this already.

Before you install, we strongly recommend that you join the SDSS Users' Group. This list will allow us to alert you to necessary upgrades in both software and documentation, as well as scheduled database downtimes. This list will only be used for such time-critical notification of users. The other group, the SDSS Users' Forum, is a bulletin board for SDSS scientists, and is open to all fellow scientists interested in the SDSS.

Download and install the sdssQT version 2.3.2, and don't forget the tool that converts bin to FITS binary tables (including instructions for compilation and installation.) For the EDR, we have made available the latest fully functional version of the Query Tool, which is called ``sxQT" or "sdssQT".
The official SDSS QT guide is available below. You need JavaScript enabled to read the documentation.

SDSS QT Early Data Release User's Guide : last update Jan 28, 2002

You may need a complete description of the SDSS database structure and classes: sxQT documentation for classes and database descriptions

You can check if Tcl/Tk is installed with a "which wish" command. Tcl/Tk can be downloaded from the following site(s):
Tcl/Tk 8.0
Tcl/Tk 8.3

A Tcl/Tk installation caveat: the default tcl/tk installation names the "wish" executable with a version number, e.g. "wish8.0". The SDSS Query Tool script looks for an executable with just the name "wish", so the user needs to add a logical link "ln -s wish8.0 wish" in the bin directory where the executable is installed.

Start-Up hints from a novice for a novice:

1. The executable brings up a blank square. To start the action, use the Connect menu option.
2. The server requires a username password combination. Use username *guest* and password *archive*.
3. Select the FermiEDR as the server.
4. Try a File>Load Examples>Simple Tutorials for a sample of how the tool works. These tutorials can be modified with guidance from the SDSS QT and database documentation.
5. Output can be directed to a local file, remote file or remote socket, with some format options.

---

2. readAtlasImages

SDSS standalone programs to read fpBin, fpAtlas, and fpField files

- README file; ASCII
- file. Shift-click to download.

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Help

- User's Forum questions
- User's Group questions
- Frequently Asked Questions
- Please e-mail the Archive for SDSS related questions.
- You may also call the archive at **410-338-4547**

SDSS Spectral Pages

This page provides an introduction to the MAST SDSS Spectral Data Products tool. The Catalog interface will also use this interface for requesting data. More description will appear here after the tool is fully complete. A cookbook thread is available for use with SDSS Query Tool. Users of the MAST Catalog Interface will not need a cookbook thread.

There is also a cgi tool which allows users to download the SDSS 1-D spectra. The link below is to retrieve spectra with line identifications and these are available in either **FITS** or **gif** format. Additional spectral retrieval options which are better integrated with the catalog searches will become available in the future. 1-D Spectra
may be requested by **Full Fiberid** , **Compact ID** and **RA and DEC**

A suite of cgi tools for the SDSS is available for multiple data product retrieval.

version Beta 1.3 -- e-mail: archive@stsci.edu

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Images

From these pages you will have access to the image products from the SDSS: MAST SDSS Image Data Product Retrieval .

An alternative source for atlas images and the recontructed, and the corrected frames is the cgi tool page hosted by Fermilab.

Most users will have to conduct a catalog search using either the MAST Catalog Search or the SDSS Query Tool to collect the parameters needed to make a request for the images. The MAST Catalog Search will allow users to put the objects of interest into a shopping basket, then request the products for those objects. The SDSS Query Tool results can be copied into the MAST SDSS Image Data interface. A cookbook thread describes this process.

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SDSS Catalog Access

Access to the Catalog Archive Server can be made via the MAST interface, the SkyServer interface, or the SDSS Query Tool. The catalog contains measured quantities (variously called parameters or attributes) for detected objects from imaging and spectroscpic data.

Simple Interface: A basic MAST SDSS Catalog Form (*which actually interfaces with the sky Server*) allows searches by source sky position in equatorial coordinates RA and Dec or by position obtained from a name resolver (NED or SIMBAD). Queries may be additionally constrained by limiting the object types, magnitudes and colors. All queries must have a position constraint, however, because the server and the typical browser could overload on a more open-ended query.

A request for data products can be made directly from this interface, using the convention of a shopping cart. Viewing query results in html format also allows the user to mark the objects for which products are desired. The user can "Add marked records to shopping cart". When the shopping cart list is complete the user then can "Retrieve data products for shopping cart". This request brings up the MAST SDSS products form, properly populated with the object identification records (run/rerun/camcol/fieldID/ObjectID). The user can then customize the request, specifying product types, bands (for relevant imaging data) and file format (tar.gz, .tar, .zip).

Advanced Interface: Download the SDSS Query Tool Program and documentation sdssQT. This interface allows for more general queries of all parameters in the catalogs and data-mining.

The SDSS Query Tool will also allow users to copy-and-paste object lists from the Query Tool to the MAST SDSS products interface. A cookbook thread is provided.

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Getting Started: Products, Access, User Groups

Users' Groups

All users should sign up for the SDSS Users' group, for time-critical user information from the SDSS about software upgrades or scheduled downtime. Users are encouraged to sign up for the SDSS Users' Forum for useful information exchange between users.

Available SDSS Data Products

Image and Spectroscopic Parameters (Object Catalog data):

- **Image Parameters:** Properties and profiles of all detected objects: positions, magnitudes, sizes, shapes and more (300 attributes per object).
- **Spectroscopic Parameters:** Redshift, line identifications and spectra-based classifications. (30 attributes per object).

Color Images and Plots of Spectra:

- Three-color composite images
- Flux vs. wavelength plots with spectral features identified, and other notations overlaid.

Image Pixels and Spectroscopic Pixels:

- Photometrically and astrometrically calibrated images in five wavebands (**corrected frames** with 0.4 arcsec pixels; binned images of the sky with 1.6 arcsec pixels, and objects removed.)
- Cut-out pixel maps, called **atlas images,** surrounding each object detected in the images.
- Maps of regions (mask images) which could not be used for science surrounding bright stars, bad columns, and other defects.
- Flux- and wavelength-calibrated spectra in the range of 3900-9100 Angstroms; 4096 samples at R=1800 (resolution).

Interfaces

There are multiple gateways to the public SDSS catalogs and data products. Researchers may want to start with the web-based MAST interface, and then download the SDSS query tool for larger and more advanced queries. The data products useful for scientific and display purposes are available through either the MAST catalog interface (select the html display of results and mark the objects for data retrieval) or more directly, with the appropriate catalog information copied from either the MAST SDSS catalog interface or the SDSS Query Tool, through the MAST data products interface for images and spectra

The skyServer interface taps into the same catalogs, but provides a more graphical interface to those catalogs, and is designed to be more useful to the public.

The MAST interface provides the user with the capability to search the catalog by position, and then, based on the query results, request additional data products. The more sophisticated data-mining queries must be submitted through the SDSS Query Tool. This Tool will allow the user to create a list which can be uploaded to the MAST data products interface for the data products associated with objects in the query results. The SkyServer interface provides an alternative interface to the public and the education community.

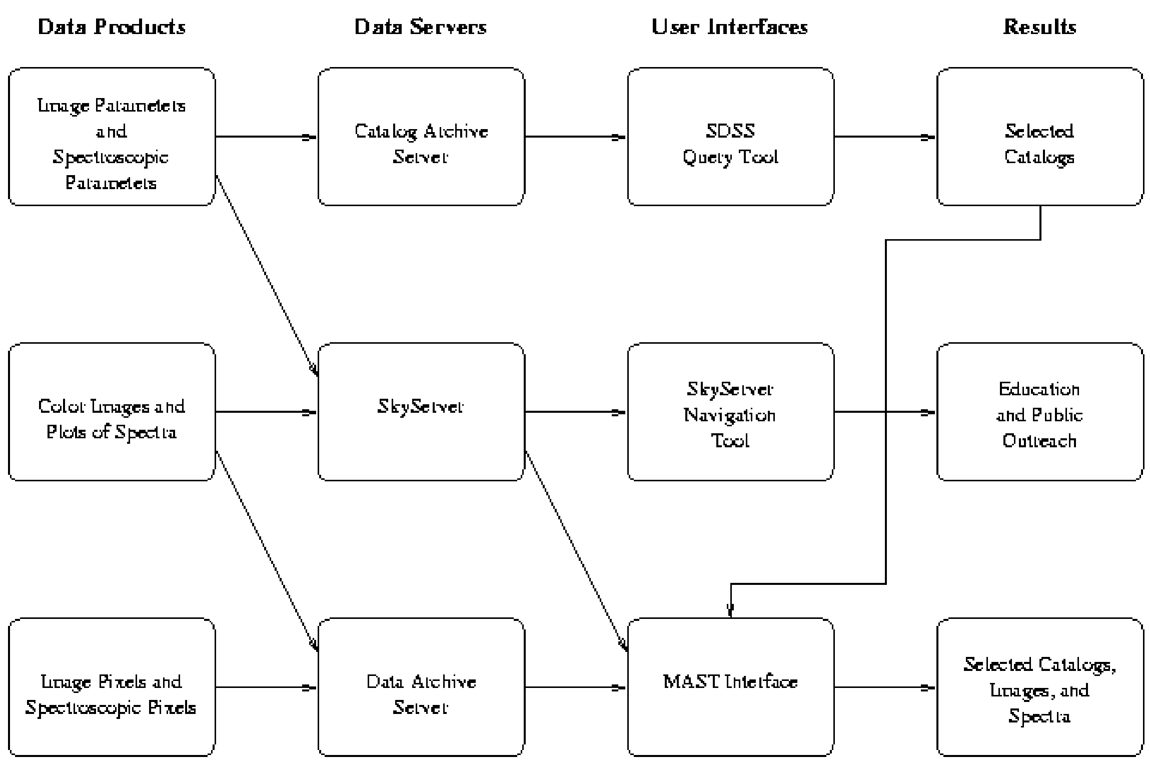
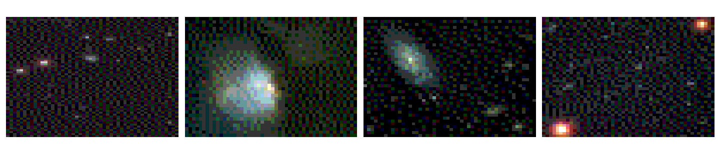


Table of SDSS Data Products

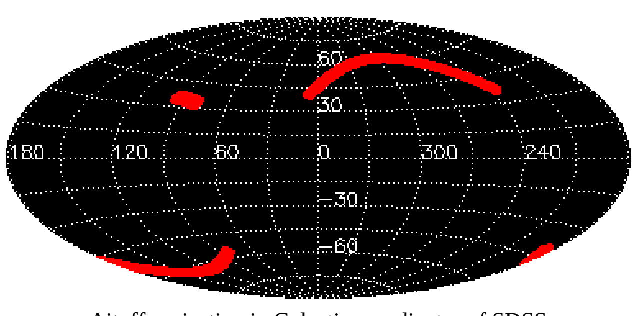
If you seek:	Go Here:	
Catalog Access	MAST/Simple	SDSS Query Tool/Advanced
Image Parameters (RA, Dec, mag...)	MAST/Simple	SDSS Query Tool/Advanced
Spectral Parameters (redshift, line ids and attributes)	MAST/Simple	SDSS Query Tool/Advanced
Science and display images	MAST+request	Products interface
Science and display images	MAST+request	Products interface
Color Pictures or Spectra Pictures	Search with skyServer	
Pretty Pictures	Gallery	SkyServer and click on Famous Places

Sign up for the Users' Forum and Users' Group.

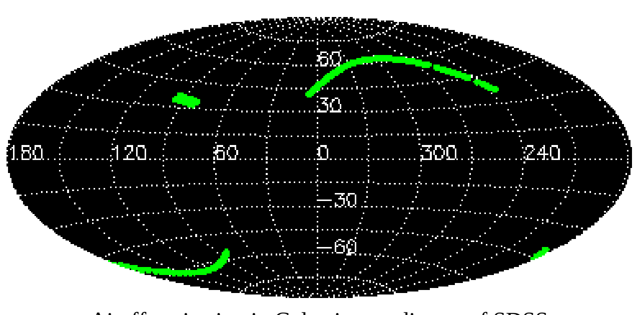


SDSS Early Data Release (EDR)

The available data products include: a searchable catalog containing the detected objects and their associated image and spectral parameters or attributes, 3-color pictures in JPEG format, data images in FITS format, and spectra in both GIF and FITS format. The EDR covers about 462 square degrees of sky.



Aitoff projection in Galactic coordinates of SDSS Early Data Release Imaging Sky Coverage



Aitoff projection in Galactic coordinates of SDSS Early Data Release Spectral Sky Coverage

Early Data Release Runs			
Run Number	Strip	Net Area (deg^2)	Location
94	82N	83	RA: 351° - 56°, Dec: 0°
125	82S	83	
752	10S	114	RA: 145° - 236°, Dec: 0°
756	10N	114	
1336	42N	16	RA 257°, Dec: 59°
1339	42S	16	
1356	43N	17	RA: 261°, Dec: 60°
1359	43S	19	

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SDSS EDR Paper Links

- Draft submitted to AJ Sept 2001 in PostScript format, Early Data Release paper, Stoughton, et al. 2002.

Click on the following links for files (not sites) referenced in the EDR paper.

- QSO Catalog compiled from the EDR, as described by Schneider et al. 2002, AJ, in press. This catalog supersedes the quasar entries in the EDR.
- sdssQT , the SDSS Query Tool.
- Data Model , describing the fine naming convention, FITS headers, and contents.
- Help Desk Contact information, FAQ, email address for help, phone number.
- Response Function (Transmission curves, for the total system efficiency), ASCII format
- FLAGS: A detailed description of flags used in processing the imaging data.
- README file for the stand-alone programs to read fpBin, fpAtlas, and fpField files, and a tar.gz file.
- Aperture correction per field an ASCII table of the aperture correction suggested for each field (apCorrRunErr)

SDSS Data Caveats Page

This page provides information about known data anomalies and subtleties in the SDSS Early Data Release. Additional information is available in the Frequently Asked Questions FAQ page. This page will be updated periodically as more information becomes available.

- Photometry
  - **Filter Bandpasses** : The EDR paper (Stoughton et al. 2001) uses the filter designations: **u* g* r* i* z*** to indicate these are not the final calibrations. The final calibrations will be designated, **u', g', r', i', z'**
  - **Holes** -- A **list** of holes in the EDR data has been provided by Brian Yanny.
- Catalog
- Spectroscopy

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version Beta 1.3

SDSS Contributed Data Products

This page provides access to images, spectra, catalogs and catalog papers related to SDSS results in addition to SDSS publications.

1. SDSS Unusual Broad Absorption Line (BAL) Quasars
2. SDSS Quasar Target Selection Algorithm
3. SDSS Quasar Catalog paper and catalogs: this is the preferred source of quasar data, preferred over the EDR catalog itself.
4. Composite Quasar Spectra
5. USNO 40 Catalogued Stars
6. SDSS Galaxy Luminosity Function fits

Composite Quasar Spectra From the Sloan Digital Sky Survey

– 44 –

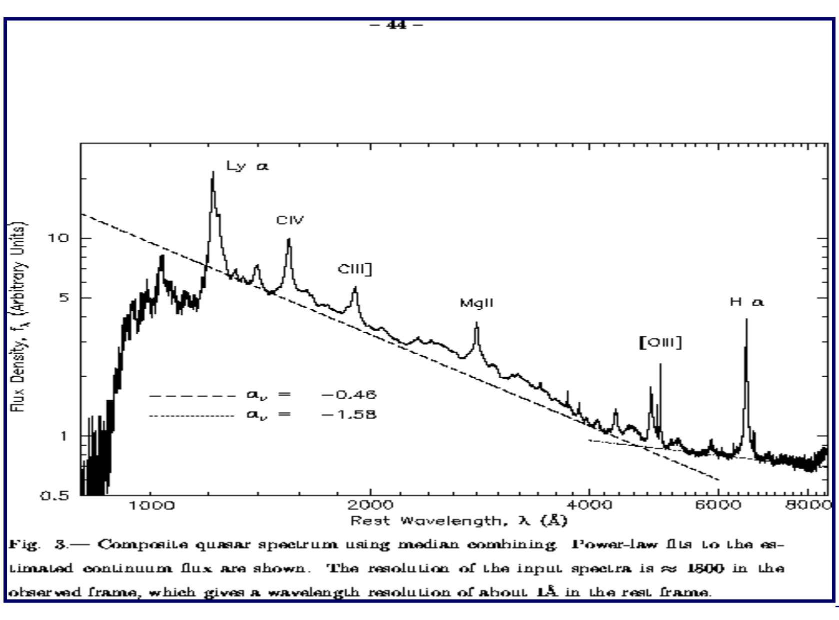

Fig. 3.— Composite quasar spectrum using median combining. Power-law fits to the estimated continuum flux are shown. The resolution of the input spectra is ≈ 1800 in the observed frame, which gives a wavelength resolution of about 1Å in the rest frame.

This is a composite quasar spectrum created by combining over 2200 individual SDSS quasar spectra. The flux density value at each bin is the median value of all of the spectra which cover the wavelength in the quasar rest frame. The quasar sample spans a redshift range of 0.044 <= z <= 4.789, and an absolute r' magnitude range of -18.0 to -27.7.00. The input spectra cover an observed wavelength range of 3800 - 9200 Å at a resolution of 1800. The median composite covers a rest wavelength range from 800 - 8555 Å, and reaches a peak signal-to-noise ratio of over 300 per 1 Å resolution element in the rest frame. Over 80 emission line features are identifiable in the spectrum (Vanden Berk et al. 2001, AJ submitted).

SDSS Composite Quasar in postscript

You may also download find an **ascii table** of the values for the composite QSO.

Vanden Berk Paper

The USNO40-calibrated **u' g' r' i 'z'** standard star catalogue can be found at the SDSS Primary Standard Star Network

The non-parametric fits to the SDSS Galaxy Luminosity Function Data by M. R. Blanton et al, AJ, 121, 2358, are available.

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What's New for SDSS during last 6 months

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

New Interface for SDSS EDR Quasar Data
2001 December 3
A web-based search and spectra retrieval interface for the SDSS EDR Quasar catalog and spectra, is now available at http://archive.stsci.edu/sdss/quasars/. The interface is based on a generic MAST interface we are developing and comments and suggestions, as always, are welcome at archive@stsci.edu.

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

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SDSS Links

SDSS Science - the Project Book

All of the links under the Project Book here will take you to the Project Book hosted at Princeton University.

- Large Scale Structure
- Clusters of Galaxies
- Quasars
- Galaxies
- Galactic Structure
- Stars
- Reddening
- Serendipity
- Solar System Objects

SDSS Technical Information - the Project Book

- Survey Strategy
- Telescopes
- CCD Cameras
- Photometry
- Spectra
- Data Processing (a SDSS document)

Other Links

- SDSS www.sdss.org links
- SDSS Server Status

The sdssQT User's Guide

This document is intended to guide novice users of the SDSS public release data through the steps necessary to obtain and understand the data.

The survey, including strategy, photometric and spectroscopic characteristics, is described at the STScI MAST interface site. The MAST site is intended for users who wish to make only basic queries, such as those centered on, or limited by, sky coordinates, object type, simple magnitudes, or colors ONLY. The capabilities and limitations of this method are explained in the Use Mast or QT? section of this site. More complex queries require use of the science archive query tool (sdssQT), a Tcl/Tk application allowing SQL (Structured Query Language) type queries. **Description and instructions for this tool are found from the links at the top of this page.**

In order to use the sdssQT effectively, users must understand the different classes and object parameters stored in the database, and their relations to one another. The data model and parameters are described from the *Data Parameter* link at page top. Users will also need at least a basic understanding of SXQL (the Science Archive version of SQL); examples and help are provided under the *Using sdssQT* menu above.

For **help** on this site, please visit the Help Page. If you have any questions or comments, or notice any errors, *specifically about this user's guide*, please email the author of this document:
Roy Gal, rrg@pha.jhu.edu.

Class Overview

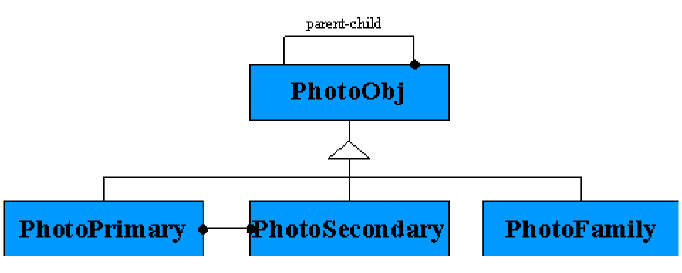
Since the Science Archive is based on an object-oriented database, we have **classes** for each object, not **tables** as opposed to objects in a relational database. The classes are linked to each other either by **inheritance** or by **association**.

Inheritance is a way to specialize a class. Every data member of the base class is also member of the inherited class, but the inherited class may have additional data members. In the schemata below, inheritance is represented by a large empty arrowhead between the classes.

Associations link classes to one another. There are one-to-one, one-to-many and many-to-many associations. Through the associations one can access the data members of the associated class through the dereferencing operator '.' (dot). In the schemata below, associations are the thick lines connecting classes, -to-many links represented as blobs at the corresponding end.

Photometric Survey Objects

Objects of the photometric survey are all members of the base class **sxPhotoObj**. It is specialized into primary, secondary and bad objects:

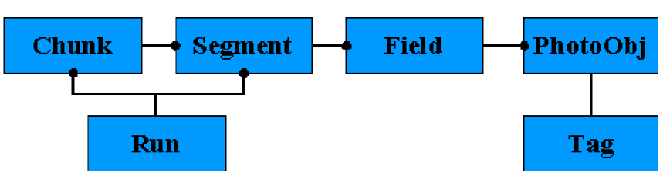


PhotoPrimary objects are the primary survey catalog objects. Secondaries are secondary observations of objects (in the overlap area of the stripes). More than 10% of all objects have secondaries. There is a many-to-many link between primary and secondary objects. A secondary object may be associated to more than one primary if the secondary observation is of a bad quality and could not be resolved into two or more objects. And obviously primaries can have associations to several secondary observations.

The link of the PhotoObj to itself is the one-to-many parent-child link. Each object may belong to a family of objects (the deblender was at work here).

Bad objects are kept only if they are member of a family, for example spiral arms of a galaxy that have been deblended.

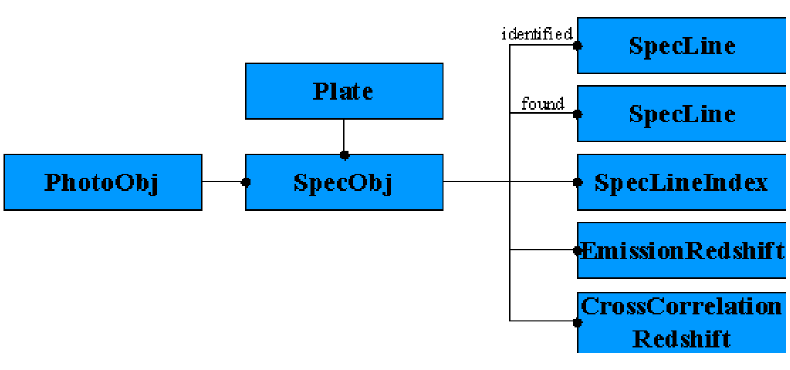
Photomeric Survey Structure



The photometric survey is strucutred into Chunk > Segment > Field > PhotoObj, all linked by a one-to-many association. The Tag object contains the coordinates and model magnitudes of each object along with the object flags. Each PhotoObj object has exactly one Tag associated with it through a one-to-one link.

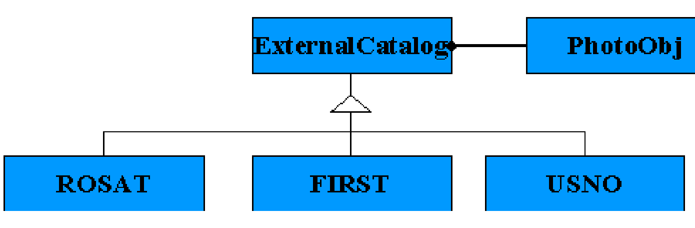
Spectroscopic Survey Objects

The spectra are taken on spectroscopic plates, to each of which we have a corresponding sxPlate object. The sxSpecObj objects correspond to each spectroscopic survey object, and they have associations to the found and identified spectral lines as well as the emission and cross-correlation redshifts measured. Spectral line indices are not included yet but a placeholder is there.



External Catalog Objects

Some objects are identified in external catalogs too and have some extracted quantity in those catalogs. There are links to ROSAT, FIRST and USNO catalogs.



Additional Classes

The **Profile** class has a one-to-one association to the PhotoObj class and contains the profile bins for each object. This has been splitted off the main PhotoObj to save space.

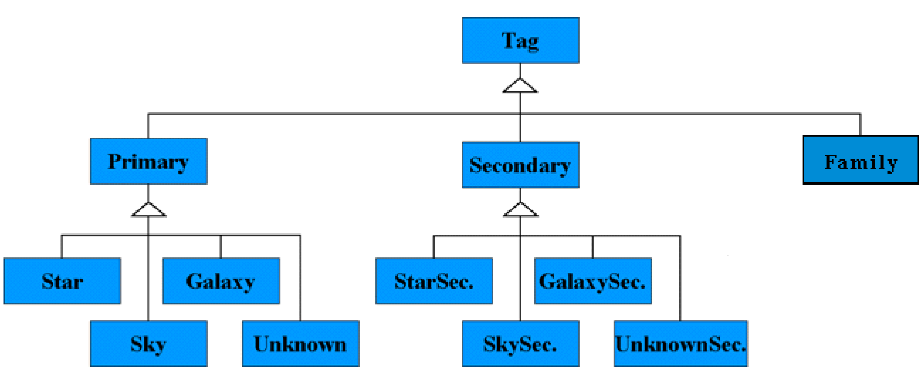
The **SDSSConstants** class contains global survey constants of interest.

There are two placeholder classes for photometric redshifts to come.

Tag Objects

Tag objects have been introduced as a lightweight object to actually do the database searches on. Most queries will have a cut either in coordinate or in color space so we suggest querying on a Tag object to enhance query speed significantly.

The Tag objects are specialized using inheritance into several classes depending on their type:



Tag objects are chosen based on the following selection criteria:

```
      if ( ( ( ( obj->status & AR_OBJECT_STATUS_FIRST_FIELD ) && gotFirst_ )
||
            ( !( obj->status & AR_OBJECT_STATUS_FIRST_FIELD ) && !gotFirst_ )
)
           && (  obj->status & AR_OBJECT_STATUS_PRIMARY  )
           && (  segH->status == AR_SEGMENT_STATUS_PRIMARY  )  ) {

             ---> sxPrimary

       if ( ( obj->objc_type == AR_OBJECT_TYPE_STAR) ) {

                ---> sxStar

        } else if ( ( obj->objc_type == AR_OBJECT_TYPE_GALAXY) ) {

                ---> sxGalaxy

        } else if ( ( obj->objc_type == AR_OBJECT_TYPE_SKY) ) {

                ---> sxSky

        } else {

                ---> sxUnknown
        }


      } else if (
           ( ( ( obj->status & AR_OBJECT_STATUS_FIRST_FIELD ) && gotFirst_ )
||
            ( !( obj->status & AR_OBJECT_STATUS_FIRST_FIELD ) && !gotFirst_ )
)
           && (  obj->status & AR_OBJECT_STATUS_SECONDARY  ) ) {

             ---> sxSecondary

       if ( ( obj->objc_type == AR_OBJECT_TYPE_STAR) ) {

                ---> sxStarSecondary

        } else if ( ( obj->objc_type == AR_OBJECT_TYPE_GALAXY) ) {

                ---> sxGalaxySecondary

        } else if ( ( obj->objc_type == AR_OBJECT_TYPE_SKY) ) {

                ---> sxSkySecondary

        } else {

                ---> sxUnknownSecondary
        }


      } else {

             --> sxFamily
      }
```

Try to use the Tag object and its inherited classes whenever possible as your query object.

This standalone atlas image reader can be built in one of two ways:

```
1/ Simply type
        make
No survey environment is required. If your machine is little endian, add
        -DSDSS_LITTLE_ENDIAN
to CFLAGS in the Makefile. If you have a survey environment and have
setup dervish, but still want the fully standalone version, you'll either
have to unsetup dervish, or uncomment the lines
#DERVINC =
and
#DERVLIB =
in the Makefile before building read_atlas_image

2/ Setup dervish, and type
        sdssmake

I'd recommend that you do a
        make clean
before switching between these two ways of building read_atlas_image. You may
not strictly need to do so, but it's certainly a wise precaution.


Then, to write object 12's 2nd colour (i.e. r)'s atlas image (found in file
fpAtlas.fits) to file ai.fits, you'd say

        read_atlas_image -c 2 fpAtlas.fits 12 ai.fits


I don't expect that many users will actually want to use the
read_atlas_image executable (although it is perfectly functional). The
main use of the product will probably be to link into custom built
executables that need to process atlas image data. I believe that the
code should be easily reused for this purpose.



The standalone programmes read_mask (reads fpM files) and read_PSF
(reads psField files) are similar; build instructions are identical.

To read the z' INTERP mask from from run 1336, column 2, field 51 you'd say:
        read_mask /u/rhl/data/1336/objcs/2/fpM-001336-z2-0051.fit 1 foo.fit
The resulting file (foo.fit) would be a char FITS file, with a 1 in each
pixel that was interpolated. The bitplanes are:

   typedef enum {
      S_MASK_INTERP = 0,           /* pixel's value has been interpolated */
      S_MASK_SATUR,                /* pixel is/was saturated  */
      S_MASK_NOTCHECKED,           /* pixel was NOT examined for an object */
      S_MASK_OBJECT,               /* pixel is part of some object */
      S_MASK_BRIGHTOBJECT,         /* pixel is part of bright object */
      S_MASK_BINOBJECT,            /* pixel is part of binned object */
      S_MASK_CATOBJECT,            /* pixel is part of a catalogued object */
      S_MASK_SUBTRACTED,           /* model has been subtracted from pixel */
      S_MASK_GHOST,                /* pixel is part of a ghost */
      S_MASK_CR,                   /* pixel is part of a cosmic ray */
      S_NMASK_TYPES                /* number of types; MUST BE LAST */
   } S_MASKTYPE;

with HDU _one_ corresponding to plane _zero_ (INTERP).  You can specify
these HDUs by name (e.g. OBJECT) or number (4).  With the -p flag, instead
of generating a FITS file, a description of each mask object as a set
of convex polygons is written in ascii to the output file; the format
should be obvious.  One caveat: the vertices of the polygons are the
pixel indices, so the boundaries pass _through_ the edge pixels, and
the quoted areas are not quite the areas of the polygons that include
all of the area.

The current version of this polygonal approximation code in fact generates
exactly one polygon per photo object, the convex hull.

To reconstruct the z' PSF (i.e. the 5th HDU) at the position
(row, col) = (500, 600) from run 1336, column 2, field 51 you'd say:
        read_PSF psField-001336-2-0051.fit 5 500.0 600.0 foo.fit
The desired PSF would appear as an unsigned short FITS file in foo.fit;
the background level is set to the standard `soft bias' of 1000.
If you want a floating image, change a line in the read_PSF.c; look for
        /* create a float region */


                        Robert Lupton (rhl@astro.princeton.edu)
```

SDSS Relevant Software

---

1. SDSS Science Archive Query Tool (sdssQT)

sdssQT v2.3.2 is available.

The SDSS Query Tool (sdssQT) is a Graphical User Interface (GUI) that provides the functionality necessary for SDSS users to prepare and submit simple or complex queries to the Science Archive. The current interface is a Tcl/Tk client application that allows you to connect to the SDSS Catalog Archive Server and run queries on the Catalog Archive. You will need Tcl/Tk version 8.0 or later installed on your machine, and have a "wish" executable in your path that runs a wish8.0 or later. Many platforms have this already.

Before you install, we strongly recommend that you join the SDSS Users' Group. This list will allow us to alert you to necessary upgrades in both software and documentation, as well as scheduled database downtimes. This list will only be used for such time-critical notification of users. The other group, the SDSS Users' Forum, is a bulletin board for SDSS scientists, and is open to all fellow scientists interested in the SDSS.

Download and install the sdssQT version 2.3.2, and don't forget the tool that converts bin to FITS binary tables (including instructions for compilation and installation.) For the EDR, we have made available the latest fully functional version of the Query Tool, which is called ``sxQT" or "sdssQT".
The official SDSS QT guide is available below. You need JavaScript enabled to read the documentation.

SDSS QT Early Data Release User's Guide : last update Jan 28, 2002

You may need a complete description of the SDSS database structure and classes: sxQT documentation for classes and database descriptions

You can check if Tcl/Tk is installed with a "which wish" command. Tcl/Tk can be downloaded from the following site(s):
Tcl/Tk 8.0
Tcl/Tk 8.3

A Tcl/Tk installation caveat: the default tcl/tk installation names the "wish" executable with a version number, e.g. "wish8.0". The SDSS Query Tool script looks for an executable with just the name "wish", so the user needs to add a logical link "ln -s wish8.0 wish" in the bin directory where the executable is installed.

Start-Up hints from a novice for a novice:

1. The executable brings up a blank square. To start the action, use the Connect menu option.
2. The server requires a username password combination. Use username *guest* and password *archive*.
3. Select the FermiEDR as the server.
4. Try a File>Load Examples>Simple Tutorials for a sample of how the tool works. These tutorials can be modified with guidance from the SDSS QT and database documentation.
5. Output can be directed to a local file, remote file or remote socket, with some format options.

---

2. readAtlasImages

SDSS standalone programs to read fpBin, fpAtlas, and fpField files

- README file; ASCII
- file. Shift-click to download.

Links to Mission Search Pages

Active Missions / Projects

HST Web Search	**FUSE (Science)**
STARVIEW	**FUSE (Exposures)**

Legacy Missions

IUE	**EUVE**	**Copernicus Raw** **Copernicus Co-add**	**ROSAT**
ASTRO -->	**HUT**	**UIT**	**WUPPE**
ORFEUS -->	**BEFS**	**IMAPS**	**TUES**

Catalogs & Surveys

DSS	**VLA-FIRST**	**GSC II**	**SDSS MAST Simple Form** **SDSS Query Tool/Advanced**

Cross Mission Searches

Search across missions for single target

List and display representative spectra/images from MAST archive for a single target. (Scrapbook)

Search across missions cross-correlated with catalogs

Target Search Help

A target search utility is provided on most of the MAST mission pages. A user may enter either a SIMBAD compatible target name or coordinates. Target names will be resolved by SIMBAD to obtain the appropriate coordinates. Coordinates will also be sent to SIMBAD where they will be used to determine the coordinates of the closest object (up to 10 arcminutes from the input coordinates). In both cases, the returned coordinates of the found object are then used to perform the database search. If the user needs an explanation of the search results, help is available from the search results page.

User-entered target names must be recognized by SIMBAD. If the target name is not found, consult SIMBAD's Dictionary of Nomenclature of Celestial Objects. If the the object names is not recognized by SIMBAD, or there is some other problem with SIMBAD, then the search will fail and (in some cases) the standard mission search page will be displayed.

User-entered coordinates may be entered as either "hr min sec deg min sec" or as "ra dec" in decimal degrees. In either case, THE SIGN OF THE DECLINATION MUST BE SPECIFIED or the search will fail.

Using the standard mission database search form will allow the user more advanced searches. It is normally accessible from the "Data Search" link on the main mission page.

Getting Started

The Hubble Space Telescope (HST) Data Archive (HDA) contains science data from all completed HST observations and calibration files. As of March 1, 2001, the archive contains over 7 Terabytes of data, for a total of more than 230,000 science exposures. In addition to all the science data sent to observers and all the calibration reference files, the archive contains engineering files that may be useful for diagnosing some questions about observations. As data are archived, information about observations and the targets is extracted from the headers of the data files and stored in an on-line catalog.

HST data become available to the astronomical community (or to any individual with the interest and hardware capabilities required to analyze the data) upon the expiration of a proprietary period. Most general observer (GO) and guaranteed time observer (GTO) observations have proprietary periods of a year, but some observations have shorter or longer proprietary periods. Nearly all calibration observations are made public immediately upon receipt. The archive catalog contains information about all observations that have been made with HST. Access to the HDA is open to everybody but registration is necessary. All public data can be retrieved from the HST archive. Proprietary datasets may be retrieved by GOs and GTOs with the appropriate authorization (contact the archive hotseat at archive@stsci.edu).

There are two different ways to access data in the HDA: StarView and a World Wide Web (WWW) interface. StarView is an astronomical database browser and research analysis tool. Developed in Java, StarView provides an easy to use, highly capable user interface that runs on any Java enabled platform as a stand-alone application. More details and instructions on how to install StarView are available at the StarView Home Page. The HDA can also be accessed via an interface available from the archive WWW page. Most users will find the WWW interface more convenient to use, as it does not require any client-server software installation and can be accessed by any WWW browser. Note, however, that the WWW interface does not provide all the functions of StarView as regards HST data.

STScI automatically processes and calibrates all data received from HST via a so-called "pipeline." Pipeline processing assembles data into datasets, calibrates the data according to standard procedures, and stores both uncalibrated and calibrated (for some instruments) datasets in the HDA. Almost all the files in the HDA are stored in FITS format. Most observations have multiple image planes; for example, WFPC2 images usually have four planes, one for each CCD chip. HST data can be analyzed or recalibrated using the Space Telescope Science Analysis System or STSDAS. Detailed information can be found at the STSDAS WWW page.

Search and Retrieval

HST data can be found using the HST search form to query the Hubble Data Archive (HDA) catalog. The catalog is stored in relational database tables at STScI, but users do not need to know about databases or Structured Query Language (SQL) to browse through it. The two possible user interfaces are the java-based StarView application and the web-based HST search page. These interfaces take care of the technical details and makes searching the catalog quick and easy. Both interfaces take the user's specifications - e.g., right ascension and declination, filter, exposure time, release date, etc. - and search the database for exposures that match them. They then return the search results in a table format or one record at a time. (One can save these results to a file.) See the how to search page for more information.

Once the user has found HST data he/she wants to retrieve, he/she will need to register for an archive account. Registration is open primarily, but not exclusively, to astronomical researchers who can make scientific use of HST data. HST data are intended for professional astronomical data reduction and analysis systems like IRAF, MIDAS, IDL, etc. Before registering, users should read about our retrieval policies.

Registration forms are available on-line or by contacting the HST Archive Hotseat. We use this information to contact users about the status of their retrievals, and about new developments in the archive we think they should know about.

Once users are registered, they will have an archive retrieval account with an associated username and password. After searching the HDA with one of the two available interfaces, the datasets of interest can be marked for retrieval with the `Mark' button and then submitted for retrieval to DADS, the HST Data Archiving and Distribution Service. Different retrieval options are available, including ftp of the data to the user's home machine and transfer (for public data only) to the archive staging disk. DADS will send email when the request is completed.

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What's New for HST during last year

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Larger Staging area for HST and FUSE data
2002 February 27
The staging area for HST and FUSE data retrieved with the HOST option has been significantly increased to around 500 GB from 27GB.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

Magellanic Cloud Planetary Nebulae Data Sets now Available
2001 November 15
HST prepared datasets of the Magellanic Cloud Planetary Nebulae are now available.

HST Literature Links Update
2001 November 13
The HST reference database table entries (and ADS data links) are now complete through the first half of this year.

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Exposure time searches offered for WFPC2 Pointings
2001 September 27
The WFPC2 Pointings search form now allows searches to be performed on total exposure times. See the pointings help page for more information.

OTFR Implemented for NICMOS Data
2001 September 26
As of today, all requests for archived NICMOS data will utilize the On-the-fly Reprocessing (OTFR) system.

New Archive Search Service for Wide Field Planetary Camera2 Observations
2001 August 24
The Pointings Search Interface allows users to explore a new table set we have created for WFPC2 pointings. We developed this table by defining a "pointing" for the WFPC2 to be a location in the sky circumscribed by a circle with a radius of 40". Then we assigned each WFPC2 observation to a pointing. We then compiled a table which described each pointing: the number of "u", "b", "v", "r", "i", and "narrow-band" observations at each pointing, the number of unique bands, the total number of exposures, and the number of days between the first and last exposure. Each pointing is also identified with a galactic and ecliptic latitude.

HST Literature Links Update
2001 August 22
The HST reference database table entries (and ADS data links) are now complete through the year 2000.

FOC Images added to MAST Scrapbook
2001 August 1
Representative spectra from the HST Faint Object Camera (FOC) have now been added to the MAST scrapbook.

New site available for FOS Calibration/Information
2001 July 11
STSDAS software for applying improved calibrations to FOS data plus a slew of other new FOS features (on-line material, etc.) is now available from the FOS POA site at the ESA European Coordinating Facility. See their web site for more information.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

Target Search Error
2001 June 12
An error was discovered in the target search available from the main MAST page. Searches would fail for object names containing special characters (such as a "+" symbol as in BD +28 4211). The error was fixed on the above date.

Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

OTFR Pipeline Delivered
2001 May 15
All STIS and WFPC2 archive data are reprocessed upon retrieval from the original telemetry, with the most optimal reference files and software available.

Updated Literature References
2001 April 9
The HST literature references (and ADS data links) now include papers from 1997 and early 1998.

Frequently Asked Questions

Proposal

- ***Who do I contact for help with proposal preparation?***
  STScI is maintaining a hotseat from 9:00am to 5:00pm Eastern Time at 410-338-1082 or (toll-free in the U.S.) 800-544-8125, and e-mail to help@stsci.edu. There is also the ST European Coordinating Facility, at 49-89-320-06-291, email: stdesk@eso.org, as well as a list of contacts in Appendix A of the Call For Proposals.

  If you have a question regarding Archive facilities used in preparing your proposal (such as duplication checking or the Planned and Archived Exposures Catalog), please contact us at archive@stsci.edu.

- ***Can I do duplication checks on the web?*** NEW
  You can use the web-based duplication search to check your proposals for duplication conflicts. Duplication checking is still available via StarView.

Retrievals

- ***How do I get the latest FOS calibrated data?***
  Improved calibrations for FOS data are available using STSDAS software available from the www.stecf.org web site. Additional FOS information is also available from this site.

- ***Why can't I log into archive.stsci.edu as `guest`?***
  The archive guest account has been discontinued. You can install StarView6 on your machine. You can also use the Web form. If neither of these approaches is sufficient to meet your needs, please let us know.

- ***How can I retrieve HST data?***
  You'll need to register for a retrieval account. Your retrieval account will give you access to any science, calibration, or engineering data in the Archive. PIs need a special authorization attached to their retrieval accounts which allows them to retrieve proprietary data from their own proposals; see this answer for details. You can retrieve public data using one of the following options:
  - by installing and running StarView6 at your site;
  - by using the HST Archive Search on the Web;
  - The archive guest account has been discontinued.

  The data can be retrieved either to the staging disk using the `HOST` option or directly to your own site using the `NET` option. Both options are now available via StarView6 or the HST Archive Searches on the Web.

  If you use the `HOST` retrieval option, DADS will retrieve the data to the staging disk of the host machine listed in your retrieval completion message.

  If you use the `NET` retrieval option, you will need to specify the machine address, login, password and directory where you wish the data to be retrieved.

  > DADS will ftp the data directly to a directory on your computer. (Note that we protect your destination information when it is transferred *to* us with the same kind of secure-web mechanism that is used by commercial sites conducting online commerce.)

  Note that the `NET` option is the only one available to retrieve proprietary data across the internet.

  If internet transfers are not feasible, both public and authorized proprietary data can also be retrieved to tape-- just use the `TAPE` retrieval option. We will ship it to the address given in your account registration.

- ***I am the PI on proposal xxxx. Can I use StarView or the Web to retrieve my data?***
  We're happy to tell you that you can! You can have your retrieval account set up so that you will be able to retrieve proprietary data from those proposals directly to a directory on your home machine.

  Just send an email to archive@stsci.edu. Please note the proposal id's, and designate any others who you believe should have access to the data.

  You can't retrieve *any* proprietary data to the Archive hosts; it has to be delivered to your machine using the `NET` option or to tape using the `TAPE` option.

  You can also designate your co-investigators for this privilege.

- ***I am the PI on proposal xxxx. Why can't I retrieve the data?***
  You can, but you'll need to let us know you want it. Currently, PIs do not receive automatic electronic access to their data. (This is a technical limitation, not a policy.) If you are the PI and want electronic access to your proposal, contact *archive@stsci.edu* and let us know the proposal ID and your archive username. We will attach the proper access privileges to your account to allow you to retrieve this data electronically.

  You can also authorize co-investigators and co-workers to have electronic access as well. Just tell us the proposal ID and the names and archive usernames of those to whom you wish to grant access. (If they don't have accounts, or you're not sure if they do, then let us know their email addresses to we can help them set up accounts for access.)

  Authorization may be set up only on a per-proposal basis; we cannot restrict access to certain data within the proposal.

- ***How do I get permission to retrieve my proprietary data and documents?***
  We ask that the PI send us an email (to archive@stsci.edu). In that email, note the proposal id's, and designate any others who you believe should have access to the data.

Once an individual is authorized for a particular proposal, they have access to all proprietary data in that proposal only.

Be sure to use the `NET` retrieval option!!

If while retrieving your data you get a message saying that the data are still proprietary, one of the following has happened:

  - You are trying to retrieve the data to the Archive Host staging disk. The staging disk is an anonymous FTP area, so we can allow only non-proprietary data to be written to it. Have the data sent directly to your disk or sent to you on tape instead.
  - We made a mistake and didn't properly authorize your account. This may be particularly true if you (for some reason) have more than one archive account.
  - The data are under restriction, which means that they were found to duplicate planned or existing proprietary observations, and an access restriction has been placed on them until the data with which it conflicts is released.

- ***I forgot my password***
  Don't worry, it happens to the best of us. Just call the Archive Hotseat and we'll reset it for you.

- ***How long should a retrieval take?***
  The retrieval time depends on a variety of factors:
  - the type of data in the request. Some older data is stored offline and requires an operator's intervention.
  - the size of the request- the larger the request the longer it takes, both to move the request up the queue , and to retrieve the data.
  - the number of requests in the system at the time.
  - the destination of the request. The internet connections between STScI and some sites, especially those overseas, is sometimes a significant source of delay.

  If everything is running smoothly, expect a median turn around time of a few hours. If it takes more than one day, and you don't think any of the factors listed above are playing a significant role, please contact us.

- ***When I submit a request, it fails immediately, telling me my host password contains forbidden characters...***
  There are 5 characters that are forbidden:
  ( ) * " /
  In order to successfully submit a request, you will need to change you password to something not containing those characters. We hope to fix this eventually, as it can be a significant inconvenience.

- ***I submitted a retrieval, but never got a notice that my request was submitted and queued...***
  DS may be down, so it's not reading its mail. The way a retrieval works is that StarView emails the request to DADS. (If you have your mailer set to automatically log outgoing mail, then you'll see these requests, in their encrypted form, in your outgoing mail folder.) DADS then reads its mail and puts your emailed request onto the retrieve queue.

  If DADS is down, or is not reading its mail for some reason, then your message will be held in the folder until DADS comes back up, when it starts reading its mail and queueing requests again. That's when you'll be notified.

- ***I tried retrieving some data, but the staging disk is full...***
  Fortunately, this doesn't happen as often as it used to, since we installed a bigger staging disk on one of the Archive host machines. (You can check its capacity to be on the safe side.) However, if it does, you can either contact the Hotseat and we'll see if we can do anything to make room (usually by contacting other users and asking them if we can delete their data), or by resubmitting the request and having the data delivered directly to a directory on your home machine (`NET` option), rather than onto the staging disk.

- ***My request failed. Now what do I do?***
  If it failed for a reason you can identify (such as a mistyped password/directory/login or no space left on destination device) go ahead and resubmit the request with the necessary alterations. Once a request fails in DADS, it is dropped from the system.

  We do not resubmit failed requests for users, you will need to do that yourself.

  If the failure occurred for a reason that isn't clear, contact the Archive hotseat with a description of the failure and we will investigate.

- ***What does this error message mean?***

  `General FTP error`: Transfer failed due to ftp errors. If it isn't clear from the code and comments what caused the error, and it continues to occur, please contact us and we will investigate.

  `File not found`: Usually a result of a hardware error on our end. You can resubmit the request and usually the problem goes away. If it doesn't, please contact us.

  `File not processed`: If you receive this error and cannot subsequently retrieve the data, please let us know.

  `Dataset does not exit`: This can result when you have submitted a request using the customize retrieval options, or have edited your request file. Double check that there are no errors in the filenames, classes and extension you requested. If you are certain that this file should exist, please contact us and we will look into it.

- ***I submitted a request two days ago, and it hasn't finished yet.***
  Chances are it won't finish. Retrievals may have crashed and taken your request with it. We will contact you when that happens, but sometimes we may not be able to.

  DADS retrieval times are dependent on the size of your request, the destination you specified and the number of requests in the system. A median retrieval turnaround time is a few hours, so if your request has taken more than a day without you getting a completion message, contact the Archive Hotseat and ask about your request. It has been our experience that users outside the United States sometimes experience longer retrieval times.

- ***How can I find out how my retrieval is doing?*** UPDATED
  Via the web, you can check the status using a simple tool at
  http://archive.stsci.edu/cgi-bin/reqstat

- ***I retrieved some data and got a notice that it was ready. Where is it?***
  If you selected the `HOST` option in StarView or on the Web then the data was retrieved to the staging disk of stdatu.

  It has a "lifetime" on that disk of about 3 days.

  Use anonymous FTP to get your data (ignore the `/stdatu/dads_stage` part of the pathname).

  If you selected `NET` as the media option, then the data will have gone to the node name and directory you gave to Starview as the destination directory.

- ***I don not want the data I just requested. Can you kill this request?***
  Once the request has been queued, we can't kill it-- at least, not without bringing down retrievals completely.

- ***Can I get the data in (GIF/JPEG/whatever) format?***
  The data are delivered from the Archive in multigroup Flexible Image Transport System (FITS) format only. We currently do not support conversion to other formats; you will have to do this yourself.

- ***How do I display data in FITS format?***
  There are various FITS readers available. For example SAOimage (ds9), which can be retrieved via anonymous FTP from sao-ftp.harvard.edu in the directory /pub/rd/ds9, runs on various systems. More information on HST data and data analysis software is available on-line (in particular, see the HST Data Handbook).

- ***I know I have an account on stdatu, but I can not log into it any more...***
  The Archive guest account has been discontinued. Users should either:

  - Install StarView6 at their home sites
  - Use the Web tools for searching the catalog and retrieving data

  If neither of these options meet your needs, please contact us at archive@stsci.edu.

- ***I don't need the whole dataset. How do I retrieve just one file extension?***
  With the current OTFR system, this is not possible. You will get a `Dataset does not exit` error. For instruments not using On The Fly Calibration or Reprocessing, it will still work.

  This option will eventually be reactivated.

  We recommend not using it in the meantime.

  As of May 15 2000, ST ScI stopped archiving calibrated WFPC2 data. For datasets archived after this date, selecting a calibrated file extension will return a dummy file containing no data. Use the On-The-Fly Calibration option to retrieve calibrated data for WFPC2 datasets archived after May 15 2000.

Searches

- ***I need to recalibrate some data. Can I retrieve the calibration files?***
  Yes. In Starview, for each instrument, there is a calibration screen that will show you what files the dataset was calibrated with, and which files you should use if you are recalibrating. Each of these screens has special buttons to mark the used or recommended calibration files for retrieval.

  If you already have the names of the files you want, then you can retrieve them directly. Go directly into the Retrieval screen through the Commands menu and use the "Add dataset by name" or "Add datasets from file" options. In the "File Options" screen, just press the "Calibrated" (or "OTFC" for STIS or WFPC2) button. That will ensure you get the right files.

  Via the Web, select the appropriate choice from the Retrieval Options page: "Best Reference" or "Used Reference" files.

  To search for specific calibration files, you will need to know the names of the files and search for and retrieve them using the Dataset List Search page.

- ***How do I find observations of an object by name?***
  You can try entering this in the "Target name" field of a search screen, but the target names in our database are chosen by the proposer, so they might be a little (or a lot) different than you might guess.
  The best way to search for a specific (fixed) target is to use the "Get

Coordinates"/Resolve button. Press this button and a window will pop up asking you for a target name. When you enter a target name and search, it will resolve the target names into RA and Dec through SIMBAD or NED. It will then enter the target's RA and Dec on the StarView screen, along with a 10-arcminute search radius (which you can change, if you want). (If you do a lot of extragalactic work, you can choose the NED resolver instead of SIMBAD.)

For solar-system targets, you may still need to search by target name. In this case, it would be wise to wildcard the target name. For example, to search for observations of Jupiter, enter `*JUP*` into the target name field. Also, you can constrain your search to solar-system proposals by entering `Solar System*` in the "Description" field, if there is one on the screen. (Note the wildcard!)

- ***How do I find all the observations for a class of objects (like Seyferts?)***
Specify a target description. Pull down the "Help" menu and select "On Targets". This help topic will show you how to search for observations of classes of objects. There is also an up-to-date list of target descriptions currently in the HST Archive.

- ***Can I use StarView or the Web to cross-correlate a list of my targets?***
Both StarView and the web offer cross correlation.
There are instructions on how to use the StarView cross correlation in the online StarView help documentation.

Cross correlation is also available on the web at http://archive.stsci.edu/search/. There are help texts that describe how to use this function.

Starview

- ***Java-based StarView 7 Released*** NEW
Developed in Java, StarView version 7 provides an easy to use, highly capable user interface that runs on any Java enabled platform as a standalone application.

You can download and install it. It requires Java 1.2 or higher to run, but it is recommended that users download StarView 7 with the optional Java 1.3 included. (Note Java 1.3 is up to 30% faster!)

The old StarView 5.4a and 6 have been discontinued. All x-windows and crt-versions are no longer functional. Users will need to switch to StarView7.

- ***Does StarView run on platform X?***
StarView7 needs a system that has a Java 2 Runtime Engine. You will need to make sure that you have a version of Java that is 1.2 compliant. See download and install links for more information.

- ***Can I install the StarView7 software on my machine?***
Yes. StarView7 is available from the web.

- ***Can I get the source code for earlier versions of StarView and compile it on my machine?***
Please use StarView7.

- ***How do I run StarView?***
You can install StarView7 and run it from your home site.

- ***I need to run StarView on archive.stsci.edu. Why can I not login with my archive user id and password?***
The Archive guest account was been discontinued. Users should either:

  - Install StarView7 on their home sites
  - Use the Web tools for searching the catalog and retrieving data

If neither of these options meet your needs, please contact us at archive@stsci.edu.

- ***When I try to start StarView5.4, it crashes immediately. What is wrong?***
StarView 5.4 is now obsolete. Please install StarView7.

Documentation

- ***Where can I get the Archive Manual?***
  - *The **Archive Manual** is available on-line.*
  - *The **HST Data Handbook** can be found here.*
  - *You can get these via anonymous FTP from:*
    - *ftp.stsci.edu, in the directory* `archive-html`
    - *archive.stsci.edu, in the directory* `pub/manuals`
  - *You can also use our document request form to order printed copies (they're free), or just contact the Archive Hotseat.*

- ***How do I find out the latest versions of the Manual?***
We will keep the most up to date manual we have available on-line

- ***Is there an Archive Newsletter?***
Yes. The electronic newsletters provide information about the various archives supported by the Multi-mission Archive at STScI (MAST). In addition to HST data, MAST also provides support for VLA First, IUE, Copernicus, and EUVE data. Data from the FUSE, Astro-1 and Astro-2 missions for the UIT, HUT, and WUPPE instruments will be added in the future.

It is sent out electronically to a distribution list. You can also read it on-line.

Paper Products

- ***I had some observations made recently, but I haven't yet received a tape...***
As of August 1, 2000, we are no longer generating tapes for proposals. If you wish to have a tape of your data, please submit a retrieval request as you normally would, and use the TAPE retrieval option.

- ***Can I have multiple copies of a tape made for my collaborators?***
Because of the volume of data that we handle, we can only make one copy of the data. However, see the "How_can_I_retrieve_HST_data_" question about PIs retrieving their own data for information on how to let your CoIs retrieve the data from the Archive directly.

- ***Can I get my tapes sent via a next-day carrier?***
All tapes are sent out via FedEx Next Day Air by default.

- ***How do I generate paper products myself?***
*We offer paper products electronically in PDF format. As of **August 1, 1999** we no longer manufacture hardcopies of the paper products, but will still provide them for extreme need cases. Please contact us if this is the case.*

Users will need to retrieve their paper products using the PDF Search Page

Files are password protected (unless the proposal is a calibration program) and users will need their archive name and password to access documents (as well as authorization to access the proposal). This interface is not intended for general archive users but specifically for PIs of HST programs.

You can also generate paper products from your data using a task in IRAF/STSDAS called pp_dads.

ASCII Catalogs

- ***How often are the catalogs updated?***
The AEC is updated monthly. Check the file README.AEC for the date through which the AEC is complete.

The PAEC and proposal catalogs are usually done once or twice each proposal cycle.

- ***Where do I find the ASCII catalogs, namely the AEC and PAEC?***
The ASCII catalogs are online at http://archive.stsci/hst/catalogs.html.

Data Reduction/Analysis

Hubble Space Telescope (HST) science data are stored in the HST Archive in FITS format. Information on the FITS header keywords in HST data files can be obtained from the keyword dictionary. Access to the archive is open to everybody but non-astronomers should be aware of the fact that HST data are intended for professional astronomical data reduction and analysis systems.

The Space Telescope Science Institute (STScI) supports dedicated software, the Space Telescope Science Analysis System (STSDAS), for reducing and analyzing HST data. This software works within the Image Reduction and Analysis Facility (IRAF).

Specific details about the format and content of science datasets can be found in the HST Data Handbook. For any questions about HST data reduction and analysis users should contact the STScI Help Desk at help@stsci.edu.

For several HST instruments improved calibrations, as compared to the calibrated files available in the archive, are possible with newer calibration files. These files can be retrieved for a given dataset using this interface. Note that with the release of On-The-Fly Reprocessing (OTFR) archive users can obtain WFPC2, NICMOS, and STIS data that are processed with the latest calibration files, software, and data parameters. The OTFR system calibrates data when processing a user's request for the data from the archive.

Improved calibration of FOS data using new STSDAS software is available from the www.stecf.org/poa web site, along additional FOS-related news, documentation, and activities.

The results of investigations with HST archive data are generally published in the scientific literature. All publications based on these data should carry an acknowledgment.

HST Target Search
HST Home
Getting Started
Data Search & Retrieve
Go to ...
What's New
FAQ
Data Reduction/Analysis
Proposal Support
Duplication Checking
Proprietary Rights
ASCII Catalogs
GO / GTO Support
Science Products
Project Publications
Related Sites
Acknowledgments

Proposal Support

The Hubble Space Telescope (HST) proposal process involves various steps, which are summarized below. For more details please check this page.

- Call for Proposals

  The Call for Proposals (CP) invites the astronomical community to propose for observing time on HST in a given cycle (nominally one year in duration). It summarizes the policies and procedures for proposing in that cycle of HST observing, including requests for funding research on archival HST data. A CP for a given cycle is issued approximately a year before the nominal start of the cycle.

- Phase I: Writing and submitting a proposal for HST observing time

  The CP describes in detail the policies and procedures for submitting a Phase I proposal for HST. Proposers should also consult all relevant technical documentation about the capabilities and sensitivities of the instrument(s) to be used in their programs and should discuss the requirements of their observing programs with appropriate Space Telescope Science Institute (STScI) experts. Contacts are provided via the STScI Help Desk at help@stsci.edu. To avoid duplication conflicts proposers also should consult up-to-date exposure ASCII catalogs, the Duplication Checking Web Form or the Duplication Check Screen in StarView.

- Phase II: Providing the details

  A Telescope Allocation Committee (TAC), organized by the STScI, reviews and evaluates the submitted Phase I proposals. The TAC recommends a list of programs to the STScI Director for preliminary approval and implementation. Upon final approval by the Director, a successful proposal enters into the Phase II stage of proposal preparation, during which proposers must provide the details required by the ground system to schedule HST and obtain their observations.

Most HST observations have proprietary periods of one year, during which the data are only accessible to the proposers. More details on HST proprietary rights are available.

GO/GTO Support

Hubble Space Telescope (HST) archive support for general observers (GOs) and guaranteed time observers (GTOs) include:

- **Reference files.** For several HST instruments improved calibrations, as compared to the calibrated files available in the archive, are possible with newer calibration files. These files can be retrieved for a given dataset using this interface. Note that with the release of On-The-Fly Reprocessing (OTFR), archive users can obtain WFPC2, NICMOS, and STIS data that are processed with the latest calibration files, software, and data parameters. The OTFR is performed whenever a request is received for archived data.

- **PDF paper products.** Using this interface users can search for, and display, the HST observation summaries now offered in Portable Document Format (PDF). These documents, formerly available only in hardcopy and referred to as the HST "paper products", provide a quick first look at the data. The PDF documents are password protected and users will need their archive name and password to access them. More information on paper products is available. Note: The automatic generation of PDF observation summaries was terminated on March 19th, 2002. The current interface will allow users to view the remaining online observation summaries dating roughly from March 19th, 2002 back to June, 2001.

- **Proprietary rights.** Most GO and GTO observations have proprietary periods of one year, during which the data are only accessible to the proposers. More details on HST proprietary rights are available.

MAST Prepared Science Products

The following is a listing of sites of highly processed datasets from missions supported by MAST. These are datasets consisting of atlases, images, and/or the data themselves which have been placed on the web either as final data products or as appendices referenced in recent published papers. These data are in the public domain and/or will soon be published. The datasets are organized by type of observation (survey, individual objects, time series) and will include a growing number of catalogs with links to the data and in some cases spectra and/or images.

Deep Sky Surveys

- Hubble Deep Field
- Hubble Deep Field South
- Medium Deep Survey

Wide Field Survey Catalogs

- Magellanic Clouds Planetary Nebulae (HST)
- SDSS Quasar Catalog

Spectral Atlases: multi-object samples

- Ultraviolet Spectral Atlas of Standard Stars (IUE)
- Library of Copernicus Atlases of Selected Stars
- Far-Ultraviolet Spectral Atlas of Stars (EUVE)
- Library of IUE NEWSIPS SWP Echelle Spectra for White Dwarfs
- FOS Composite Quasar Spectrum (FOS)

Spectral Atlases: individual objects

- High S/N GHRS LSA G160M Observations of 10 Lacertae (HST)
- High S/N GHRS SSA Echelle Observations of chi Lupi (HST)
- High S/N GHRS SSA Observations of Chromospheric lines in Procyon (HST)
- High S/N GHRS LSA G270M Observations of alpha Ori (HST)

Time-Dependent Spectra

- Grayscale of Time Variations of gamma Cas near SiIV Doublet (HST)

Guidelines for authors of new prepared science products

For further information see: VizieR astronomical catalogs

HST Archive Documentation

The HST Archive Manual

Provides extensive information on how to access the HST and Multimission archives via two user interfaces, StarView and the World Wide Web. Gives advice on search strategies; higher level functions of StarView; descriptions of StarView screens and the HST catalog; nomenclature convention for HST data.

Version 7.0 of the Archive Manual was released in June 1999.

PDF version (3.9 Mb),

On-line version

Postscript version (gzipped) (2.1 Mb).

Users will find the PDF version more flexible and quicker to use. Loading of some chapters with the on-line version might take some time.

The HST Data Handbook

The comprehensive guide to calibrating, reducing, and analyzing HST data.

Archive Newsletters

The electronic newsletters provide information about the various archives supported by the Multi-mission Archive at STScI (MAST), including HST

Old HST Archive Newsletters [incomplete]:
January 17, 1995
March 21, 1995
May 23, 1995
December 12, 1995

Related Sites

Affiliated Institutions

AURA NASA CADC
SPACE TELESCOPE European Coordinating Facility NAOJ

Other Data Centers

HST Archive Acknowledgments

Publication of HST Archival Research Results

The results of investigations with HST archive data are generally published in the scientific literature. All publications based on these data should carry the following footnote:

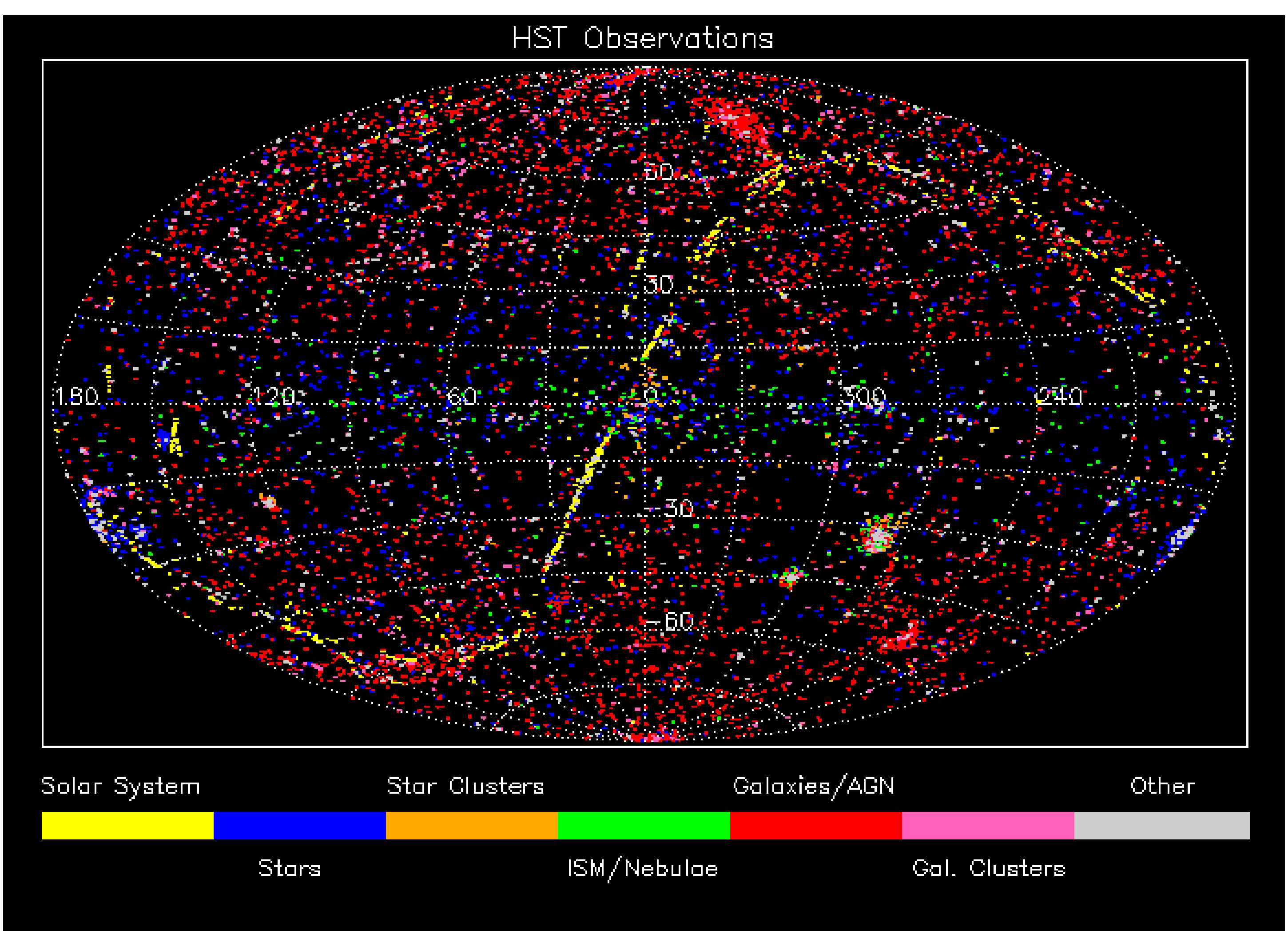
"Based on observations made with the NASA/ESA Hubble Space Telescope, obtained from the data archive at the Space Telescope Science Institute. STScI is operated by the Association of Universities for Research in Astronomy, Inc. under NASA contract NAS 5-26555."

If the archival research was supported by a grant from STScI, the publication should also carry the following acknowledgment at the end of the text:

"Support for this work was provided by NASA through grant number ________ from the Space Telescope Science Institute, which is operated by AURA, Inc., under NASA contract NAS 5-26555."

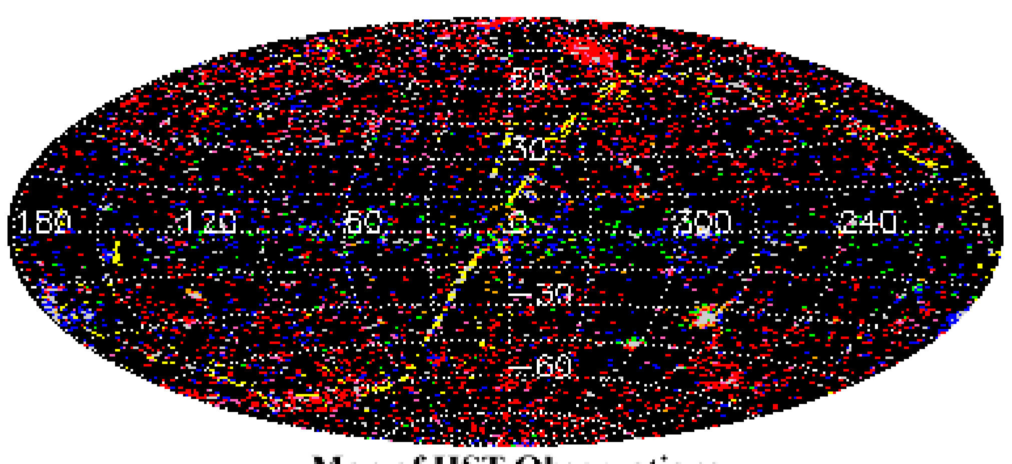
Please send one preprint or reprint of each refereed publication based on HST archival research to the following address:

Librarian
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218 USA


HST Observations
60
30
180
120
60
0
300
240
-30
-60
Solar System
Star Clusters
Galaxies/AGN
Other
Stars
ISM/Nebulae
Gal. Clusters

http://archive.stsci.edu/hst/

Hubble Space Telescope (HST) is an orbiting astronomical observatory operating from the near-infrared into the ultraviolet. Launched in 1990 and scheduled to operate through 2010, HST carries and has carried a wide variety of instruments producing imaging, spectrographic, astrometric, and photometric data through both pointed and parallel observing programs. MAST is the primary archive and distribution center for HST data, distributing science, calibration, and engineering data to HST users and the astronomical community at large. Over 100 000 observations of more than 20 000 targets are available for retrieval from the Archive.



Map of HST Observations

FUSE Abstract Search Help

This page describes how to use the *new* FUSE Abstracts Search form.

You can use the FUSE Abstracts Search to find FUSE observing program abstracts containing specified words or phrases. All FUSE program abstracts matching your search expression will be displayed. (Currently, all we have are the abstracts. Other information, such as the title, investigator, etc. will be added soon.) The characters in the abstracts that matched your search expression will be rendered in **red boldface** to make it easier to see why an abstract matched.

The expression syntax is similar to that used in an AltaVista simple search. Expressions consist of words or phrases (quoted strings) separated by whitespace. **The search is insensitive to case.** An abstract will match if it contains any of the words or phrases in the expression, unless the word or phrase is preceeded by a `+` or a `-` sign. Prefix a word or phrase with a `+` when the word or phrase is required to be present in the abstract. Prefix a word or phrase with a `-` to exclude abstracts containing the word or phrase.

(Please note that some searches, especially those involving complex expressions or matching a large number of abstracts, may take a minute or two to complete. Searches matching a large number of abstracts may also generate a very large results page.)

Here are some examples of how to use the syntax (remember that case is ignored).

Expression	means
`macho`	Finds every abstract containing *MACHO* (or *Macho*).
`macho microlens`	Finds every abstract containing either *MACHO* or *microlens*.
`"BL Lac"`	Finds every abstract containing *BL Lac*. Note that this expression is enclosed in quotes; otherwise, the expression would also have matched words like *capable* and *loblolly*, which is probably not what you wanted.
`+iue galax`	Finds every abstract containing *IUE* which may or may not contain *galax*.
`+iue +galax`	Finds every abstract containing both the strings *IUE* and *galax*.
`+iue +"BL Lac"`	Finds every abstract containing both the strings *IUE* and *BL Lac*.
`+euve -maneuver`	Finds every abstract containing *euve*, but *not* containing the word *maneuver*. (Note that the string *euve* is contained in the word *maneuver*.)
`xray x-ray "x ray"`	Finds abstracts containing any of *xray*, *x-ray*, or *x ray*. Note again that `"x ray"` is enclosed in quotes.

Future enhancements will include searching other information besides the abstract and adding query options, like case-sensitivity and scoring. (I'm trying not to clutter the interface too much though.)

Getting Started

Launched on June 24, 1999, the Far Ultraviolet Spectroscopic Explorer (FUSE) is a young high-dispersion spectroscopic mission. The instrument is optimized for the wavelength region 905-1185 Å and is particularly suitable for studies of interstellar atomic and molecular lines, heavy hydrogen abundances, the OVI resonance lines in hot stars, and the redshifted 584Å ("helium H-alpha") line of neutral helium in distant galaxies.

Unlike most astronomical space platforms, FUSE consists of four coaligned telescopes, each of which brings light to its own spectroscopic optical elements and are focused on one of two detectors. This segmented instrumental configuration serves to increase the telescope's effective aperture at low cost and to optimize detecting efficiency in different wavelength regions. Its capabilities make FUSE a natural follow-on mission to the earlier Copernicus, IUE, HUT, EUVE platforms.

A user can request FUSE data by going to the FUSE search page and selecting "Science Data Search." If you are not yet registered with an FUSE (HST) user account you must first do so to get to the data retrieval page. Instructions for this step can be found in the how to retrieve FUSE data page. Because FUSE is a young mission, a requestor will typically see a large fraction of listed datasets to be coded in yellow. This means that they are still proprietary to the original proposer.

Before investigating data, the observer should be aware of several caveats which are unique to FUSE and can affect the spectral quality. In the future preview (quick-look) spectral images will be available in at least two different stages of pipeline reduction in order for an investigator to assess the quality and possible problems for a given exposure. The Observer's News page should also be consulted for recent changes in the status of FUSE instrument or pipeline processing of data or for answers to FAQs.

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Search and Retrieval

FUSE data are contained can be found by using the main FUSE search form to request one or more observations from the data archive catalog. Most users request observations by observation, but for some applications it is desirable to request certain "exposures" within an observation, and the exposures search form provides this capability. This form may be accessed by clicking the link to it in the upper left corner of the main FUSE search form or from the gutter. Note that because FUSE is an active mission data are being put into the public access area continually. One can get a list of additions within the last several days by consulting the daily data reports

Once the user has found FUSE data he/she wants to retrieve, he/she may need to register for an archive account. If the user has already done this to obtain Hubble data, this step is unnecessary. Registration help is available, or users can access registration forms on line or contacting the HST Archive Hotseat. Before registering, users should read about our retrieval policies. Once users are registered, they will have an archive retrieval account with an associated username and password.

After searching the FUSE archive, the datasets of interest can be marked for retrieval with the `mark' button and then submitted for retrieval to DADS, the STScI Data Archiving and Distribution Service. f you have problems making the search query, consult the **search help** page. Different retrieval options are available, including ftp of the data to the user's home machine and transfer (for public data only) to the archive staging disk. DADS will send email when the request is completed.

Once the requested files are located, they are written to a data distribution disk area on the system, bundled into a tar or zip format file, and downloaded to the disk area specified by the user in the "save as.." pop-up window. The files are downloaded when the pop-up window disappears.

If you have problems retrieving your data, you can contact the help desk via the link at the bottom of this page.

Daily Data Reports

This area contains reports of recently archived and recently released FUSE data. The reports are updated automatically every morning at 5:00AM Eastern US time. All reports are sorted on program ID. more information.

A FUSE dataset is "released" when its proprietary period expires. The default proprietary period of FUSE data is six months from the time of ingest into MAST. Once the dataset is released, it may be retrieved from MAST without special authorization. Principal investigators and co-investigators may have their MAST archive accounts enabled to retrieve proprietary data from their observing programs. Contact archive@stsci.edu for more information.

The links labeled *gz* are the gzip-compressed versions of the reports. Most modern browsers are capable of handling compressed HTML on the fly, so these compressed versions may download significantly faster for you than the uncompressed versions, especially over a slow Internet connection.

Data released within the last 3 days (*gz*), 7 days (*gz*), 14 days (*gz*), or 28 days (*gz*)
Last updated: Fri, 22 Mar 2002 5:00 AM

Data archived within the last 3 days (*gz*), 7 days (*gz*), 14 days (*gz*), or 28 days (*gz*)
Last updated: Fri, 22 Mar 2002 5:00 AM

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Mission/category: ALL all Go

List all changes for FUSE

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

Target Search Error
2001 June 12
An error was discovered in the target search available from the main MAST page. Searches would fail for object names containing special characters (such as a "+" symbol as in BD +28 4211). The error was fixed on the above date.

Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

FUSE Daily Data Reports
2000 November 20
We've added a set of pages showing recently archived and recently released FUSE data. These pages are automatically updated every day.

FUSE Search Pages Revised
2000 August 28
Minor changes were made to the science and exposures search and retrieval pages. Help files are also now available describing the column headings of the search results tables.

New FUSE Page
2000 August 21
The MAST FUSE page has been revised following the format used for the other MAST mission pages. An "all sky" plot was also added showing FUSE observations up through August 18th, 2000.

Cross Correlations with Sky2000 Catalog
2000 August 16
Cross correlations of MAST missions with the SKYMAP Sky2000 catalog (version 3) are now possible from the MAST Cross Correlation page.

New Copyright Notice
2000 May 12
STScI has adopted a new Copyright statement. Most, if not all, MAST web pages should now include a link to the new page.

FUSE
1999 June 24
FUSE is launched. FUSE data will be archived and available through MAST.

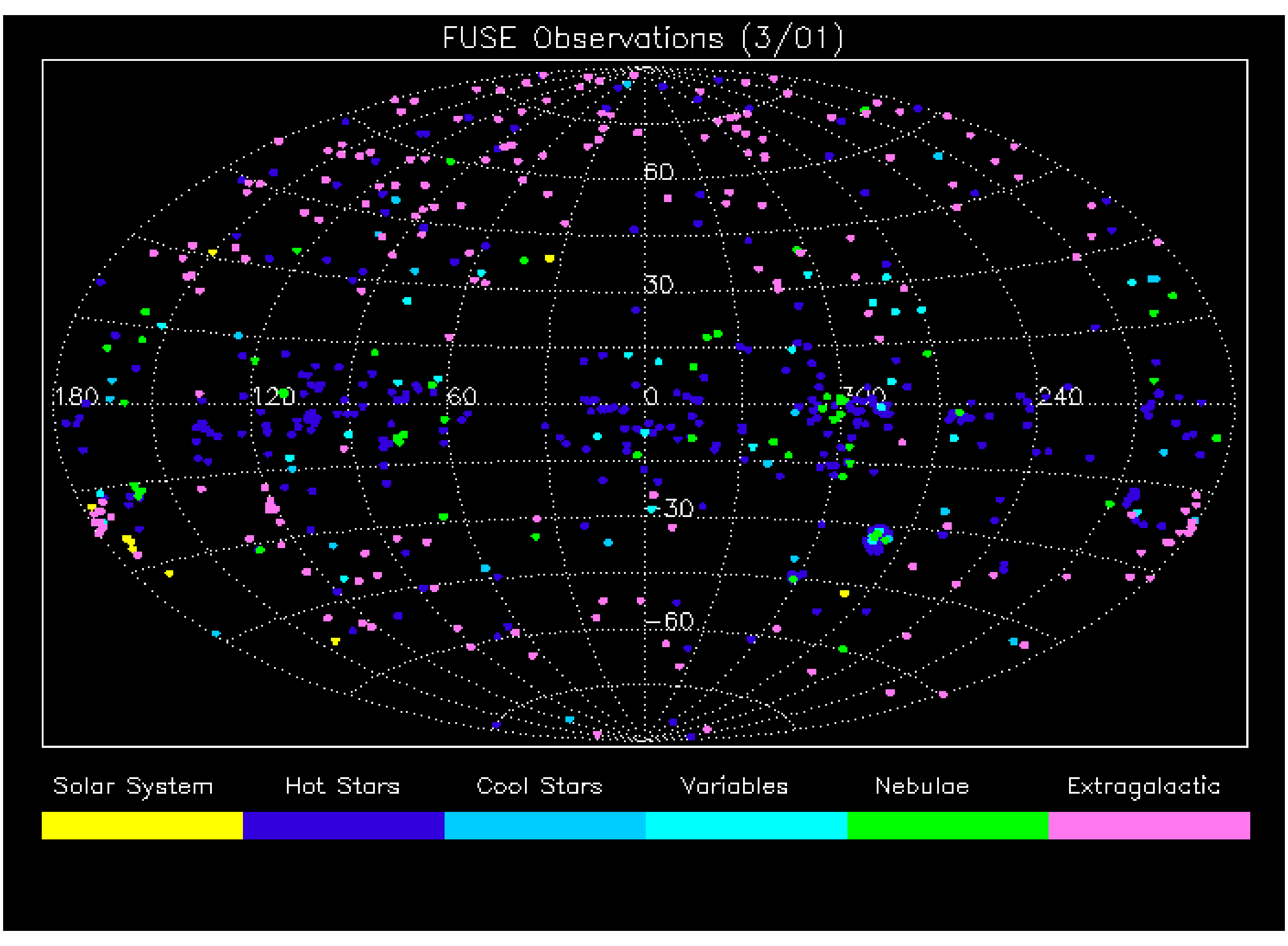
Instrumentation/Operations

- Mission Operations
- FUSE Observer's Guide
- Mission Status

Acknowledgments

We would like to acknowledge the FUSE project for providing the majority of online information available from MAST. We recommend that users consult the Johns Hopkins FUSE website for the latest information on FUSE.

Please e-mail questions regarding the Johns Hopkins FUSE website and/or guest obsever support, to fuse_support@pha.jhu.edu. Comments about the FUSE archive or MAST interface should be sent to archive@stsci.edu.

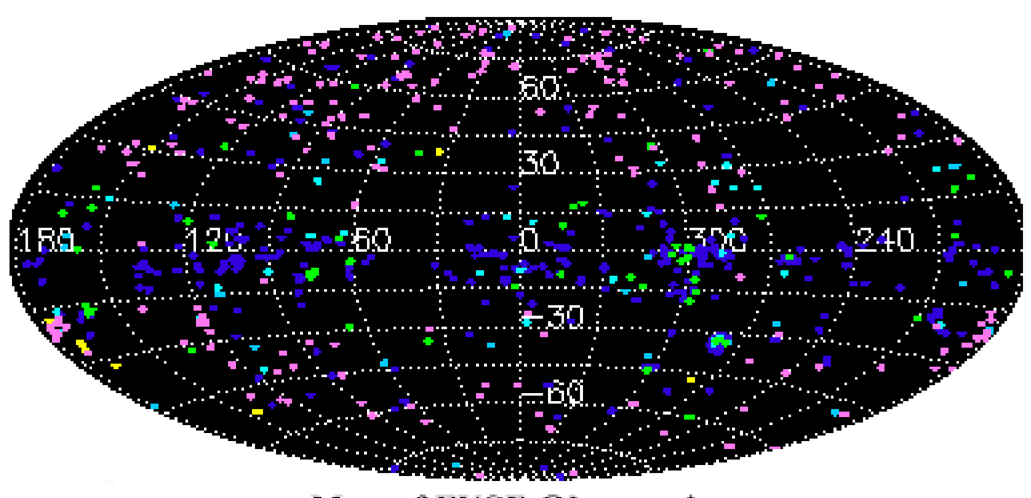


FUSE Observations (3/01)
60
30
180
120
60
0
300
240
-30
-60
Solar System
Hot Stars
Cool Stars
Variables
Nebulae
Extragalactic

The Far Ultraviolet Spectroscopic Explorer (FUSE), launched on June 24, 1999, covers the 905-1187 Å spectral region and will obtain high resolution spectra of hot and cool stars, AGNs, supernova remnants, planetary nebulae, solar system objects as well as perform detailed studies of the interstellar medium. FUSE will be able to observe sources 10 000 times fainter than Copernicus, an early FUV mission, and has superior resolving power than the Hopkins Ultraviolet Telescope (HUT) and the Berkeley Spectrograph (BEFS) and the Tübingen Echelle Spectrograph (TUES) of the Orbiting Retrievable Far and Extreme Ultraviolet Spectrometers (ORFEUS). FUSE was planned for a 3 year lifetime with funding for an additional 2 years expected.

More information about the FUSE Guest Investigator program, including PI and Cycles 1 and 2 GI target lists, may be found at the FUSE Guest Investigator Program site at http://fusewww.gsfc.nasa.gov/.

Although FUSE data is maintained and archived within MAST, most of the documentation available from the MAST FUSE page is obtained from the Johns Hopkins FUSE website.



Map of FUSE Observations

Getting Started

The International Ultraviolet Explorer (IUE) satellite was a unique space observatory in that it was operated like a ground-based observatory. Astronomers came to the Telescope Operations Center and directed their observations while observatory staff members commanded the instrument and read down the data in real time. It was launched on January 26, 1978, and operated for nearly 19 years until September 30, 1996. The instrumentation included two spectrographs, one from 2000 to 3300 Å and the other from 1200 to 2000 Å, in both high (R ~ 10,000) and low (R ~ 300) resolution modes.

The archive of over 107,000 spectral images includes about 9200 individual objects, many of which were observed repeatedly for variability studies. All types of astronomical objects, from planets to galaxies, were observed by IUE but a major portion of the archive is devoted to stellar observations. The search form may be used to select data from the IUE catalog by object name, coordinates, observing mode, date of observation, etc. The data files of interest may then be marked and retrieved.

MAST holdings contain the fully reduced and calibrated spectra in two versions. The first version consists of the original processed data using the IUE Spectral Image Processing Software (IUESIPS). The data files are stored in VICAR header format and can be read and analyzed with the IUE Data Analysis Center (IUEDAC) software package written in IDL. The data were later reprocessed using new calibrations and improved processing techniques (NEWSIPS), producing a second version known as the IUE Final Archive. The NEWSIPS data files are stored in FITS format and may be read with a variety of FITS readers, including iuetools in IRAF and programs in the IUEDAC software package. The Final Archive data are the preferred version for most applications, but both versions are available.

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Search and Retrieval

The IUE Archive is currently maintained at the Space Telescope Science Institute (STScI) as part of **MAST**, the Multi-mission Archive at STScI. The data are stored in gzipped compressed format on compact discs (CD's), and accessed through a CD jukebox. The IUE archive contains data processed from both the IUESIPS and NEWSIPS data processing systems. Primary access is via the web although alternatively, users may **download IUE files via ftp**. Additional data retrieval methods may be available in the near future.

Normally web users will search the IUE database for particular files using the **IUE search page**. The returned table of found entries will allow the user to mark the images to be downloaded. Alternatively, if the camera and image numbers are already known, they can be directly entered into the **IUE data retrieval** page. Your request for data begins a retrieval job. Several CD's may need to be accessed in order to obtain the files you have requested. Once the requested files are located, they are written to a data distribution disk area on the system, bundled into a tar or zip format file, and downloaded to the disk area specified by the user in the "save as.." pop-up window. The files are downloaded when the pop-up window disappears.

If you have problems reading the file formats, please check our **data retrieval help** page for suggested ways to read the downloaded compressed files.

If you have problems retrieving your data, please contact the ST Archive **help desk.**

IUE Retrieval Options

Image IDs

NEWSIPS Data:	**IUESIPS Data:**
MX (FA extracted spectra - mxlo,mxhi)	ME (SIPS - MELO,MEHI)
EXTRACT-FA (si,mx)	EXTRACT (SIPS - MELO,ELBL,MEHI)
ALL-FA (ri,li,si,mx)	ALL (SIPS - raw,mehi,melo,elbl)
SI (FA resampled spectra - silo,sihi)	ELBL (SIPS - Extracted line-by-line)
RI (FA raw image - rilo,rihi)	RAW (SIPS - Raw data file)
LI (FA linearized image - lilo,lihi)	

Download NEWSIPS **data as a** **HELP...**

.tar **file**

Submit Request   Reset this form

Fri Mar 22 07:24:42 2002

archive@stsci.edu

Data Retrieval Help Page

To retrieve IUE data, mark the rows in the search results page of the desired exposures (or click on the "more retrieval options" page and enter camera and image numbers in the list under "image IDs"). Once the desired files are marked, several options are available for formatting and compressing the data. Generally, MAST files are most efficiently (and quickly) downloaded as a bundled tar or zip file. This means however, that the user is left with the task of extracting the files. The descriptions below list the programs available on different operating systems for reading the various file formats.

Clicking the "Download NEWSIPS MX Files as a .tar file" from the IUE search results page will download a tar file of NEWSIPS FITS files. Users desiring a zip file, or a gzipped tar file, should click the "More retrieval options" button **after** selecting the desired files from the search results list.

Other options available from this page include downloading NEWSIPS, IUESIPS-GO, or IUESIPS-RDAF format files, selecting various NEWSIPS or IUESIPS file types, or requesting files by entering the IUE camera names and image numbers. **Note the current retrieval options allow only one data type and one file format to be requested at a time and the two selected options must agree (e.g. don't select NEWSIPS files and an IUESIPS file type).** If both IUESIPS and NEWSIPS files are desired, two separate file downloads are required.

Data Type
Requests can be submitted for either IUESIPS or NEWSIPS files. NEWSIPS files are in FITS format while IUESIPS data is archived in IUE GO format and needs special software to be read. In general, NEWSIPS data is recommended for most users.

Conversion Options
IUESIPS data can be requested in either GO or RDAF formats. The default format is GO. IUE RDAF software uses RDAF format files, however the IDL program GOTORDAF can be used to convert GO format files to RDAF format (see also RDAFTOGO).

File Download Options The current IUE file download options include:

Data Format:

- NEWSIPS - FITS files produced by the IUE New Spectral Image Processing System,
- IUESIPS_GO - IUE GO format files produced by the original IUE Spectral Image Processing System,
- IUESIPS_RDAF - IUESIPS-processed files in RDAF-format.

Data Compression Options:

- .tar - uncompressed files bundled in a tar file. (Note, prior to 10/21/99, the individual files were also gzipped by default.)
- .tar.gz - files are bundled into a tar files which is then compressed using gzip.
- .zip - files are bundled (and compressed) into a zip file,

Download times can vary according to the number of CD's needed to be mounted in order to fulfill the data request. NEWSIPS MX files (i.e., mxlo or mxhi files) however are now online and can therefore be retrieved much faster. Users know when the request is completed when the browsers "Download window" disappears. Requests for a few files are normally completed in a couple of minutes.

It should be pointed out that the "time Left" gauge in the pop-up window will not accurately show the remaining download time. The file transfer speeds will eventually be displayed, but the download is basically not complete until the pop-up window disppears.

In addition to the requested files, users will also receive an ASCII text file called **filetypes.txt** which describes the various IUE data types, and, an ASCII text file called **status.txt** describing the status of the users data request. More information on status.txt is provided below.

UNIX

For unix users, the downloaded tar files can be extracted using the command:
$ tar xvf filename

Gzipped tar files can be read the same way, after first running the command:
$ gunzip filename

Requested ZIP files can be opened using unzip:
$ unzip filename

If FITS files were requested, the uncompressed files can be read with a standard FITS reader (although it must support binary table extensions). If IUESIPS GO format files were downloaded, they can either be read using custom software, or converted to rdaf format using the gotordaf routine from the IUEDAC IDL library. RDAF format files can also be requested directly from MAST.

VMS

Since gzipped, tar, and zip file formats are not as common on VMS systems, users may first need to download the software necessary to extract the downloaded files. GUNZIP, TAR2VMS, and UNZIP are all public domain software available from DECUS. To see if these programs are already available on your system, type:
$ show symbol tar2vms
$ show symbol gunzip
$ show symbol unzip
Depending on the format you select for downloading the files, if the program you want is undefined, (and assuming it doesn't exist under another name) they can be downloaded as follows:

Download the TAR2VMS executable by clicking on the appropriate OpenVMS system below:

- (VAX `tar2vms` executable) (15 blocks)
- (ALPHA `tar2vms` executable) (20 blocks)

Once you have downloaded the executable, type the following commands (note the first command defining tar2vms could be added to your login.com file):

VAX:

$ tar2vms :== $disk:[account]tar2vms.exe
$ tar2vms xvf iue.tar
or ALPHA:
$ tar2vms :== $disk:[account]tar2vms_alpha.exe
$ tar2vms xvf iue.tar

where "disk" and "account" are the names of the disk and directory where the executable resides.(Note the "$" in front of the disk name!) The file "iue.tar" listed above is an example of the file name downloaded from MAST. The actual name will depend on the file format requested.

The gunzip program (as well as unzip for ZIPed files) can be dowloaded directly from **Digital**. Be sure to select the appropriate executable for your system (i.e., *-vax for vaxes, *-axp for alphas). To install gunzip or unzip, follow the directions above for tar2vms. That is, define a symbol for the command name (with the "$" added to the file path) and then just type (for example):
$ unzip iue.zip   or
$ gunzip iue.tar.gz
(Note after downloading and unpacking RDAF format IUESIPS files, VMS users will need to convert their files with a program such as CON_RDAF (i.e., using the SPARC to VMS mode option).

The above commands will create a subdirectory called IUE containing all the requested files. NEWSIPS files will have names in the form swp12345.mxlo, while IUESIPS files will have names such as swp12345llg.dat & .lab, or swp12345.melol.

IUESIPS files can be requested from the "More Retrieval Options" page in either GO format, or RDAF format. After extracting, GO format files will have names such as swp12345.melol, while RDAF format files will have names such as swp12345llg.dat and swp12345llg.lab. The main differences between the 2 formats is that the RDAF format stores the VICAR label in a separate file from the data and, the data stored in the RDAF .dat files are assumed to be converted to a format compatible with the local operating system. Because of the latter difference, VMS users planning to use the IUERDAF IDL software should run the program con_rdaf on all rdaf-format files. (i.e., using the SPARC to VAX mode option). (Since the MAST archive is stored on a unix computer, no conversion is needed when the files are downloaded to unix or Macintosh computers.) Alternatively, users may request GO format files and convert them to RDAF format using the IUERDAF program GOTORDAF. For example, to convert the file described in the example above from GO to RDAF format, simply type (from IDL):
IDL> gotordaf,'swp07971.melol'
This will produce a standard .dat and .lab file in the format appropriate for the host computer. (The RDAF IDL routines can be downloaded from the **IUEDAC** web page.)

Windows

If you are using a PC running Win3.x, Win95, or WinNT, you can request the data in either tar or zip format and use the shareware program **WinZip** to both uncompress and extract the files. Extracting the tar or zip file from WinZip will create an IUE subdirectory containing the images requested. If you don't have WinZip, the programs **pkzip/pkunzip** should also work, but they have not been tested.

The tar.gz format can also be read on a pc, but in our experience with WinZip, the system renames the downloaded file to be iue_tar.gz (instead of the original iue.tar.gz), and therefore the file may need to be renamed to iue.tar to be recognized as a tar file after unzipping.

IUESIPS files can be requested from the "More Retrieval Options" page in either GO format, or RDAF format. After extracting, GO format files will have names such as swp12345.melol, while RDAF format files will have names such as swp12345llg.dat and swp12345llg.lab. The main differences between the 2 formats is that the RDAF format stores the VICAR label in a separate file from the data and, the data stored in the RDAF .dat files are assumed to be converted to a format compatible with the local operating system. Because of the latter difference, Window users planning to use the IUERDAF IDL software should run the program con_rdaf on all rdaf-format files. (i.e., using the SPARC to MIPSEL mode option). (Since the MAST archive is stored on a unix computer, no conversion is needed when the files are downloaded to unix or Macintosh computers.) Alternatively, users may request GO format files and convert them to RDAF format using the IUERDAF program GOTORDAF. For example, to convert the file described in the VMS example above from GO to RDAF format, simply type (from IDL):
IDL> gotordaf,'swp07971.melol'
This will produce a standard .dat and .lab file in the format appropriate for the host computer. (The RDAF IDL routines can be downloaded from the **IUEDAC** web page.)

Macintosh

Mac users can now use a free file-decompressor program called **MindExpander** from MindVision, to extract .zip and .gz files. Alternatively, the standard (but not free-ware) **Stuffit Deluxe** utility can also be used. Other utilities include: **UnZip**, **ZipIt**, and UnTar. Since most utilities only support zip or gz files, Mac users may want to request zip format rather than tar from the "more retrieval options" page. Tests run with Stuffit Deluxe however, showed that tar files can be read without any trouble.

IUE Data Types

The available IUE data types are displayed on the "More Retrieval Options" page and are described below. Normally users request the merged extracted spectral files (i.e., NEWSIPS MXLO or MXHI files, or IUESIPS MELO or MEHI files). Additional documentation is available on both the NEWSIPS and the (GO-format) IUESIPS data products.

NEWSIPS Files

- **MX** - The merged extracted spectral files containing the absolutely-calibrated fluxes, wavelengths, data quality flags, and sigmas (or noise estimate for MXHI files) in a FITS binary table extension. The high dispersion files are named MXHI and the low dispersion files are MXLO. Note that although low dispersion double aperture exposures are listed as two separate entries on the search results page, both spectra are contained in one MXLO file.
- **EXTRACT** - This group contains the MXLO, MXHI files described above, plus the resampled image files (SILO & SIHI) from which the fluxes were extracted. The SI files contain the photometrically-corrected and rotated image as a primary array, wavelength information in a binary table extension, and an image extension containing an array of data qualiy flags. These files are useful for identifying camera artifacts such as cosmic ray hits, etc.
- **All-FA** - All the archived NEWSIPS data products for a given observation can be requested by selecting this group. In addition to the files above, the RILO, RIHI raw image files (a 768x768 primary array image) and the LILO, LIHI linearized image files (a 768x768 primary array file with associated data quality flags as a 768x768 array image extension) will be downloaded.
- **SI** - Select this group if only the SILO, SIHI resampled image files are to be downloaded.
- **RI** - This group allows only the RILO, RIHI raw image files to be downloaded.
- **LI** - This group allows only the LILO, LIHI linearized image files to be downloaded.

IUESIPS Files

- **ME** - This group includes the merged extracted spectral files containing the absolutely-calibrated fluxes, wavelengths, and data quality flags in a project-defined data format based on VICAR. The high dispersion files are named MEHI and the low dispersion files are MELO.
- **EXTRACT** - This group contains the MELO, MEHI files described above, plus the low dispersion resampled line-by-line image (ELBL) files from which the fluxes were extracted (note no IUESIPS high dispersion resampled images were generated). The ELBL files contain the photometrically-corrected image data, wavelength information, and data qualiy flags. These files are particularly useful for identifying cosmic ray hits, reseau, microphonic noise, etc.
- **ALL** - All the IUESIPS archived data products for a given observation can be requested by selecting this group. In addition to the files above, the RAW image file (a 768x768 array) will be downloaded.
- **ELBL** - This group allows only the low dispersion resampled image (ELBL) files described above to be downloaded.
- **RAW** - This group allows only the RAW image files to be downloaded.

Status.txt File

The status.txt file is downloaded along with the users requested files to provide information on the users request. This file may be useful for explaining why an expected file was not received. The following information is currently included in these files:

- **Observations requested** - The number of camera name/image sequence number entries specified by the user.
- **Requested data types** - A list of the IUE data types (e.g., melo, sihi, etc.) to be retrieved from the MAST archive as specified by the user in the data type menus on the "more retrieval options" page, or as specified on the search results page if downloading MX files was requested,
- **Compression type** - The method used to compress/bundle the requested files. The possible values are:
  - tar - files will be bundled as a .tar file.
  - zip - Files bundled and compressed as a zip file with no further compression applied to individual files.
  - tar.gz - Files bundled as a gzipped tar file
- **Data format** - Describes whether NEWSIPS, IUESIPS-GO, or IUESIPS-RDAF format files were requested,
- **File list** - The list of downloaded files showing the (uncompressed) file name and the uncompressed file size in kilobytes. A message will appear next to any entries either "not found in the database" or, more rarely, "found in the database but not located on the jukebox". (Users should report any missing files to archive@stsci.edu.)
- **Total number of found files** - The total number of files found in the database that were requested by the user. Note that it's possible for files to be listed in the database but still not available from the CD jukebox. These cases should be reported to archive@stsci.edu.
- **Total file size** - The total amount of disk space (in kilobytes) required to uncompress the requested files. Note that RDAF format IUESIPS file sizes are approximate.

Retrieving IUE Data via FTP

The IUE archive consists of raw and processed data produced by both the IUESIPS and NEWSIPS data processing systems, and is accessible through MAST, the Multi-mission Archive at STScI. The data sets are stored in gzipped compressed format on compact discs (CD's), and accessed through a CD jukebox. Although most users access the archive via the IUE search page using a web browser, FTP access is also possible using either a web browser (i.e., ftp://archive.stsci.edu/pub/iue/data/), or, as explained below, using anonymous ftp from an ordinary terminal with network access.

Users should be cautioned that FTP access is currently restricted in the following ways:

1. the user must already know the camera name, image sequence number, and the data type of the file(s) to be downloaded,
2. no files conversions are currently available via ftp, so returned files are sent individually, in gzipped compressed mode.

In general, IUE data is accessed via symbolic links in subdirectories under /pub/iue/data. The directories are organized by camera name and image sequence number. A separate directory exists for each camera (i.e., lwp,lwr,swp,swr) and below each of these directories is a separate directory for each 1000 image numbers. These directories are named according to the starting image number in each group (i.e., 1000, 2000, 3000, ...). As an example, a typical interactive ftp session to retrieve files lwp21500.mxlo.gz and lwp21500.silo.gz would be:

ftp archive.stsci.edu
anonymous
username@univ.edu
binary
cd /pub/iue/data/lwp/21000
get lwp21500.mxlo.gz
get lwp21500.silo.gz

To simplify access, two shell scripts and a vms command file have been written which require the user to specify only the file name and the desired data type. The programs determine the file path based on the input image name. In addition to downloading the data, the VMS command file also renames the files. Because VMS file names are not allowed to have two decimal points, a file named lwp21500.mxlo.gz would normally be downloaded as lwp21500.mxlo$5Ngz. (at least this is what we've found using Multinet ftp). The command file getiue.com renames these files to lwp21500_mxlo.gz, uncompresses them (requires gunzip) and them renames them to be (for example) lwp21500.mxlo. The shell scripts **iuemulti**, **getiue** and the VMS command file **getiue.com** are all available via ftp on archive.stsci.edu in /pub/iue/software/data_retrieval.

If you have problems reading the file formats, please check our **data retrieval help** page for suggested ways to read the downloaded compressed files.

If you have problems retrieving your data or wish to donate your own shell scripts or programs for accessing MAST data, please contact the ST Archive **help desk.**

What's New for IUE during last year

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

Coplotting Option now available for IUE Spectra
2001 December 10
A new option is available on the search results page of the IUE search script which allows users to coplot up to 15 selected IUE spectra and interactively rescale the resulting plot.

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

Target Search Error
2001 June 12
An error was discovered in the target search available from the main MAST page. Searches would fail for object names containing special characters (such as a "+" symbol as in BD +28 4211). The error was fixed on the above date.

Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

Frequently Asked Questions

Data Requests

- Why do I get 2 IUESIPS MELO files for some low dispersion images but only 1 NEWSIPS MXLO file?
- Can I request IUE data in ASCII format?
- Why are some IUE NEWSIPS data not available? The IUESIPS version is available from the archive.

Reading Files

- How do I read NEWSIPS files into IRAF?
- How do I read NEWSIPS files into IDL?
- Why are my RDAF-format IUESIPS files unreadable after I transferred them from NDADS to my unix workstation?
- Can I use SAOimage to look at NEWSIPS files?

NEWSIPS Processing

- What is the wavelength scale used for NEWSIPS? Is it heliocentric?
- I have a NEWSIPS image which may not have been processed correctly (wrong dispersion, wrong exposure time). How can I get a correct version?
- The wavelengths for the Mg II h and k lines are very different, by almost an Angstrom, between my IUESIPS and NEWSIPS high-dispersion data. Is this an error?
- The wavelengths for my high-resolution NEWSIPS spectra seem to be off by almost an Angstrom. What happened?

ASCII Logs

- Are there ASCII files containing the IUE Merged Log?

Data Analysis

- When analyzing data, which of the data quality flags should I use to throw out pixels?
- When coadding like spectra, should I weight the constituent spectra by exposure time or the square root of exposure time?
- Whew! Is there a simpler way of estimating noise?

Data Requests

- ***Why do I get 2 IUESIPS MELO files for some low dispersion images but only 1 NEWSIPS MXLO file?***
  In IUESIPS, the extracted data for large and small aperture data from a given image were archived as two separate files (e.g. MELO1 and MELO2). In NEWSIPS, the extracted data for both apertures were archived in the same FITS file (e.g. MXLO).

- ***Can I request IUE data in ASCII format?***
  ASCII versions of the mxlo and mxhi files are available. From the search results page click on the object name to display the preview image. The ASCII versions can be downloaded by clicking on the line "Download a gzipped ASCII file of the large/small aperture preview spectrum." This line is found at the bottom of the preview page. If the image contains an exposure for both apertures, there will be a line and file for each aperture.

- ***Why are some IUE NEWSIPS data not available? The IUESIPS version is available from the archive.***
  There are various reasons why certain images may not be available. Some images are have problems that can't be handled by the NEWSIPS software but are glossed over by IUESIPS. Some images were misplaced during the processing and archiving process; we are chasing them down now. If you are interested in a particular image that doesn't seem to be available, please contact us and we will find out and make it available to you if possible.

Reading Files

- ***How do I read NEWSIPS files into IRAF?***
  The **iuetools** package will allow users to read NEWSIPS files. Currently the package requires IRAF (V2.11 or later), TABLES (V2.0 or later) and STSDAS (V2.0 or later). Here is more information.

- ***How do I read NEWSIPS files into IDL?***
  IDL programs are available to read in the NEWSIPS files. Use READMX to read either MXLO or MXHI files, and READSI to read either SILO or SIHI files. See the IUEDAC User's Guide for more information.

- ***Why are my RDAF-format IUESIPS files unreadable after I transferred them from NDADS to my unix workstation?***
  RDAF format files from NSSDC use the VAX VMS floating point data format and must be converted to IEEE format before being copied to a unix workstation. See our helpful hints about file copying from NDADS for more information. **(Note however that IUE files are no longer available from NDADS.)**

- ***Can I use SAOimage to look at NEWSIPS files?***
  Yes, it will handle the RI, LI, and SI files but not the VD and MX files. Use the options -fits to tell SAOimage that the files are FITS and -upperleft to display the images in the usual orientation, e.g. saoimage -fits -upperleft SWP12345.RILO. Adding the options -min and -max to scale the dynamic range of the grayscale display is also a good idea.

NEWSIPS Processing

- ***What is the wavelength scale used for NEWSIPS? Is it heliocentric?***
  Yes, the wavelengths have been corrected for both the Earth's motion around the Sun and the IUE spacecraft's motion around the Earth, computed as of the start of the exposure. A more up-to-date platinum-neon line library was used to create the wavelength calibration, resulting in some small systematic changes in the wavelength scale compared to IUESIPS. Some other small differences compared to IUESIPS are described in the NEWSIPS Manual Appendix III.

- ***I have a NEWSIPS image which may not have been processed correctly (wrong dispersion, wrong exposure time). How can I get a correct version?***
  Please let us know; we certainly would like to correct any errors. We have a limited capability to reprocess images through NEWSIPS if there was an error in the processing. Send email to archive@stsci.edu.

- ***The wavelengths for the Mg II h and k lines are very different, by almost an Angstrom, between my IUESIPS and NEWSIPS high-dispersion data. Is this an error?***
  The IUESIPS data follows the old convention of giving wavelengths in air for wavelengths greater than 2000 Å and in vacuum for wavelengths shorter than 2000 Å. The NEWSIPS data follow the new convention, also used by HST, of giving all

ultraviolet wavelengths in vacuum. The difference is pretty large. For instance, Mg II h is 2802.695 in air but 2803.52 in vacuum, Mg II k is 2795.53 in air but 2796.35 in vacuum, and Mg I is 2851.65 in air but 2852.49 in vacuum.

- ***The wavelengths for my high-resolution NEWSIPS spectra seem to be off by almost an Ansgtrom. What happened?***
  The NEWSIPS data follow the new convention of using ultraviolet wavelengths in vacuum. Most IUE data users are accustomed to using wavelengths in air for wavelengths longward of 2000 Å, i.e. all LWP and LWR data. (See also the answer to question about Mg II line wavelengths above.)

ASCII Logs

- ***Are there ASCII files containing the IUE Merged Log?***
  Yes, there are ASCII files with the IUE Merged Observing log. There are several subsets of the observing log available also.

Data Analysis

- ***When analyzing data, which of the data quality flags should I use to throw out pixels?***
  Almost certainly all of the nonzero flags. One can imagine situations (the only spectrum in the archives of your source) where you would want to "look" at a spectral feature which was uncalibrated, on the edge of the camera field, or whose fluxes were extrapolated beyond the highest ITF-calibration level - but even in this regime one would probably not want to try to conduct a quantitative analysis of the feature.

  Users should also be aware that no attempt was made in NEWSIPS to eliminate cosmic rays from the high-dispersion images, and the attempts made for low dispersion probably err on the conservative side. The reason for this was a concern that a provision for cosmic rays would lead NEWSIPS inadvertently to remove actual emission lines. Users should especially be cautious about the influence of oblique, diffuse cosmic rays, which can subtlely affect the background surface by 150 pixels or more from the centroid of the "hit" region and be responsible for less than optimal fits to the background surface. We suggest that the SIHI or SILO images be first visually screened before the extracted spectra are analyzed.

- ***When coadding like spectra, should I weight the constituent spectra by exposure time or the square root of exposure time?***
  Probably neither. An analysis of the noise properties of the IUE cameras for IUESIPS (e.g. as given by Ayres, PASP, 102, 1420, 1990 and PASP, 105, 538, 1993), but probably also applicable to NEWSIPS, suggests that the signal to noise gain is an increasing function of exposure time, but which is slower than either the limits of Exp_time or sqrt(Exp_time). Of course, the actual situation is even more complicated. For example, for integration longer than the "optimal" exposure time, illuminated pixels saturate and are useless. In this regime the quality of the data quickly *degrades*; saturated pixels can never be used for any purpose.

  For the coaddition of data, we recommend weighting individual spectra by reciprocal of the means of their noise fluctuations. (But in computing such a mean consider only those pixels with zero-value quality flags!) The "sigma" vector is computed by NEWSIPS as an estimate of these fluctuations as a by-product of the flux extraction process. For the extracted MXHI data the estimate for each wavelength pixel is based on predicted fluctuations of extraction slit pixels from the noise model for the same region of the camera. The units of the sigma vector in high dispersion are in "FNs" (Flux Numbers), the same as the *net flux* vector. For MXLO data the sigma vector is derived from the noise model, but it depends also upon the relative illuminations of pixels along the extraction slit. In this case the result is also scaled to units of *absolute flux*.

- ***Whew! Is there a simpler way of estimating noise?***
  Yes. The time-honored way is to find a stretch of continuum in the extracted spectra which contains no spectral features and is free of pixels of with negative data-quality flag values and then compute the rms formally from its noise fluctuations.

  Since "clean" continuum is not always easy to find, let's consider an empirical procedure which works well even for a spectrum containing features. As long as the flux errors are primarily gaussian-distributed, we can make use of the fact that randomly drawn samples will differ from one another, on average, by exactly one standard deviation. In the computing language IDL, an estimate of the rms may be computed conveniently by a few steps. Defining "*f*" as a spectral flux array taken from pixels near the blaze maximum (so the noise will be approximately uniform along the spectrum) and containing only zero-valued quality flags, we compute the mean point to point fluctuation of two pixels separated by a short distance *n*:

  The distribution of noise fluctuations among these pixels can be obtained from the computation:

  rmsdist = abs(*f* - shift(*f* , *n*)) .

  The median of this distribution is computed by sorting the distribution *rmsdist* and finding the middle element of the sorted *rmsdist* array, which by definition is half the number of elements in the distribution. Thus:

  ntot = n_elements(*rmsdist*), so *ntot2* , = *ntot*/2 ,

  Now we compute the sorted index distribution and take the value of *rmsdist* we need:

  isort = sort(*rmsdist*) ,

  medrms = *rmsdist*(isort(*ntot2*)) . *medrms* is the our noise estimate using the median average.

  The *mean* of the distribution can likewise easily be determined from:

  meanrms = total(*rmsdist*)/*ntot* .

  This value will be biased on the high side if there are outlying fluctuations in the spectrum. In practice the pixel separation distance *n* should be at least a spectral resolution element (3 or more).

Index of IUE Topics

Acronym Lists for IUE Terms
- INES < INES Glossary (pdf file) >
- NEWSIPS < NEWSIPS Man. Append. 2: Glossary >
- MAST < MAST acronym list >

Apertures
- Dimensions (in arcsec) < NEWSIPS Man. Chap. 2.2 >
- Geometry < NEWSIPS Man. Figs. 2.16-2.18 >
- LGAP tilt corrections < NEWSIPS Man. Chap 7.2.3 >

Cookbooks for Input/Output & Analysis of Data
- For IUEDAC routines < http://archive.stsci.edu/iue/iuedacfits.html >
- For IRAF/STSDAS routines < http://archive.stsci.edu/iue/ueiraffits.html >

Data Anomalies
- Camera artifacts (high disp.) < Crenshaw et al. PASP paper >
- DMU corrupted pixel ("DN = 159") < NEWSIPS Man. Chap. 4.5 >
- 1515Å artifact (low disp.) < NEWSIPS Man. Chap. 6.4.3.2 >

Database
- IUE Merged Log (ASCII) < IUE Merged Log Files >

Data file types
- IUESIPS < IUESIPS Man. Chap 8.1.3 >
- NEWSIPS < NEWSIPS Man. Chap 12.1 >

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- FAQ (pixels to excise?) < FAQ #15 >
- Spectrum for low disp. < NEWSIPS Man. Chap. 9.6 >
- Spectrum for high disp. < NEWSIPS Man. Chap. 10.2.4 >
- Resampling < NEWSIPS Man. Chap. 7.5 >
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- IRAF i/o of FITS files < STSDAS/IRAF Routines > < FAQ #6 >
- Conversion of GO (IUESIPS) files < IUEDAC routines, Sect. 1B >

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- Browse NEWSIPS spectrum or image <IUE Preview Images >
- FAQ on "saoimage" for images < FAQ #9 >

Echelle Orders
- Line locations in pixels (high disp.) < NEWSIPS Man., Chap. 10.2.1, Tab. 10.1 >

Errors (net flux)
- see "data quality flags" above
- Noise estimate (empirical) < FAQ #17 >
- Noise model, High disp, NEWSIPS < NEWSIPS Man. Chap. 10.2.3 >
- Noise Model, Low disp, & SWET use; NEWSIPS < NEWSIPS Man. Chap. 9.1 >
- Noise Model, High disp, used by SWET; NEWSIPS < NEWSIPS Man. Chap. 9 >
- Periodic noise < NEWSIPS Man. Chap. 6.1.4> >
- Pixel weighting < FAQ #16 >
- Signal gains for coaddition of spectra < Nichols & Linsky AJ paper, p.531 >

Extraction (gross flux)
- Length of slits (high disp, in px) < NEWSIPS Man. Chap. 10.2.2, Tab. 10.2 >
- "Optimal" (low disp), "SWET" < Kinney et al. PASP paper > < NEWSIPS Man. Chap. 9 >

Extraction (background flux)
- Background verification (high disp.) < INES pdf file, Sect. 3, p. 7 >
- How to customize < NEWSIPS Man., Chap. 10.1.6 >
- Reported problems (null drift) < Smith 1999 PASP paper >

Final Archive
- General description of NEWSIPS < Nichols & Linsky AJ paper >

Instrumental...
- Attributes (high disp.) < Spectrogr. parameters >
- Layout < IUE Observing Guide, Fig. 2.1 >
- Resolution in disp. dir. < Chap. 2.3.1.1, low disp. > < Chap. 2.3.2.1, high disp. >
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- NEWSIPS Man., Tables 11.5--11.8 < LWP, low disp. > < LWR-"A" > < LWR-"B" > < SWP >

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- IDL users' library < IUEDAC s/w procedures >
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- Photometric Correction < NEWSIPS Manual, Chap. 6 >

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- Characterization & avoidance < IUE observing guide, Chap. 4.11 >
- Detection in NEWSIPS < NEWSIPS Man. Chap. 4.2 >
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- Line strengths < Knauth et al. Ap.J. 2001 paper >
- Wavelengths < Smith et al. 2001 PASP paper >
- Flux repeatability < INES pdf file, sect 4., p. 11 >

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- IUE object class code < NEWSIPS Manual, Chap. 14.2 >

Observing Guide
- IUE observing guide < http://archive.stsci.edu/iue/instrument/obs_guide/guide.html >

Observing Research Programs
- IUE research program codes < http://archive.stsci.edu/iue/prog.html >

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- Accuracy < IUESIPS Man., Chap. 6.5, Tab. 6.4 >
- Accuracy: published analysis Smith 2001 PASP paper
- Compute from Grating eqn. < NEWSIPS Man. Chap. 8.3.5, Tab. 8.7 >
- Coverage for order-m (high: all cams.) < NEWSIPS Man. Chap. 8.3.5, Tab. 8.8 >
- Format on raw image, all cams., disps. < NEWSIPS Man. Chap. 2.1 >
- Heliocentric corrections < NEWSIPS Man. Append. 3 >
- Pixel-dims. (spatial), all cams., disps. < all cams., disps. (Tab. 2.3) >
- Instrumental Resolution < Chap. 2.3.1.1, low disp. > < Chap. 2.3.2.1, high disp. >
- Vacuum-to-air conversion (IUESIPS only) < IUESIPS Man., Chap. 6.4.2 >

We welcome suggestions for additional index topics

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Study of Time-Dependent Background and Continuum Flux Levels in SWP-Hi Images

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Papers

The following compilations of scientific atlases, catalogs, and published papers were collected and provided to MAST by the IUE Project.

- IUE Atlases and Catalogues
- Publications

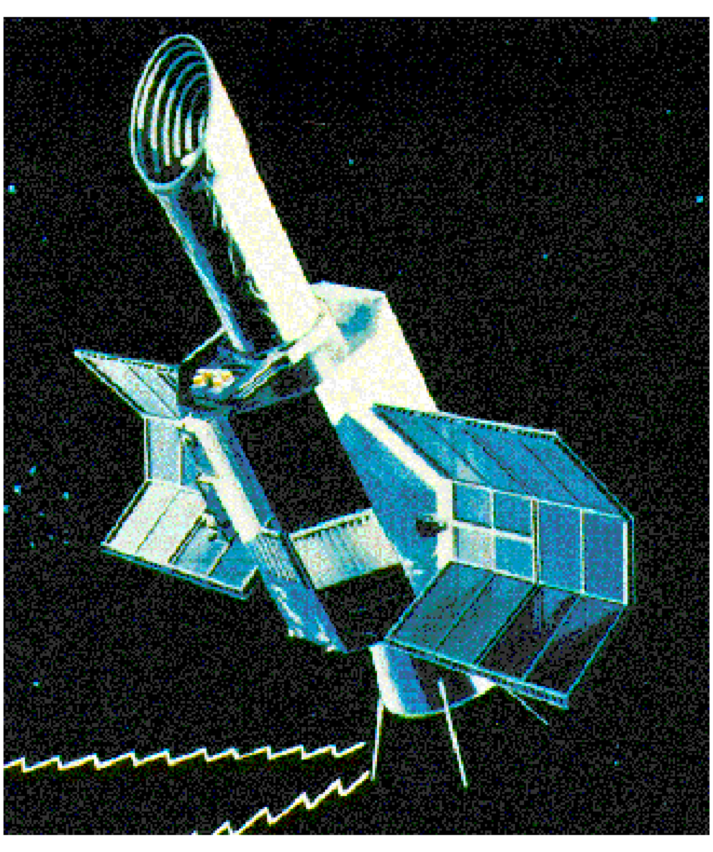
IUE Related Sites

- UK IUE site
- IUE Newly Extracted Spectra-INES Principal Center (STScI Server down until further notice)
- ESA IUE site
- NASA NSSDC Master Catalog Entry

IUE Gallery

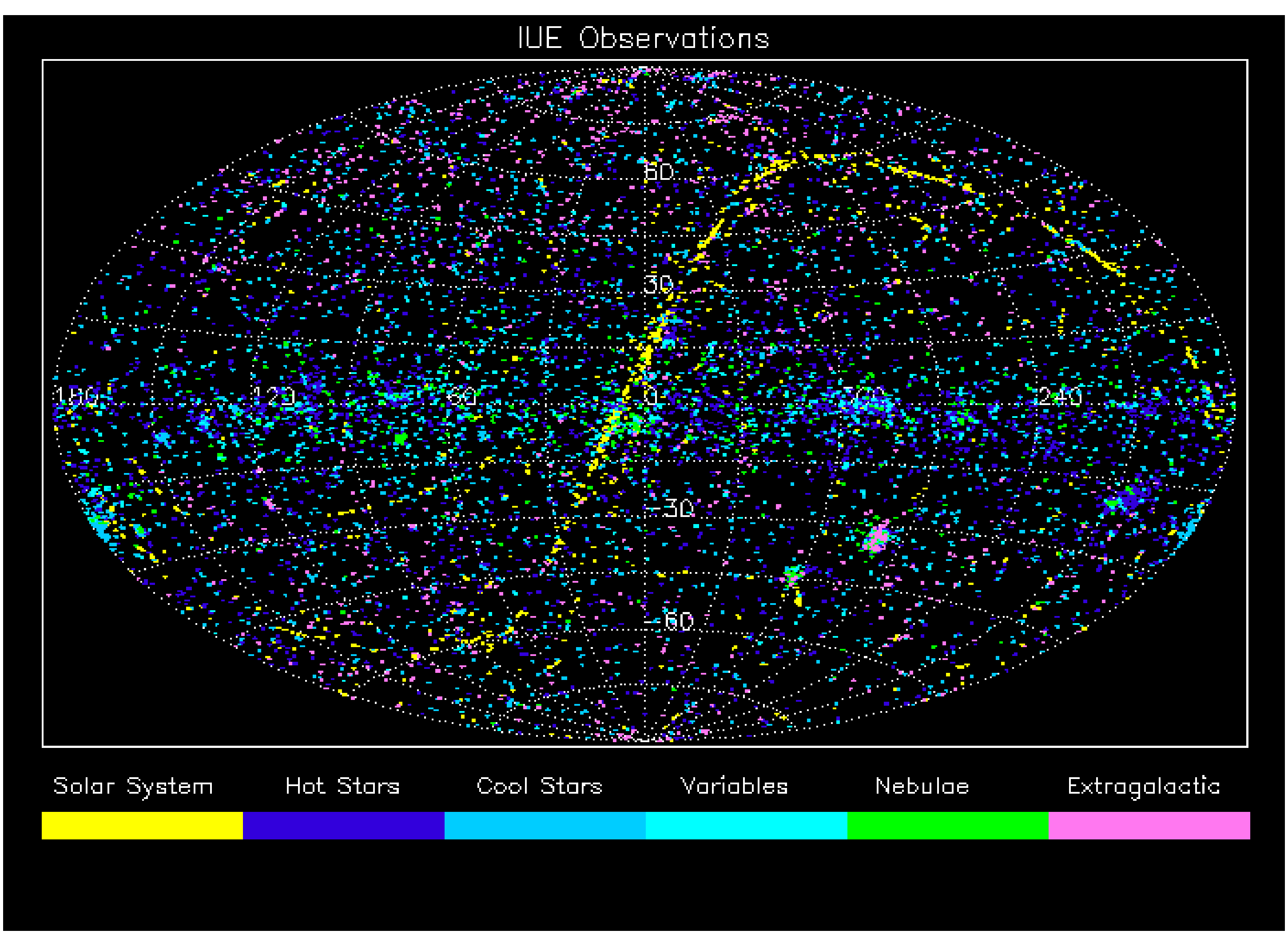
The IUE Data Analysis Center and Telescope Operations staff members collected a variety of photos, images and spectra. The following pages and images were obtained from IUE Project at Goddard Space Flight Center.

- Science and Instrument Related Images
- Additional Public Relations images
- Text only version of Additional Public Relations images
- Prelaunch photographs



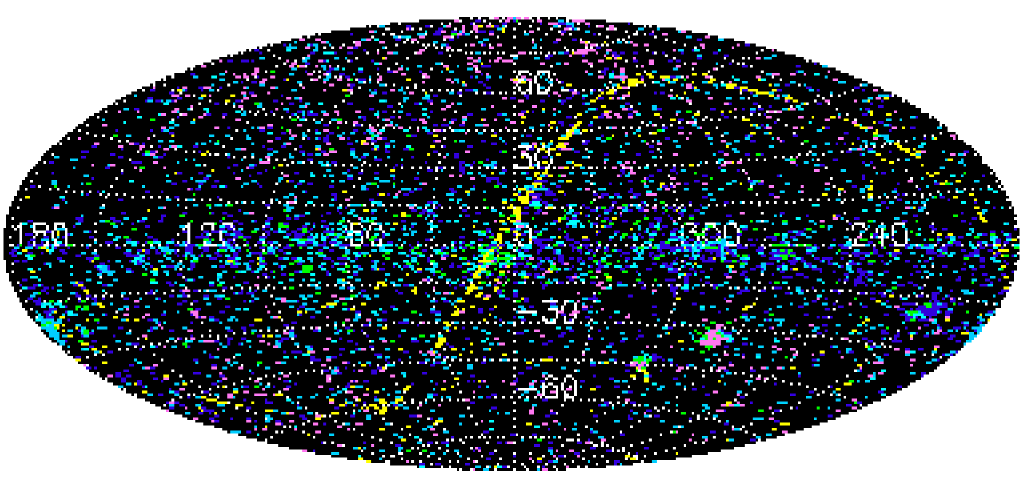
Acknowledgments

The MAST staff would like to thank the IUE Project staff at Goddard Space Flight Center and the National Space Science Data Center staff members for extensive help in acquiring the IUE data, documentation, and web pages.


IUE Observations
Solar System
Hot Stars
Cool Stars
Variables
Nebulae
Extragalactic

http://archive.stsci.edu/iue/

The ***International Ultraviolet Explorer (IUE)*** performed spectrophotometry at high (0.1-0.3 Å) and low (6-7 Å) resolution between 1150 Å and 3200 Å. The data cover a dynamic range of approximately 17 astronomical magnitudes: -2 to 10 for high dispersion; -2 and 14.9 for low dispersion. Over 104,000 ultraviolet spectra were obtained with IUE between January 26, 1978, and September 30, 1996.



Map of IUE Observations

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Getting Started

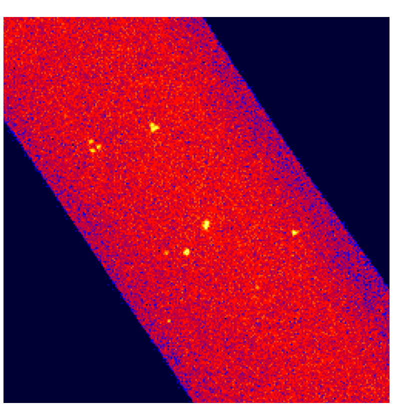
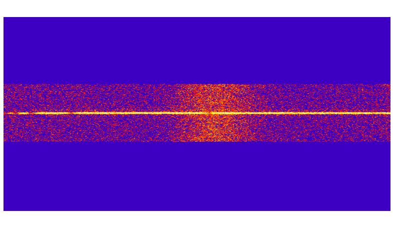
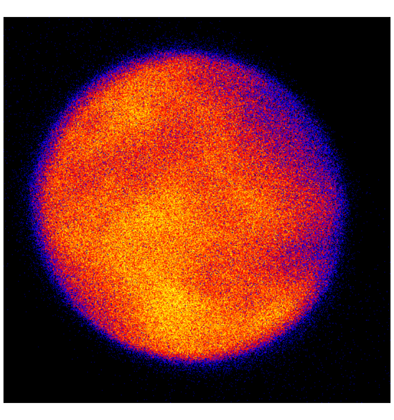
1. Introduction

The Extreme Ultraviolet Explorer (EUVE) was the first satellite entirely dedicated to the Extreme Ultraviolet (EUV) band of the spectrum (70 -760 Å). Launched June 7, 1992, EUVE conducted an all-sky survey that detected over 900 objects. The 6 month survey portion of the mission was followed by 8 years of pointed spectroscopic observations of over 350 objects. The EUVE instrumentation included the Deep Survey (DS) imager and 3 spectrometers. One-half of the light falling in the telescope was focused on the DS and the remaining half was intercepted by one the the spectrometers. The short wavelength spectrometer covered 70-190 Å, the medium wavelength spectrometer covered 140-380 Å, and the long wavelength spectrometer covered 280-760 Å. The resolving power was 260 in each spectrometer. The data from the 3 all-sky survey telescopes ("scanners") is not archived here.

The available data products for the EUVE spectrometers and Deep Survey instruments are stored in two different formats: 1) Binary FITS tables that include time-tagged events for temporal analysis (e.g. light-curves) and 2) 2-D FITS images of the DS and spectrometers. All 4 instruments are stored in a single FITS file with 4 extensions. The reductions that produced the 2-D images are expected to fill the needs of most users, but these can be re-extracted from the FITS tables. EUVE data resides at HEASARC, but are also available through MAST.

Table of EUVE Data Products

If you seek:	Go Here:
Survey Data	SKyView
Spectra	Retrieve _img files
Light-curves	Retrieve _evt files
Pretty Pictures	Gallery

Search and Retrieval

EUVE data reside at HEASARC but may be accessed electronically through either MAST or HEASARC retrieval sites. The MAST **EUVE search form** has the same layout and similar query parameters as search forms of other MAST missions. Submission of this form initiates a a query to the HEASARC "W3browse" master catalog of EUVE observations (EUVEMASTER), which includes data taken from any of the Short Wavelength, Medium Wavelength, and Long Wavelength (SW, MW, LW) cameras or all sky Deep Survey. EUVE operated optimally with one or more of its cameras turned off at any one time. Data from all operational cameras during the observation are stored in multiple extensions of a common FITS file.

Once the requested files are located, they are written to a data distribution disk area on the system, bundled into a tar or zip format file, and downloaded to the disk area specified by the user in the "save as.." pop-up window. The files are downloaded when the pop-up window disappears.

If you have problems making the search query, consult the **search help** page. Once the data are downloaded one can go to the **reading EUVE data in IRAF** page to extract data and work with spectra or light curve. Historically, IRAF is the programming language of choice for the *reduction* of EUVE data from their native files. This is because special tasks were written in that environment to extract time-tagged photon events from background noise on the detector surface. IDL affectionados are encouraged to extract their data in IRAF first and proceed with their favorite IDL routines.

If you have problems retrieving your data, you can contact the help desk via the link at the bottom of this page.

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What's New for EUVE during last year

More MAST mission data now on-line
2002 February 27

All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

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The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

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The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

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2001 October 24

Preview files were made available for the last 83 EUVE observations obtained in 2000 and 2001.

New Plotting Option Offered in MAST Scrapbook
2001 October 18

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2001 June 13

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Implementation of Redesigned MAST Web Site
2001 June 4

The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

EUVE Home
Getting Started
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Instrument and Operations
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Coordinated Data
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Project Publications
Catalogs and Atlases
Bibliography
Related Sites
Gallery
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Frequently Asked Questions

Data Requests

Instruments

Archive Data

Data Requests

- ***Where do I get EUVE archival data?***
  As of Nov 1997, the EUVE project in Berkeley is no longer delivering EUVE archival data. Events and image datasets, which may be reduced to create spectra and light-curves are available from this web site: click here to search the EUVE archive.

- ***How do I get multiple EUVE datasets?***
  If you are requesting multiple EUVE datasets, for now (since the data resides at HEASARC) you have to click on each data set or go to their ftp site. We will have a batch option in the future.

Instruments

- ***What are the wavelength ranges of the EUVE instruments?***

```
Spectrometer   Range (Å)     Resolution (Å)
   SW           70-190           0.5
   MW          140-380           1.0
   LW          280-760           2.0

Imagers:       10% Filter Bandpasses (Å)
DS Lexan              67-178
DS Al/C              157-364
ScA/B Lexan           58-174
ScA/B Al/Ti/C        156-234
ScC Ti/Sb/Al         345-605
ScC Sn/SiO           500-740
```

- ***What are the common EUVE spectral features?***
  The EUVE spectrometers have some common background features caused by airglow and scattering in the upper atmosphere.

  SW- The short-wavelength spectrometer can have a bright rim at shortest wavelengths (left) caused by scattered Lyman alpha.

  MW- The medium-wavelength spectrometer has a broad feature at 304 Å from geocoronal helium.

  LW- The long-wavelength spectrometer has a broad feature at 584 Å from geocoronal helium, which includes the 304 Å line in second order.

- ***What about the Deep Survey Deadspot?***
  There is a region of low gain (the "dead-spot") near the center of the Deep Survey Lexan/B band caused by the Feb 1993 observation of HZ 43. The region is about 2 arcmin in diameter and is described in detail in the EUVE technical memo.

- ***What about the Deep Survey's short wavelength response?***
  The short wavelength response of the DS has been investigated to explain large count rates observed from high column sources, like Sco X-1 and has often been termed "X-ray leak". The latest ideas have been summarized in John Vallerga's Memo.

Archive Data

- ***How do I get started with the EUVE permanent archive data?***
  Once you have obtained events and/or fits images from http://archive.stsci.edu/cgi-bin/euve, here are the 3 steps to read them:

  1) gunzip the files.

  2) read fits files with *strfits* (in *stsdas.fitsio*) (step no longer needed with IRAF 2.11, which allows you to read the fits files with out converting them. And *cep* will run on fits files).

  3) the img file will produce ds,sw,mw,and lw images + good times tables [you can go onto spectral extraction from these or continue and reduce the events files.]

  4) the evt file will produce the equivalent of the old format data (like table0 and so on) tables produced will have the following names: adcnts.tab lw_events.tab orientation.tab sw_events.tab ds_events.tab mw_events.tab quadrant.tab valid_times.tab)

  5) run *cep* to produce qpoe files using the appropriate script in archpipe (in egodata1.16) {Note: Only use "Rebuild DS SourceCentered Archive QPOE" for moving targets}

  6) use qpoe file as before

  Please also see the Permanent Archive Guide EUVE Permanent Archive Data Products Guide

- ***How do I extract an EUVE Spectrum?***
  In IRAF, use the EUV task *euvextract* on the two dimensional image file (which you get get from the source_date_img.fits file). See also: quick help on Spectral extraction?

- ***I run euvextract and get an error: 'dispaxis not found'.***
  You are missing DISPAXIS header line. This card was omitted from the EUVE archival format because it is specific to reduction of spectra under IRAF and, unlike the old GO products, the archival data format is not IRAF-specific.

  You can add the DISPAXIS card to an image with the standard IRAF task *hedit* . It will need to have the value '1', meaning the spectra run along the x-axis, as long as you haven't rotated the images.

- ***How do I make a Deep Survey Light-curve?***
  Quick Help on making a DS Light-curve

Data Reduction/Analysis

- EUVE IRAF softare (euve1.9.tar.Z) for EUVE IRAF data analysis.
- ISM Hydrogen Column Density Search Tool:
- EUVE Software Users Guide

Instrumentation and Operations

The Extreme Ultraviolet Explorer (EUVE) conducted an all-sky survey for the first 6 months of its mission (July 1992 to January 93). Operations after the all-sky survey turned to pointed Guest Observer (GO) observations, mainly with the Deep Survey/Spectrometer instruments, although there were a few pointed observations of the all-sky survey telescopes of comets and low-column directions. EUVE ceased operations on January 31, 2001.

Technical memos for several aspects of mission operations, intrumentation, and data analysis.

- EUVE Technical Memos

EUVE Science Highlights

- EUVE top "10" science highlights

November 9, 2000

- Flares as Coronal Heating Agents in Active Stars: The EUVE View

October 9, 2000

- Preliminary Results from EUVE-Led Super-Coordinated EX Hya Observation
- Nature of Soft X-ray Emissions in Comets Revealed with EUVE

September 8, 2000

- EUVE and Chandra Team to Discover Charge Exchange Emission from Comet LINEAR
- First with EUVE: Observation of Sharp Turn-on in Flux between Her X-1 Short High and Low States
- EUVE Catches OY Car in Superoutburst
- EUVE Results from XTE J1118+480

June 13, 2000

- Diffuse EUV Excess in Virgo
- EUVE Observation of OY Car
- EUVE Reveals Variable White Dwarf GD 394
- EUVE Detects EUV Flux from LMXB AC211
- EUVE Leads Multi-Wavelength Coordinated Observing Campaign

April 12, 2000

- EUVE Monitors Flux Variability in Coordinated Observation of NGC 4051
- EUVE TOO Catches X-ray Transient XTE J1118+480

March 15, 2000

- EUVE TOO Helps Reveal Stages of Optical, X-ray, and EUV Emission Observed in SS Cyg Outburst
- EUVE Helps Reveal Nature of Early B Star Companion in Lambda Sco

January 20, 2000

- Understanding EUV/X-ray Emission from Comet P/Encke 1997
- EUV Mapping of the LISM: the Local Chimney Revealed?
- The Source of Ionization in the LISM Cloud/Fluff??

October 4, 1999

- EUVE Observations of the Venus Dayglow
- Time-Resolved EUVE Spectroscopy of AR UMa
- EUVE Spectroscopy Shows Iron in G191-B2B Atmosphere has a Depth-Dependent Abundance

July 15, 1999

- EUVE Observation of Her X-1 at the End of the Short High State
- Serendipitous Discovery of the AM Her star EUVE J0425.6-5714

April 15, 1999

- EUVE Finds Evidence for Stratification of N Abundance in White Dwarf REJ 1032+532

January 15, 1999

- EUVE Detects Change in Interplanetary Helium Wind

December 1, 1998

- Evidence that High Energy Cosmic Rays are Source of the EUV Emission in ABELL 1795

October 12, 1998

- Theta Hya: Spectroscopic Identification of a Second B Star + White Dwarf Binary

August 31, 1998

- G191-B2B: A Stratified Atmosphere or Not?

June 30, 1998

- The 3-D Structure of EUV Accretion Regions in AM Her Stars

May 31, 1998

- Inverse Compton Scattering as the Source of Diffuse EUV Emission in the Coma Cluster of Galaxies

March 31, 1998

- New EUVE Sources Detected

January 31, 1998

- EUVE Images of the Full Moon

October 31, 1997

- EUVE Spectrum of White Dwarf Companion to a B Star

July, 1997

- EUVE/ALEXIS Partnership Yields Evidence of Unknown Object
- EUVE Unravels Soft X-rays Emanating from Comets

October 31, 1996

- Detection of EUV Emission from Van Biesbroeck 8
- EUVE Observations of the Dwarf Nova U Geminorum in Outburst

October 29, 1996

- EUVE Observations of the Eclipsing RS CVN System AR Lacertae

September 1, 1996

- EUVE Observations of EUVE J0720-317 and EUVE J0723-277

August 30, 1996

- The Quiescent and Flaring Corona of the Flare Star AU Microscopi

June 30, 1996

- EUVE Observations of the Seyfert Galaxy RX J0437.4-4711
- EUVE Spectroscopy of the WD Photosphere in the Strongly Magnetic CV AM Herculis
- EUVE Observations of the RS Canum Veneticorum binary star CF Tucanae

June 1, 1996

- Stellar coronal abundance and the role of the FIP effect in Epsilon Eridan

May 28, 1996

- EUVE Observations of the Coma Cluster

May 1, 1996

- EUVE Observations of the Bright Comet B2 Hyakutake

April 1, 1996

- EUVE Observation of the B Giant Star B Canis Majoris

March 1, 1996

- Discovery of Warm Gas in the Center of the Virgo Cluster with EUVE

February 1, 1996

- Helium found in hot DA white dwarf GD 50

January 1, 1996

- Light Curve of 5.75 millisecond Pulsar

December 1, 1995

- EUVE's Brightest RSCVn Flare

November 1, 1995

- EUVE Spectrometer observations of the eclipsing DQ Her star EX Hya

October 1, 1995

- Reports on the local interstellar medium, and six hot WDs

September 1, 1995

- Alpha Columbae: likely emission line of Ne VII at 88.2 Å at about the 3-sigma level

August 1, 1995

- First detailed EUVE observations of the AM Her star, QS Telescopii

July 1, 1995

- Dwarf nova VW Hydri in outburst and the subsequent quiescent period

June 8, 1995

- Recent results in confining the edges of the GW Vir instability strip

May 8, 1995

- Relative brightnesses of two medium wavelength components in Alpha Cen AB

April 8, 1995

- Search for short wavelength EUV emission points among known extragalactic X-ray sources
- EUV Line Emission From Cool Stars: Resonantly Scattered or Not - That is the Question!

February 1, 1995

- High-amplitude (>20%) QPOs in 1993 and 1994 June SS Cygni outbursts

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December 22, 1994
November 15, 1994
October 15, 1994
October 6, 1994

Page created by webmastr@cea.berkeley.edu Last modified 3/15/00 and brought to MAST 1/2001

EUVE Coordinated Data

- EUVE data coordinated with Chandra calibration
- EUVE data coordinated with RXTE of XTE J1118_48

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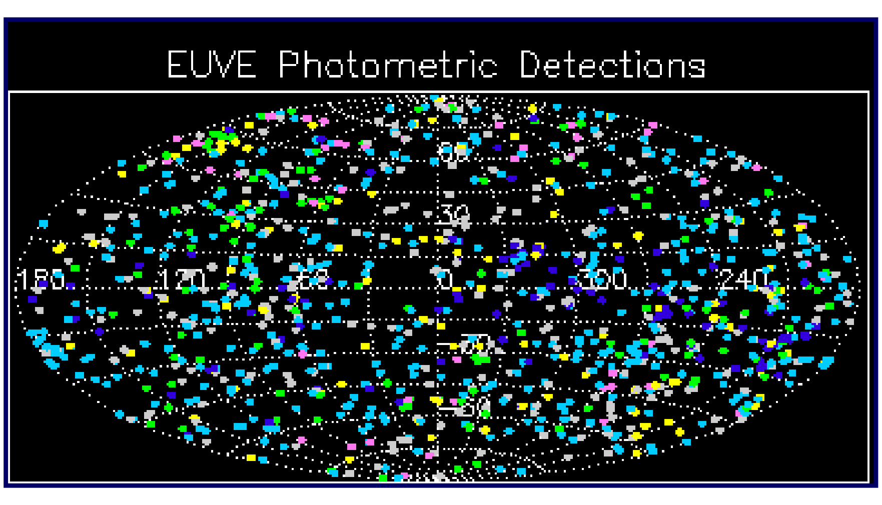
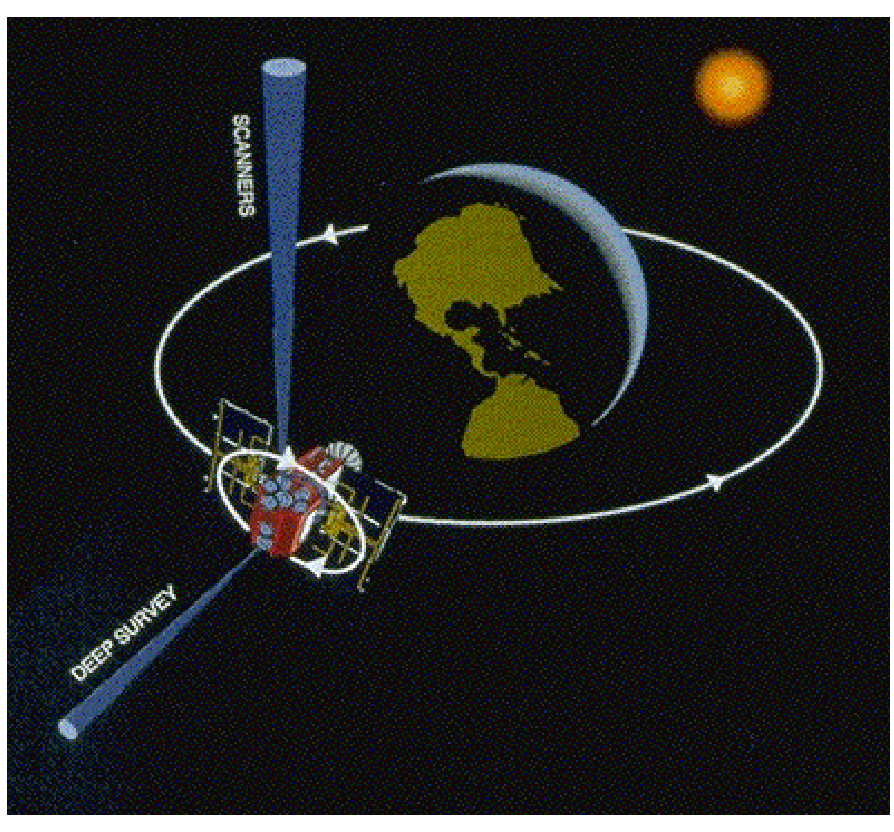
EUVE All Sky Survey

The survey phase of the mission started on 24 July 1992 and concluded on 21 January 1993. There were monthly calibration pointings conducted during this phase, and so the initial survey data included gaps in the sky coverage. Short periods of gap-filling were carried out during the first six months of the GO program. The completed survey data set covers approximately 97% of the sky with exposures ranging from a few hundred seconds at the ecliptic to 20 kiloseconds at the poles.

Two different kinds of sky surveys were simultaneously conducted. The EUVE's three scanning telescopes systematically measured the positions and intensities of sources across the entire sky, while the deep survey telescope mapped faint sources along a narrow band on the Ecliptic. The survey detected 734 objects. We show an aitoff projection of EUVE sources in equatorial coordinates. Shown are 1230+ unique sources from the EUVE all-sky survey second catalog (Bowyer et al. 1996), Lampton et al. (1997) faint list, and sources from the second RAP catalog (Christian et al. 1999) (click here for a survey results page).



Geometry of the Survey Phase



The scanning telescopes are swept across the sky by the slowly revolving spacecraft, while the deep survey telescope is pointed down the Earth's shadow.

To conduct the all-sky survey, the EUVE slowly revolved around its axis, sweeping its three scanning telescopes in great circles across the sky. These repetitive scans, combined with the Earth's orbital motion around the Sun, allowed the scanning telescopes to map the entire celestial sphere within about six months. Utilizing four band passes, the three scanning telescopes observed the sky over the entire extreme ultraviolet range (60-740Å).

Accomplishing the deep survey, however, was more challenging. The geocoronal glow, caused by sunlight that strikes the diffuse hydrogen and helium gas atoms surrounding the Earth, makes it difficult to observe faint EUV sources. Consequently, scientists configured the mission so that the deep survey telescope always pointed away from the Sun and only took measurements while viewing down Earth's shadow - the night portion of the orbit when the Earth blocks the Sun and shields the spacecraft from sunlight. This technique made the deep survey more sensitive by a factor of ten. Utilizing two band passes, the deep survey telescope observed a portion of the extreme ultraviolet range (70-365Å).

Page created by CEA and brought to MAST 2/1/99

Some Atlases and Catalogs

- The EUVE Bright Source List (Malina *et.al.*, *Astron. J.*, **107** (2), 751, 1994)
- The Second EUVE Source Catalog (Bowyer *et.al.*, *ApJ Supp.*, **102**, 129-160, 1996)
- An All-Sky Catalog of Faint EUV Sources (Lampton *et.al.*, *ApJ Supp.*, **108**, 1997)
- Serendipitous EUV Sources Detected during the First Year of the Right Angle Program (McDonald *et.al.*, *Astron. J.*, **108**, 1843, 1994)
- The Second Extreme Ultraviolet Explorer Right Angle Program Catalog (Christian *et.al.*, *Astron. J.*,117 , 2466, 1999)
- The EUVE Stellar Spectral Atlas (Craig *et.al.*, *ApJ Supp.*, **113**, 1997)

EUVE Bibliography

- Papers & Conference Presentations
- Special Edition of the Journal of the British Interplanetary Society on EUVE (September 1993, Volume 46, Number 9)

EUVE Related Sites

The EUVE data is being made available as part of a cooperative effort between CEA, STScI, NSSDC, and HEASARC.

- The Center for Extreme Ultraviolet Astrophysics (*in now closed*).
- The EUVE pages at HEASARC

EUVE Gallery of Pictures

- Cygnus supernova remnant (53 kbyte image)

  A false-color image of the Cygnus Loop supernova remnant. The extreme ultraviolet (EUV) light seen in the image originates from gas that was heated to very high temperatures by a supernova explosion. The temperature of the gas is between 1 and 5 million degrees Celsius.

- Vela supernova remnant (113 kbyte image)

  A false-color image of Vela supernova remnant. The EUV light seen in the image originates from gas that was heated to very high temperatures by a supernova explosion. The temperature of the gas is between 1 and 5 million degrees Celsius.

- Moon

  The first-quarter Moon (30 kbyte image). During the all-sky-survey portion of its mission, EUVE scanned the Moon. While not a natural source of EUV light, the Moon does reflect sunlight at these wavelengths, providing an indirect method of studying variations in our star. Direct observation of the Sun would burn out EUVE's detectors. This image was created by combining 17 observations at various wavelengths.

  The full Moon (54 kbyte image). This image was taken with EUVE's Deep Survey telescope just after the lunar eclipse of 10 December 1992. Notice that the bright regions correlate well with the lunar highlands and the dark regions with the maria.

- All-Sky Survey Sky Map (428 kbyte image)

  This is an image of the entire celestial sky, as it appears in the extreme ultraviolet. In addition to stellar objects, the Cygnus loop and Vela supernova remnants are visible. The image was created by combining EUVE scans of many small strips of the sky. These scans were taken during the all-sky-survey portion of the EUVE mission. The black strips are data gaps.

- EUVE image of the Hyades Cluster (119 kbyte image)

  This image is an EUVE Deep Survey observation of the Hyades Star Cluster. The diagonal strip in the middle of the image represents data taken with a particular filter, whilae that in the corners is from another filter. At least eight other sources are seen and marked with probably identifications. Some stellar images have a tri-lobed appearance due to the highly curved focal surface of the grazing incidence Deep Survey telescope mirror. The faintest star (M 25 VA 41) is detected in the EUV at about 1 count per 1,000 seconds.

- Map of Sources (16 kbyte image)

  Aitoff projection of EUVE all-sky and deep survey detections plus Right Angle Program detections, through July 1998.

EUVE Movies

- 1993 Total Lunar Eclipse Data
  153 kbyte mpeg movie file

- EUVE Satellite Animation
  464 kbyte mpeg movie file

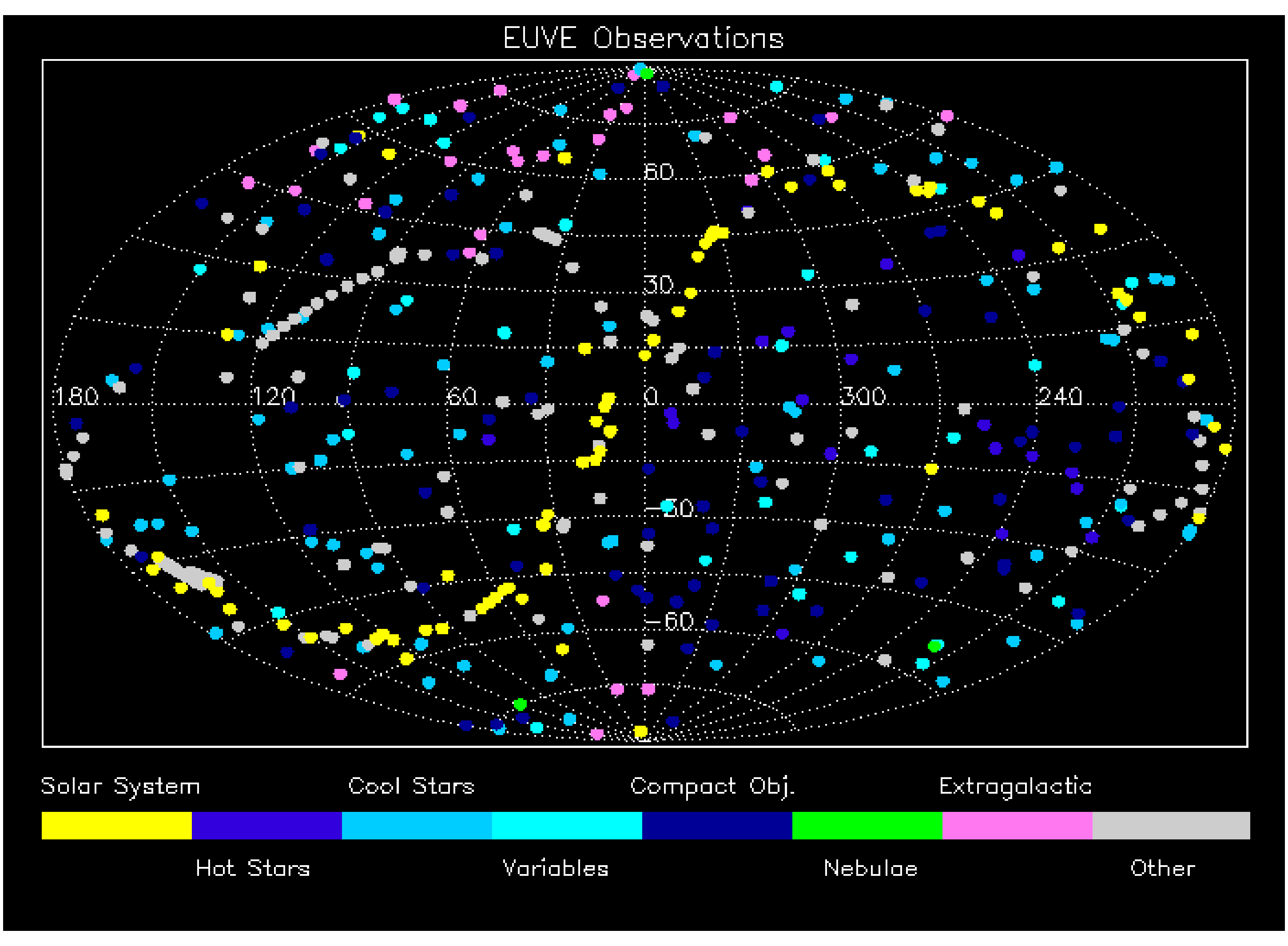
- UZ Fornacis Animation
  228 kbyte mpeg movie file

- EUVE Launch
  322 kbyte mpeg movie file

Acknowledgments

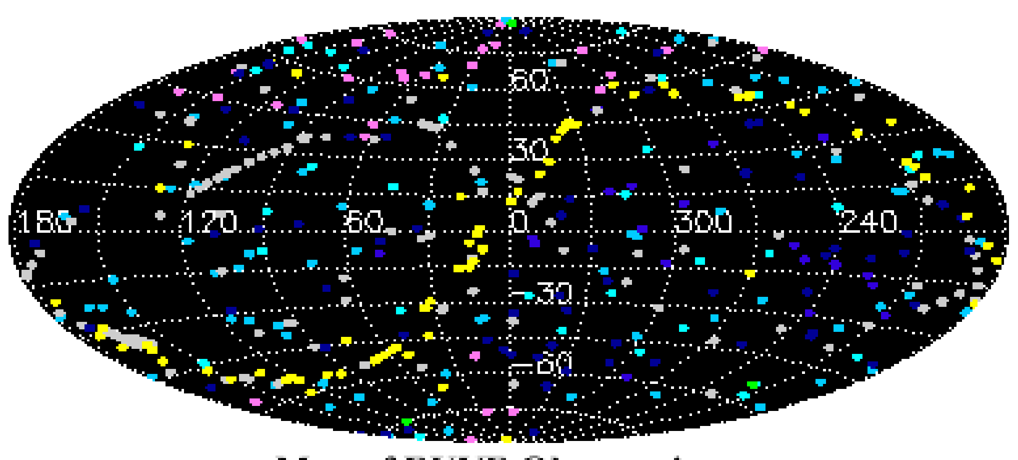
MAST made extensive use of the EUVE pages from the Center for EUV Astophysics (CEA) in Berkeley. CEA was a part of the Univerity of California Berkeley's Space Sciences Laboratory. The EUVE Team included members form UC Berkeley, NASA/Goddard Space Fligth Center, and NASA headquarters.

Pertinent documentation was established at MAST as the EUVE Project came to an end in early 2001.


EUVE Observations
60
30
180
120
60
0
300
240
-30
-60
Solar System
Cool Stars
Compact Obj.
Extragalactic
Hot Stars
Variables
Nebulae
Other

http://archive.stsci.edu/euve/

Launched in June, 1992, The ***Extreme Ultraviolet Explorer (EUVE)*** conducted the first extreme ultraviolet (70-760 Angstroms) survey of the sky and subsequently began a Guest Observer Program of pointed spectroscopy, that ended on January 31, 2001. The satellite has four photometric imaging systems and a three-channel EUV spectrometer. The imaging instruments were used to complete the sky survey. The spectrometers were used for the pointed spectroscopic programs, which collected data from over 350 unique astronomical targets.



Map of EUVE Observations

The ***ASTRO Observatory*** had three primary instruments: the Ultraviolet Imaging Telescope (UIT), the Hopkins Ultraviolet Telescope (HUT) and the Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE). The Astro Observatory was designed to use many of the spacelab components and flew on two different shuttle flights. The first Astro flight was on December 2-11, 1990, aboard the shuttle Columbia. The X-ray experiment Broad Band X-Ray Telescope (BBXRT) was also part of the Astro-1 flight. The second flight was on March 2-18, 1995, aboard the shuttle Endeavour.

HUT obtained ultraviolet spectra of astronomical objects such as quasars, active galactic nuclei, and supernova remnants, extending into the little-explored ultraviolet range below 1200 Ångstroms. The instrument consisted of a telescope, prime focus spectrograph, and intensified photodiode array. Scientific studies have included research on the cores of active galaxies (where black holes likely reside), the torus of gas around Jupiter created by its moon Io, the characteristics of the intergalactic medium, and the stellar population in elliptical galaxies.

UIT consisted of a telescope and two image intensifiers with 70 mm film transports. The instrument acquired images of faint objects in broad ultraviolet bands in the wavelength range of 1200 to 3200 Ångstroms. Astronomers have investigated the present stellar content and history of star formation in galaxies, the nature of spiral structure, and non-thermal sources in galaxies using UIT data.

WUPPE obtained both ultraviolet spectra and polarimetry for celestial objects such as hot stars, galactic nuclei, and quasars. The instrument included a telescope, spectropolarimeter, and dual diode array detectors. Researchers have studied the interstellar medium, mass loss from hot stars, interacting binary stars, and active galaxies, among other topics.

HUT Target Search

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Getting Started with HUT

The Hopkins Ultraviolet Telescope (HUT) was the spectrographic component of a triad of coaligned telescopes that flew in Space Shuttle missions during December 1990 and March 1995. HUT was designed to overlap and extend to short wavelengths the coverage of previous ultraviolet missions and was contemporaneous with the **IUE** satellite. The HUT missions were instrumental in helping to define the key science requirements of the **FUSE** satellite.

Target fluxes were detected by photoamplification of bursts produced by a phosphor and scanned at a video rate. The phosphor bursts are time-tagged, accumulated, and located by a centroid-finding routine in two dimensions. The centroid positions are computed to bins of 1/4 of the physical pixel spacing of the detector, thus producing a partially-processed, 1 x 2048 spectrum in the first ('raw') data file that the user sees.

The **search** form may be used to select data from the HUT database by object name, coordinates, date of observation, or target class (general). The data files of interest can then be marked and retrieved. The returned dataset will consist of several type of files, which are described in the **Data Products** page. For bright objects an investigator's scientific objective can usually be met without doing a careful subtraction of geocoronal Lyman alpha. For fainter targets it is often necessary to start with the uncalibrated data and subtract an appropriate Lyman alpha and air glow background spectrum. User requests generate a tar file consisting of gzipped fits file of all possible files. For most purposes a user might want to work with just the following files:

object_[N,D,A]_METsum_imcscor.ph
object_[N,D,A]_METsum_imcscor.ct
object_[N,D,A]_METsum_imcslya.ct

and relevant calibration data files. The nomenclature referred to is defined in the data types page. (D, N, A is shorthand for observations made during the day side, night side, or 'combined' sides of the orbit.) This nomenclature is defined in the **Data Products** page. Because of its generally better quality, users will in general prefer ASTRO-2 data of a given object to ASTRO-1.

archive@stsci.edu
Modified: Jun 22, 2001 11:20

Search and Retrieval

HUT data of interest may be found by **searching** the MAST HUT database. As explained in the **Search Help** page, users may specify search criteria and output format. On the search results page, users may mark datasets of interest to be downloaded as a tar file.

A **"quick search"** of the HUT catalog may be performed by entering a target name or coordinates in the form labeled HUT Target Search at the top of the left navigation menu.

Users may also peruse a **Catalog** of HUT data. Pick an object category and click on object names or datasets. Clicking on the object name brings up a preview window while clicking on datasets initiates a pop-up window and the data can be downloaded to the desired area in your computer.

HUT Catalog

The following catalog lists the objects observed by the Hopkins Ultraviolet Telescope during the two ASTRO missions. A preview of the spectrum may be viewed by clicking on the object name. The data may be retrieved by clicking on the dataid.

The observations are grouped by categories as designated by the HUT project.

Calibration
Solar System
Individual Stars
Variable & Binary Stars
ISM & Nebulae
Star Clusters
Normal Galaxies
Abnormal Galaxies
Active Extragalactic
Clusters of Galaxies

List all changes for HUT

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HUT Literature Links Updated
2001 February 26
The HUT reference database table entries (and ADS data links) are now complete through year 2000.

Customized HUT previews now available
2001 February 13
The interactive plotting option offered on IUE and EUVE preview pages is now available for HUT previews.

Corrections to HUT ASCII Files of Fluxes and Wavelengths
2000 November 14
An error was discovered in the way fluxes and error estimates were stored in the HUT ASCII table files. Instead of values being written as two columns of flux1, error1, flux2, error2, ..., the entries were stored as flux1, flux2, flux3, flux4,... error1, error2,... Corrected files are now available. The file creation date listed on the first line of the file can be used to distinguish the old and new files.

Cross Correlations with Sky2000 Catalog
2000 August 16
Cross correlations of MAST missions with the SKYMAP Sky2000 catalog (version 3) are now possible from the MAST Cross Correlation page.

HUT Journal References now Available
2000 July 24
A new column called "Ref" has been added to the HUT search results page showing the current number of known papers for each HUT data ID. Clicking on an entry (other than a "-") will display the list of known papers with links to the online ADS abstracts.

New Copyright Notice
2000 May 12
STScI has adopted a new Copyright statement. Most, if not all, MAST web pages should now include a link to the new page.

HUT catalog now available.
1999 November 11
A catalog of HUT observations has been constructed. Users may preview and retrieve data from the catalog.

HUT preview spectra now available.
1999 November 1
Preview spectra are now available from the HUT search results page for most HUT 1 & 2 observations.

HUT2 data is now available.
1998 November 18
Data acquired by HUT during the second ASTRO flight is now available.

Description of HUT1 filetypes is now available.
1998 November 10
A description of the files available for HUT1 data are described from information received from the HUT project.

HUT-1
1998 September 22
Data from the ASTRO-1 Hopkins Ultraviolet Telescope (HUT) can now be requested from MAST.

Frequently Asked Questions

Mission

Data Handling

Data Characteristics

Mission

- ***What is HUT and What Does it Do?***
  See the HUT project answer.
- ***What is the history behind HUT?***
  See the HUT history page.
- ***Where can I find a HUT Technical Summary?***
  See the HUT technical summary page. A detailed view of the HUT2 telescope module can be seen in the hardware chapter of the HUT data handbook. or alternatively in the HUT instrument and operations page.
- ***What are some major publications using HUT data?***
  See the HUT publications page. Note also the papers by Kruk et al. on final calibration of HUT 1 and HUT-2 (ApJS, 122, 299) data.

Data Handling

- ***How do I retrieve HUT data?***
  Data retrieval proceeds in much the same way as most other MAST-archived datasets. Go to the how to search HUT data page for instructions and the HUT search page for downloading of data. Data will be returned very quickly in a tarred file consisting of many zipped data files and an ASCII filetypes.txt file explaining some of the contents. For further information go to the HUT data products page.
- ***How do I read HUT data?***
  See the HUT data reading page.

Data Characteristics

- ***What are the instrumental error sources in HUT data?***
  - Unwanted time-dependent signals (dead time, phosphor persistence).
  - Airglow in emission lines (geocoronal Lyman alpha can be the dominant feature in the spectrum).
  - Extreme UV contamination (white dwarf only; corrected from model atmospheres estimates).
  - Telluric absorption (yes, there is atmosphere above the Shuttle!).
  - Flux loss from field astigmatism (extended sources only).
  - pointing-jitter errors (jitter corrected every 2 secs).

  The calibrated data consist of corrections for all these error sources. See the calibration chapter of the HUT data handbook.
- ***Did HUT lose sensitivity during its missions?***
  Yes, the losses were noticeable on an approximately 48 hour timescale, particularly in the far-UV. This is modeled in Figure 5 of Kruk et al. (ApJS, 122, 299, 1999). By the end of the mission the sensitivity of the detector (CsI photocathode) had decreased by 26% at 912 Å and 5% at 1840 Å.
- ***What were the differences between HUT1 and HUT2?***
  The second mission:
  - lasted longer (16 days compared to 8 days; 205 hours of on-target time vs. 40 hours).
  - made more observations (385 of 265 targets, compared to 136 of 87 targets).
  - had greatly improved pointing stability.
  - had less sensitivity to extreme-UV contamination because of SiC coatings on the optical elements.

Data Reduction/Analysis

Data Reduction Software

HUT data was reduced by the HUT project using IRAF with a HUT package. This package may be downloaded via anonymous ftp.

Reduced HUT software can be read and analyzed with either IRAF or IDL. Information about reading HUT data with these two packages has been provided.

ASTRO/HUT PROJECT PUBLICATIONS

>From Astro-1 Mission:

Astro-1 Review Paper by A. F. Davidsen (Science, 259, 327, 1993)

Astro-1/HUT Performance & Performance by A. F. Davidsen et al. (ApJ, 392, 264, 1992)

Final Astro-1/HUT Calibration Paper by Kruk et al. (ApJ, 482, 546, 1997)

>From Astro-2 Mission:

Astro-2/HUT Performance & Calibration by J. W. Kruk et al. (ApJ, 454, L1, 1995)

Final Astro-1/HUT Calibration Paper by J. W. Kruk et al. (ApJ, 482, 546, 1997).

Astro-2/HUT Engineering Document by B. W. Ballard (Sept. 1995)

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HUT Related Sites

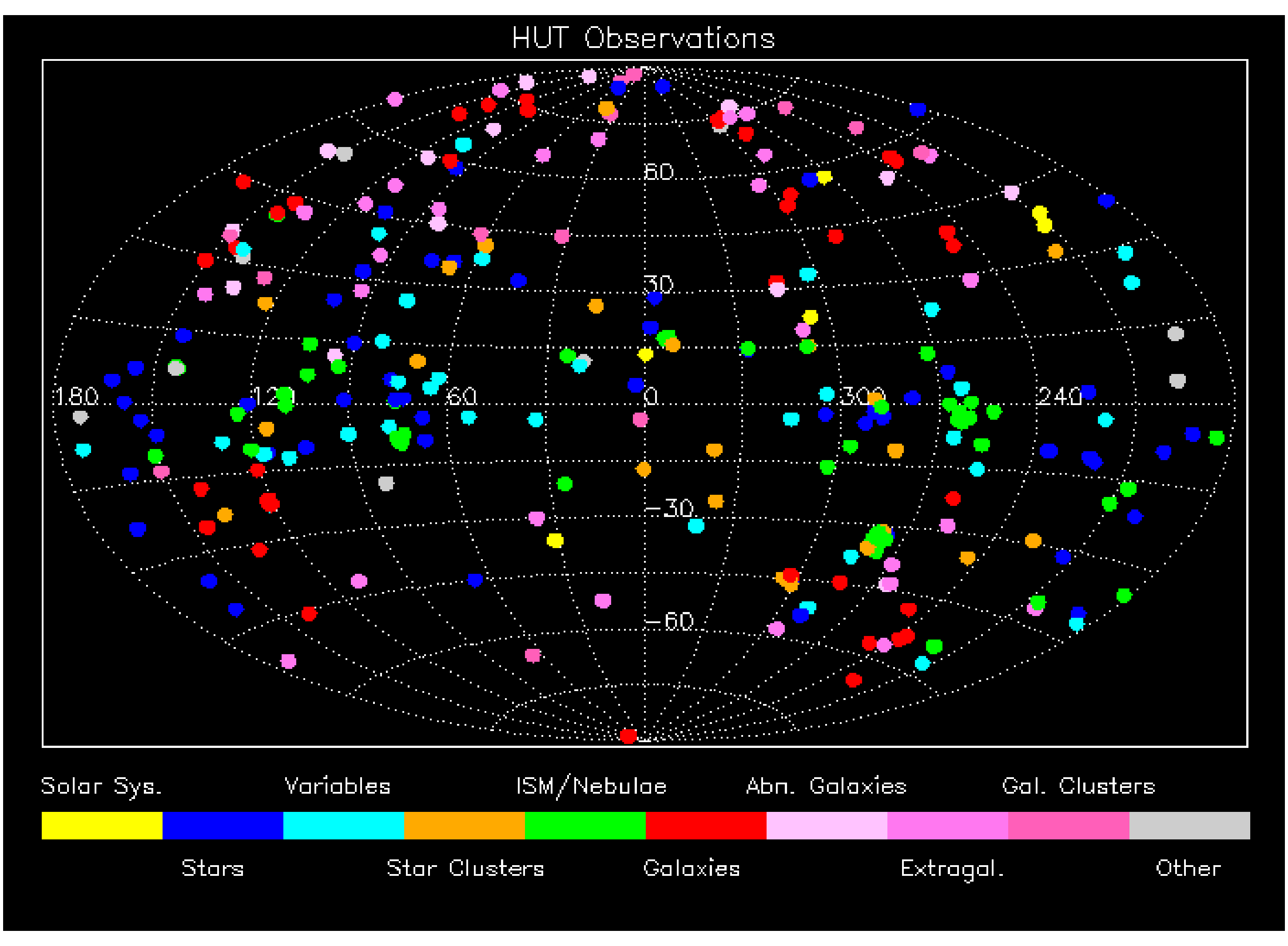
The HUT Project's Home page is the source of a number of publications concerning instrumentation, calibration and performance that are also referenced from the MAST web site.

HUT was one of three instruments of the ASTRO mission. The UIT project was based at Goddard Space Flight Center while the WUPPE project was based at University of Wisconsin. The three instrument teams coordinated observations and target

Acknowledgments

We wish to thank the HUT Project, especially Gerard Kriss, for providing data and information about the data. We used information from the HUT Project web sites extensively.

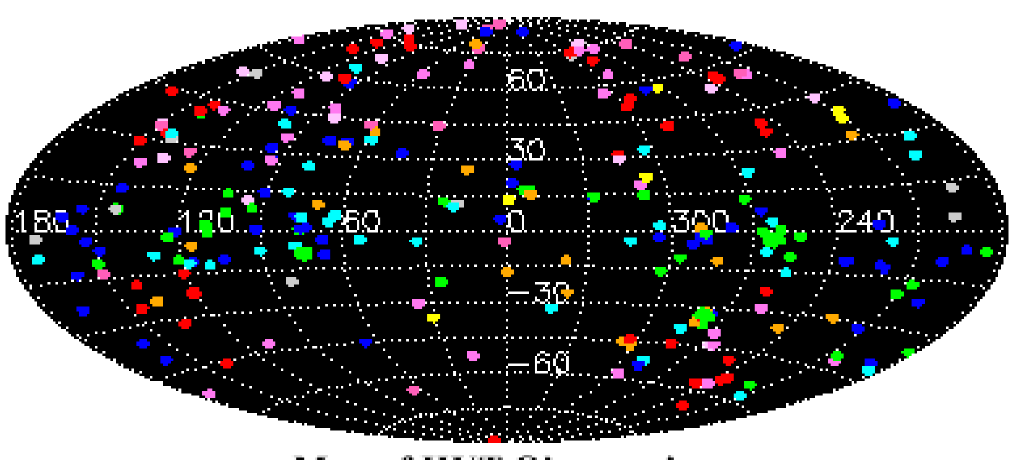
We wish to thank NASA's Goddard Space Flight Center (GSFC) Astrophysics Data Facility (ADF) with special acknowledgement to Derck Massa for providing information, the HUT data from the first flight, and providing the initial versions of the HUT Astro 1 preview files.



HUT Observations
60
30
180
120
60
0
300
240
-30
-60
Solar Sys.
Variables
ISM/Nebulae
Abn. Galaxies
Gal. Clusters
Stars
Star Clusters
Galaxies
Extragal.
Other

http://archive.stsci.edu/hut/

The ***Hopkins Ultraviolet Telescope HUT*** was one of three ultraviolet instruments of the ASTRO-1 mission flown on the space shuttle Columbia during 2-10 December 1990. 106 spectrophotometric observations of 77 targets were obtained in the far-UV (i.e., 912-1850 Å) at a resolution of ~3 Å. A few sources were observed in the 415-912 Å region with a 1.5 Å resolution. The same three instruments were later flown on the space shuttle Endeavour from 3-17 March 1995 as part of the ASTRO-2 mission. During the longer ASTRO-2 mission, 385 observations of 265 targets were obtained.



Map of HUT Observations

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Getting Started

The Ultraviolet Imaging Telescope (UIT) was the imaging component of the three **ASTRO** ultraviolet telescopes that flew on Space Shuttle missions in December 1990 and March 1995. The instrument was well suited to the study of large extended objects: globular clusters, reflection nebulae, supernova remnants, galaxies, and clusters of galaxies. The large field of view and ultraviolet bandpass make the UIT images a unique dataset, complementary to other imaging instruments such as HST's WFPC.

The MAST holdings include over 1500 ultraviolet images of 243 targets. The field-of-view is circular with a diameter of 40 arcmin and a nominal resolution of 3 arcsec. Two cameras, each with 6 filters, provide a range of effective wavelengths and bandpasses in the near- ("A" camera) and far-ultraviolet ("B" camera). Of these, the broad-band A1, B1 and B5 filters were used for most of the images. The images were recorded on Kodak IIa-O film, then developed and digitized. The data were flat-fielded, linearized, and when possible absolutely calibrated, geometrically rectified, and rotated to create fully reduced images with orthogonal RA and Dec axes and uniform plate scale.

The **search** form may be used to select data from the UIT catalog by object name, coordinates, filter, date of observation, etc. In addition, users may browse the **Catalog** or download the images using **anonymous ftp**.

The images are archived as FITS files. Several versions of the images are available as captured at various stages during the image processing. Not all the images could be fully calibrated, so users should check the file names (see **Data Products**) and FITS headers to determine what reduction and calibration steps were applied.

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Search and Retrieval

UIT data of interest may be found by **searching** the UIT database. Users may specify search criteria as well as output format (see **Search Help**). On the search results page, click on the Entry ID to view a browse image, examine the FITS header, or check for associated scientific publications. Then mark the datasets of interest to be downloaded as a tar file. Note that UIT files can be very large.

A **quick search** of the UIT catalog may also be performed. Enter a target name or coordinates in the UIT Target Search form, located at the top of the left navigation menu.

Users may also peruse the **catalog** of UIT data. Pick an object category and click on object names or datasets. Clicking on the object name brings up a preview window, while clicking on datasets initiates a pop-up window from which the data can be downloaded to the desired area in your computer.

The data may also be retrieved via **anonymous ftp**. See **Obtaining UIT Data** for information.

UIT Catalog of Observations

The following catalog lists the objects observed by the Ultraviolet Imaging Telescope during the two ASTRO missions. A preview of the spectrum may be viewed by clicking on the object name. The data may be retrieved by clicking on the dataid.

The observations are grouped by categories as designated by the UIT project.

- Calibration
- Solar System
- Individual Stars
- Variable & Binary Stars
- ISM & Nebulae
- Star Clusters
- Normal Galaxies
- Abnormal Galaxies
- Active Extragalactic
- Clusters of Galaxies

Mission/category: UIT all Go

List all changes for UIT

More MAST mission data now on-line
2002 February 27
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New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Updated UIT Data Analysis Software
2001 August 6
An updated version of the Exported MOUSSE IDL Software is now available to users. See the UIT Data Reduction/Analysis page for details.

UIT added to scrapbook
2001 August 1
Representative images from the UIT mission have now been added to the MAST scrapbook.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

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2001 June 12
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Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

UIT Literature Links Updated
2001 January 25
The UIT reference database table entries (and ADS data links) are now complete through year 2000.

Cross Correlations with Sky2000 Catalog
2000 August 16
Cross correlations of MAST missions with the SKYMAP Sky2000 catalog (version 3) are now possible from the MAST Cross Correlation page.

UIT Journal References Available
2000 July 18
A new column called "Ref" has been added to the UIT search results page showing the current number of known papers for each UIT data ID. Clicking on an entry (other than a "-") will display the list of known papers with links to the online ADS abstracts.

New Copyright Notice
2000 May 12
STScI has adopted a new Copyright statement. Most, if not all, MAST web pages should now include a link to the new page.

UIT preview images now available from MAST
1999 November 16
UIT preview images and FITS headers can now be displayed from the UIT search results page (prior to this date, the browse files were downloaded from the NASA ADF project).

UIT ASCII Logs available.
1998 October 21
In addition to the UIT search routines, you may find these ASCII listings of the UIT catalog useful. They maybe copied from our anonymous ftp area.

ASTRO-1 UIT Data now Available
1998 July 29
The ASTRO-1 UIT data is now available from MAST.

Browse Files Accessible from Search Page
1998 June 25
Users may now access ADF UIT browser from our search pages. Simply click on the highlighted object name and the browse file information for that image will be placed on the screen.

UIT-2
1998 June 1
Data from the ASTRO-2 Ultraviolet Imaging Telescope (UIT) can now be requested from MAST. ASTRO-1 UIT data will be added in the near future.

Mission/category: UIT Go

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Frequently Asked Questions

Data Requests

- ***Why does it take so long to download the UIT files?***
  The combined files for each observation are fairly large, about 28 Mb compressed, 51 Mb uncompressed. If you need only one file for a given observation, such as the fully calibrated and geometrically corrected ("G") file, you may wish to obtain it from the anonymous ftp site (see Obtaining UIT Data).

- ***How can I tell which files are fully calibrated?***
  The easiest way is by the file name. The raw image (digitized densitometer output) filenames end in D, e.g. fuv0345d.fits. The linearized, flat fielded image filenames end in E (no good astrometry solution) and F (good astrometry solution). The fully calibrated, geometrically corrected image filenames end in G.

Reading Files

- ***How do I read the UIT data files?***
  The image files are in FITS format, with the data stored in the primary arrays. The point-source photometry data are stored in ASCII table extensions, with no primary array. These simple FITS formats should be readable by a variety of FITS readers. See Reading UIT Data for more information.

Data Reduction/Analysis

Data Reduction

The UIT standard data products were produced using the Batch Data Reduction (BDR) software system. The processing steps included: (1) linearization of the data, (2) flat-fielding, (3), geometric correction of image distortions, (4) astrometric solution (mapping to RA and Dec), and (5) point-source photometry. For some images, an astrometric solution was not possible so subsequent processing steps were not performed. See also the discussion of UIT Data Products. The data reduction and calibrations involved are described in more detail in the 1997 PASP paper. An analysis of the geometric correction was published by Greason et. al. 1994.

Software

The UIT project archived three sets of software with the GSFC Archive (NDADS) with the UIT Astro 1 data. The UIT project has indicated that the software used for Astro 2 data was relatively unchanged. These software sets have been retrieved from NDADS (the updated MOUSSE software was provided by Wayne Landsman from Goddard Space Flight Center), and are available from MAST as gzipped tar files via anonymous ftp. The software packages were archived for documentation purposes and may require some revision to work outside the UIT project environment. The software is unsupported. Documentation is available as both postscript and tex files.

1. BDR Software

The Batch Data Reduction software, written in Fortran and C, was used to process UIT data and generate FITS output files.

bdr.tar.gz	Gzipped UNIX tar file containing software used in UIT batch data processing. Includes programs in FORTRAN and C, associated data files and documentation.
bdr_doc.ps, bdr_doc.tex, bdr_readme.txt	Description of BDR design and programs.
fits.ps, fits.tex	Description of FITS headers.
readme_cal.txt	Listing of calibration files used by the software.

2. Exported MOUSSE Software

The Multi-Option UIT Software System Environment was used by UIT team members to analyze their data. The programs are written in IDL and were meant to supplement the procedures contained in the ASTRON library.

export.tar.gz	Gzipped UNIX tar file containing IDL procedures used by the UIT team to manipulate and analyze UIT images; a data base program; and an on-line help facility.
export.ps, export.tex	Description of the IDL procedures used to display and manipulate UIT images. These are subset of IDL analysis system MOUSSE (Multi-Option UIT Software System Environment).
db.ps, db.tex	Description of an IDL database system.
ft.ps, ft.tex	Description of IDL routines for reading FITS table files.
phot.ps, phot.tex	Description of IDL point-source photometry programs, based on DAOPHOT.
mousse.ps, mousse.tex	A list of MOUSSE software likely to be used by interactive user.

3. IDL Version of BDR

This IDL version of the processing software was used for calibration and testing, such as quickly testing a sample characteristic curve on an image.

idlbdr.tar.gz	Gzipped UNIX tar file of IDL procedures and supporting files used to process a UIT density image through photographic background subtraction, linearization and flat field division.

In addition, users may find some of the IDL procedures in the ASTRON library useful.

Instrumentation and Operations

Telescope: The telescope is a 38 cm Ritchey-Chretien telescope, with a system focal ratio of f/9, effective focal length of 342.9 cm, and field of view of 40 arcmin.

Image Motion Compensation: An Image Motion Compensation (IMC) system stabilized the UIT pointing at a finer level than possible with the Spacelab Image Pointing System (IPS) on the shuttle. Two gyros and a CCD startracker were used to sense motion. A servomechanism that controls small tilts of the UIT secondary mirror was then commanded to maintain stable pointing. Pointing problems affected about a third of the UIT images, evidenced by asymmetric stellar images.

Filters: Each camera had 6 filter settings. The A6 filter wheel slot was empty to accomodate tranmsmission grating mode observations.

Filter	Effective Wavelength (Å)	Bandwidth (Å)	Number of Observations
A1	2488	1147	172
A2	1892	412	51
A3	1964	173	4
A4	2205	244	32
A5	2558	456	74
A6	Grating		15
B1	1521	354	455
B2	1359	160	2
B3	1445	256	2
B4	1585	129	10
B5	1615	225	610
B6	1496	404	54

Transmission Grating: The grating was ruled at 75 lines mm^{-1} on a CaF_2 substrate. The first order yields a linear dispersion of 840 Å, with a resolution of about 19 Å in the range 1400 - 3400 Å over a 35 arcmin field of view.

Cameras: Two detectors were used, each of which was a magnetically focused, two-stage image intensifer with phosphor output, coupled with fiber optics to 70mm film. The near-ultraviolet (NUV or "A") camera used a Cs_2Te photocathode, while the far-ultraviolet (FUV or "B") camera camera used CsI. The NUV camera failed at launch during ASTRO-2 and was not used during that flight. Both provided long-wavelength cutoffs that made the instrument solar-blind.

Film: The images were recorded on Kodak IIa-O film. The specially designed film transports each held about 1200 frames. The film was advanced by stepper motors. Annotation devices projected the frame count, exposure time, 30-step grey scale, and fiducial marks on each frame.

Further information about the UIT instrument and operations may be found in *Section 1. Introduction and UIT Overview* of the 1997 PASP article describing the UIT mission, as well as the earlier 1992 ApJ article describing its design and performance.

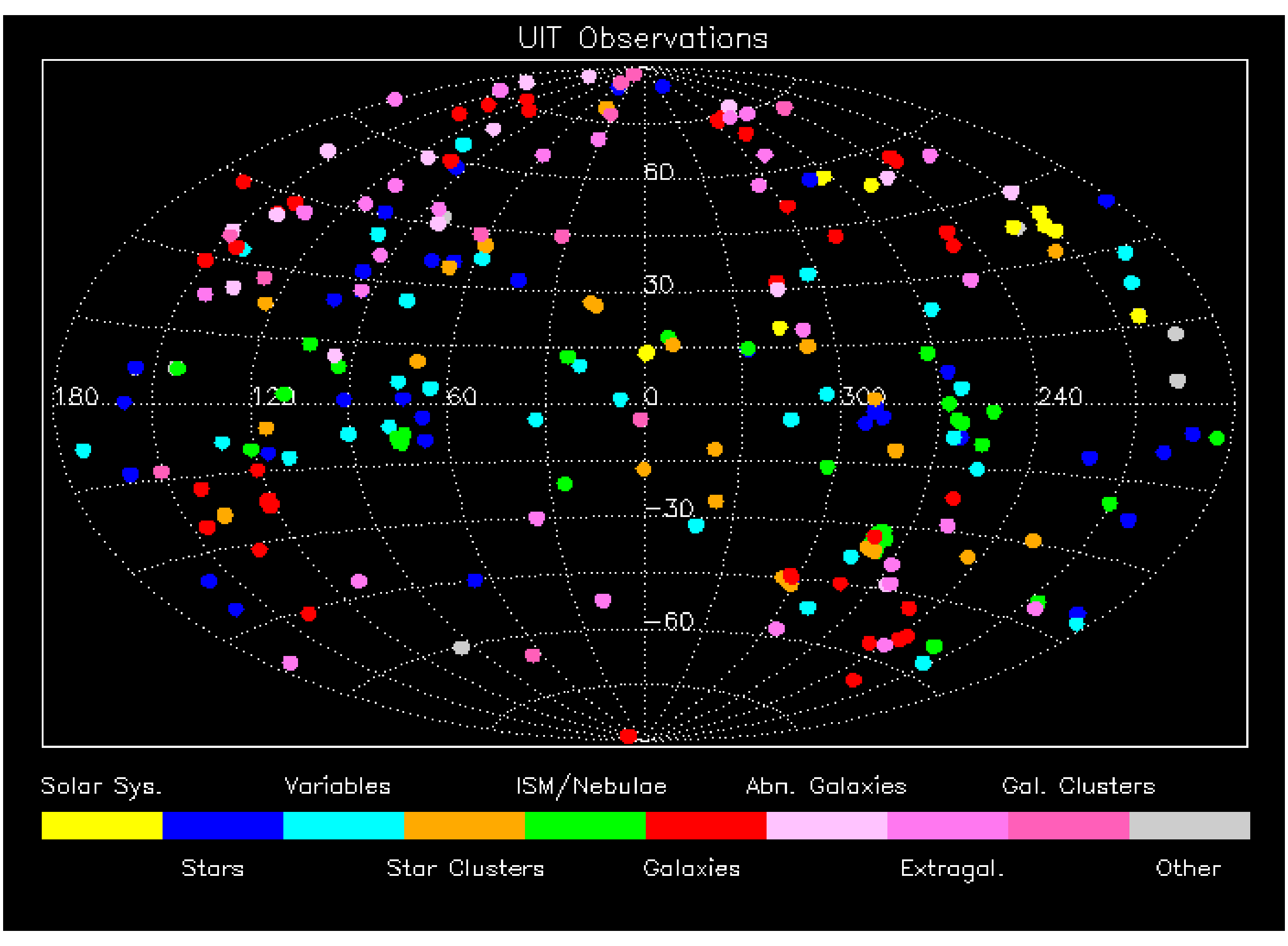
UIT Related Sites

The UIT Mission Home Page has some information and the UIT Picture Gallery.

Acknowledgments

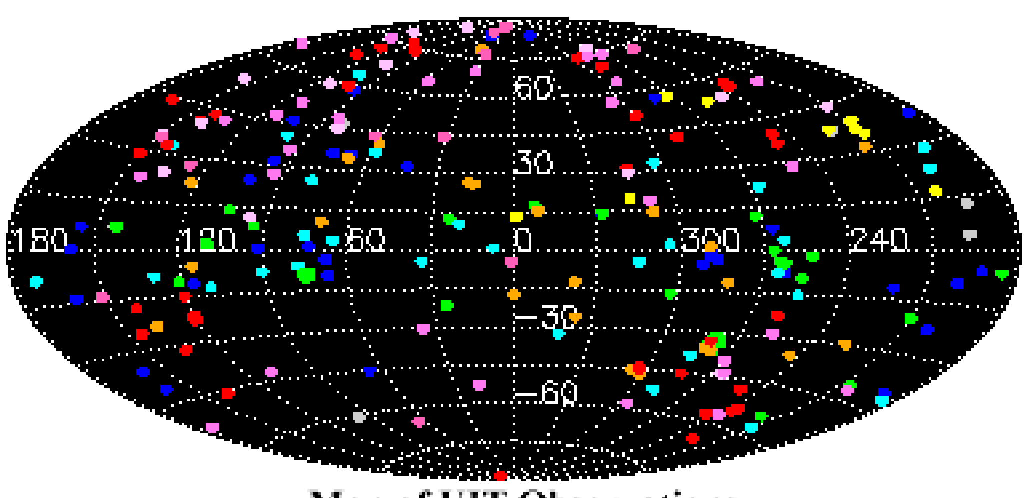
We wish to thank the UIT Project for information about the data.

We wish to thank the staff of NASA's Goddard Space Flight Center (GSFC) Astrophysics Data Facility (ADF) for the data, databases, the preview files and answering questions.


UIT Observations
60
30
180
120
60
0
300
240
-30
-60
Solar Sys.
Variables
ISM/Nebulae
Abn. Galaxies
Gal. Clusters
Stars
Star Clusters
Galaxies
Extragal.
Other

http://archive.stsci.edu/uit/

The ***Ultraviolet Imaging Telescope UIT*** was one of three ultraviolet telescopes on the ASTRO-1 mission flown on the space shuttle Columbia during 2-10 December 1990. The same three instruments were later flown on the space shuttle Endeavour from 3-17 March 1995, as part of the ASTRO-2 mission. Exposures were obtained on 70-mm photographic film in the 1200-3300 Å range using broadband filters and later digitized using a Perkin-Elmer microdensitometer. Image resolution was 3" over a 40' field of view. Overall, UIT-1 obtained 821 exposures of 66 targets, and UIT-2 obtained 758 images of 193 targets.



Map of UIT Observations

WUPPE Target Search

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- Reading WUPPE Data
- Data Products

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- Data Search
- Catalog

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Getting Started

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) was the spectropolarimetry component of the three ASTRO instruments that flew on Space Shuttle missions in December 1990 and March 1995. A halfwave spectropolarimeter provided medium resolution spectropolarimetry for research into the interstellar medium, hot stars, stars with circumstellar material, interacting binary stars, novae, solar system objects, and active galaxies. A Lyot analyzer obtained low resolution observations of faint targets, but due to calibration problems did not produce scientifically useful data. The WUPPE instrument provides a unique data set, one of the few providing polarimetric data in the ultraviolet portion of the spectrum.

The MAST holdings include 238 WUPPE observations of 160 targets obtained with the halfwave spectropolarimeter. Of these, useful spectropolarimetric data are available for 121 targets. Ultraviolet spectrophotometry only is available for the remainder. The data cover a wavelength range from 1400 to 3300 Å, with a spectral resolution of 16 Å. The flux calibration is based primarily on the original IUE (IUESIPS) flux calibration. The polarization was calibrated on the ground and in flight, the latter by observing stars known to be unpolarized in the visible and by observing heavily polarized stars with nearly simultaneous ground-based polarimetric observations.

The search form may be used to select data from the WUPPE catalog by object name, coordinates, type of object, date of observation, etc. Click on the Entry ID to view the spectrum, degree of polarization, and polarization position angle plotted as functions of wavelength.

The data are archived as FITS files. In addition, ASCII files of the data and Postscript plots depicting the polarization and spectrum are provided as part of the standard data product. See Data Products and Reading WUPPE Files for more information.

Search and Retrieval

WUPPE data of interest may be found by **searching** the WUPPE database. Users may specify search criteria as well as output format (see **Search Help**). On the search results page, click on the Entry ID to view a browse file displaying the ultraviolet spectrum, degree of polarization and position angle of polarization, binned either by wavelength or error estimate. Then mark the datasets of interest to be downloaded as a tar file.

A **quick search** of the WUPPE catalog may also be performed. Enter a target name or coordinates in the WUPPE Target Search form, located at the top of the left navigation menu.

Users may obtain an ASCII version of the **WUPPE catalog**, sorted either by coordinates or category, via **anonymous ftp**.

WUPPE data files may also be retrieved via **anonymous ftp**. See **Obtaining WUPPE Data** for information.

WUPPE ASCII Catalogs

The series of ASCII Catalogs contain summaries of the WUPPE observations obtained from the WUPPE database. Catalogs of all WUPPE observations sorted by coordinates and sorted by WUPPE category are available via ftp.

Log	Sort
Total Uncompressed (34 kbytes) GZIP Compressed (8 kbytes)	Coordinates
Category Uncompressed(34 kbytes) GZIP compressed(8 kbytes)	ASTRO classification

The fields contained in the logs are listed below.

FIELD	DESCRIPTION
Object_name	target name assigned by the ASTRO team
RA,DEC	RA and Dec of target (J2000)
Observation Date	Date and time of observation start
Exposure Length	The total useable exposure times in seconds.
Mean % Polarization	Mean percent polarization averaged over approximately 1450-3200 Å (calculated for halfwave data only).
Mean Error	Mean error in percent polarization averaged over approximately 1450-3200 Å
Category	A broad astronomical category assigned by the the ASTRO team. These categories were incoded into the pointing id which is included in this log as part of the data ID. The translation of the pointing id is included in this version of the WUPPE log.
Data ID	The WUPPE entry_id uniquely defines each WUPPE observation. The name is of the form MISSION-OBJECTID-nnnnnn where • MISSION = either WUPPE1 or WUPPE2 • OBJECTID = object name (e.g., GAM-GEM or NGC4151), identical to the entries under "Target Name", • nnnnnn = a unique six-digit number (also known as the pointid), based on the 2-digit ASTRO Science Class, a 2-digit preassigned target number for a given science class (although some targets have more than one target number), and a 2-digit pointing number (i.e., jotfid) for a particular target. The first digit of the pointing number is a sequential number indicating the nth observation at a particular roll angle, and the second digit is the nth exposure at that roll angle. As an example, entry_id WUPPE1_HD5980_226911 designates an observation of HD5980, which is in science class 22, was the 69th selected target in class 22, the first observation at a given roll angle, and the first observation at that roll angle. Within the ASTRO project, the number 226911 would be referred to as the pointid and the jotfid is 11.

archive@stsci.edu
Modified: Mar 13, 2002 13:00

List all changes for WUPPE

WUPPE Added to MAST Scrapbook
2002 March 15
Representative spectra from the ASTRO WUPPE mission have been added to the MAST scrapbook available at http://archive.stsci.edu/scrapbook.html

New WUPPE Preview Files
2002 February 28
The WUPPE Preview files have been updated following the format adopted for the other MAST missions. Besides a plot showing flux, polarization, and polarization position angle as a function of wavelength, there are now links to display the FITS header, display the ASCII table file, display/customize a plot of flux versus wavelength, and download data in FITS format. Links to known literature references are also displayed.

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

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WUPPE publication list updated
2000 May 9
The WUPPE publication list has been updated. Additional ADS links have also been included.

WUPPE-1 & 2
1998 September 22
Data from the ASTRO-1 and ASTRO-2 Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) can now be requested from MAST.

Frequently Asked Questions

Data Requests

Reading Files

Data Requests

- ***How can I tell whether polarization data, as well as the UV spectrum, are available for a particular object?***
  In the search results page, the polarization and position angle will both be set to 0.000 if no polarization data are available. In this case, only the ultraviolet spectrum is available from the archive. In addition, the FITS file for an observation including polarization data is significantly larger (typically 34560 bytes uncompressed) than one with only spectral data (11520 bytes).

Reading Files

- ***How do I read the WUPPE data files?***
  The image files are in FITS format, and should be readable with standard FITS readers. See Reading WUPPE Data for more information.

- ***How do I convert the Stokes parameters Q and U to linear polarization parameters?***
  Linear polarization = sqrt($Q^2 + U^2$), while position angle = 1/2 $\tan^{-1}$(U/Q)

Data Reduction/Analysis

Data Reduction and Analysis (Astro1)

Fortran routines for reading processed WUPPE files. (Requires FITSIO v4.14 or later.)

Project Publications

Instrument and Data Descriptions

- WUPPE Operations Requirement/Procedures Manual
- WUPPE Instrument Description
- WUPPE Data Reduction and Analysis (Astro 1)
- WUPPE Calibration/Performance (Astro 1)
- WUPPE 1 General Information
- WUPPE 1 Halfwave Level 1 FITS Files
- WUPPE 1 Level 0 Downfield Camera Image Data FITS Files
- WUPPE 1 Level 0 SCAN Camera Image Data FITS Files
- WUPPE 1 Level 0 ZOOM Camera Image Data FITS Files
- WUPPE 1 Level 0 FIELD Camera Image Data FITS Files
- WUPPE 2 Halfwave Level 1 Reduced Data

Lists of Scientific Publications

- WUPPE Publication List, compiled by WUPPE Project, through February 2001

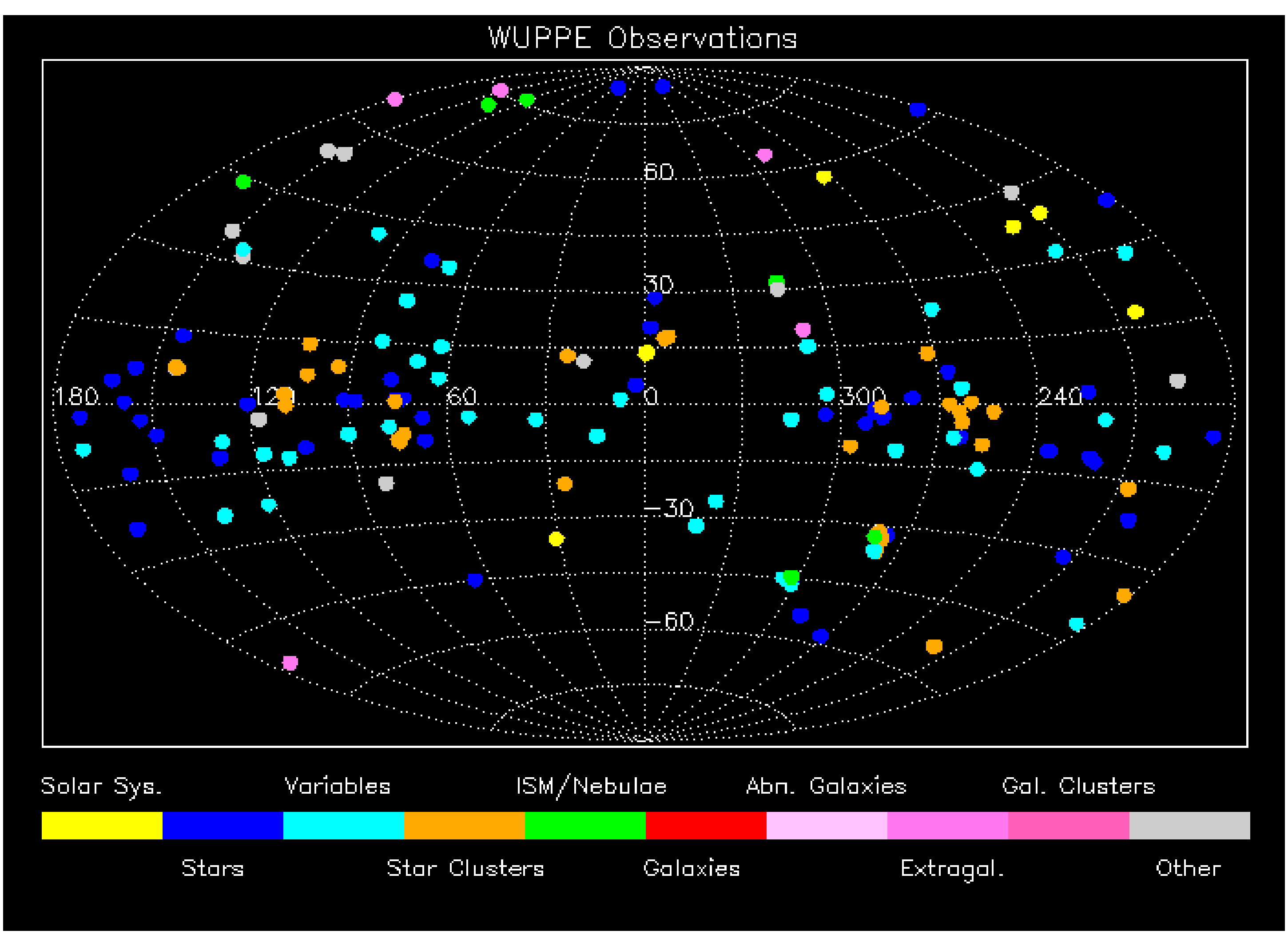
WUPPE Related Sites

The WUPPE web site at the University of Wisconsin has much information about the WUPPE project, a WUPPE Atlas of UV Polarimetric & Spectral Data , and other information

Acknowledgments

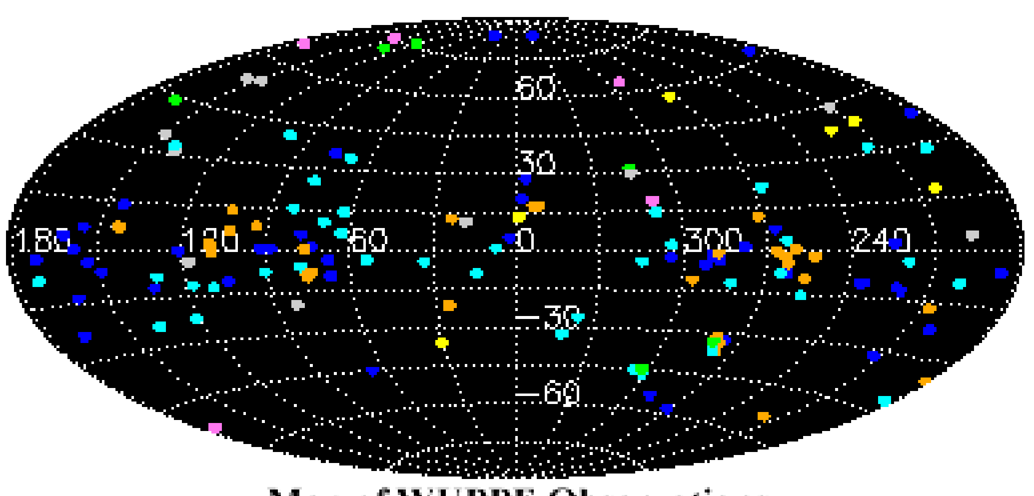
We wish to thank the WUPPE Project, especially Marilyn Meade, for extensive help. We have uitlized or are pointing to several web pages from the WUPPE web site.

We wish to thank the staff of NASA's Goddard Space Flight Center (GSFC) Astrophysics Data Facility (ADF) for the data and information about WUPPE.


WUPPE Observations
60
30
180
120
60
0
300
240
−30
−60
Solar Sys.
Variables
ISM/Nebulae
Abn. Galaxies
Gal. Clusters
Stars
Star Clusters
Galaxies
Extragal.
Other

http://archive.stsci.edu/wuppe/

The ***Wisconsin Ultraviolet Photo-Polarimeter Experiment WUPPE*** was one of three ultraviolet telescopes on the ASTRO-1 mission flown on the space shuttle Columbia during 2-10 December, 1990. 98 observations of 75 targets were obtained. The same three instruments were later flown on the space shuttle Endeavour from 3-17 March, 1995, as part of the ASTRO-2 mission. During the longer ASTRO-2 mission, 369 observations of 254 targets were obtained.



Map of WUPPE Observations

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Getting Started

Launched in August 1972, almost 6 years before IUE, the third Orbiting Astronomical Observatory (otherwise known as Copernicus) represents one of the oldest archives of astronomical UV spectra and is the oldest mission within MAST. Before ending operations in 1981, multiple observations were obtained of 551 targets ranging in brightness from -1.5 to 7th magnitude. Six single-channel detectors were used (U1,U2,U3,V1,V2,V3 with U3 and V3 mainly used for monitoring) covering the wavelength range from 900 to 3150 Angstroms. (See instrumentation/operations for more information.) The most useful Copernicus data is generally considered to be the high resolution U1 and medium resolution U2 scans which covered subsets of the 900-1600 Angstrom range. Individual Copernicus scans could begin anywhere within the prescribed wavelength range and proceeded by stepping up or down in wavelength every 14 seconds. Individual scans generally covered only a few Angstroms (i.e., they contained 14-350 points, with most containing less than 75 points). Observations were typically centered around specific interstellar lines. Occasionally a series of overlapping scans were taken to obtain a more complete spectrum of the target. The most observed target, Zeta Oph, has close to 23,000 spectral scans. A complete target list sorted by right ascension, and spectral coverage plots which give an indication of the U1 & U2 spectral coverage, are available. .

Each Copernicus raw data FITS file contains all the scans for one particular target. The scans are stored chronologically with the earliest scans first. Usually an observer would take a set of scans, once with each detector, and then repeat the process at various wavelengths. As part of a recent ADP program, the U1 and U2 scans were extracted, the contemporaneous scans were coadded, and the results were stored in a separate set of FITS files. The Copernicus spectral atlas files containing data published in the six spectral atlas papers by Rogerson, et al, represent a third set of archived data. More information is available on data products, and reading and retrieving Copernicus files.

Caveats

- Except for some of the spectral atlas data, Copernicus spectra are not calibrated or corrected for scattered light.
- The raw data FITS files use the "variable length array facility" which has not yet been adopted as an official FITS format and may not be readable by all FITS readers.
- The coadded scan FITS files use vector fields in a binary table FITS file, which, although adopted as an official FITS format, may not be readable by all FITS readers.
- The Copernicus detectors severely degraded with time, so observations obtained in the first few years generally have the highest S/N. This also implies that scans taken far apart in time are not suitable for coadding.
- Because the observations are scanned, each wavelength increment is observed roughly 14 seconds before and after its neighbor. Certain instrumental errors can therefore accrue across the spectrum (e.g., passage into the South Atlantic Anomaly),
- Stray light was found to be a problem with some U1 scans, but observing methods were adopted that effectively "blocked" the stray light. For this reason U1 scans were classified as either "blocked" or "unblocked" and the two were not coadded.
- Accurate observations times may require a time correction.
- Investigators are encouraged to read the page on data problems before analyzing Copernicus data.

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Copernicus Data Search & Retrieval

Raw Files Catalog search & data retrieval

- Complete Target List (retrieval & header display for raw data)
- Data Contents Description
- Catalog Field/FITS keyword Descriptions
- Spectral Coverage Plots for U1 and U2 scans

Coadded Scan Quick-look Files Catalog search & data retrieval

- Data Contents Description
- Catalog Field/FITS keyword Descriptions

Copernicus Spectral Atlases

Extract and Display Spectral Scans

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Extracting Spectral Scans

This page allows users to extract and display spectral scans from the Copernicus Raw, or Coadded Scan, FITS files. To run the form however, users must know either the 3-digit target number, or a coadded scan file name.

Submitting the form below with a coadded scan file name (as shown), will display a second form containing a list of the original scan numbers used in the coadded scan. Submitting a 3-digit target number will display the second form with the scan number for the specified target set to 1. In either case, the scan number(s) can be modified. If more than one scan is specified, the spectra will be coadded. Various processing and display options are also available.

Submitting the 2nd form, will display a plot of counts vs wavelength. The extracted data can also be downloaded as an ASCII table file.

Target Number or Coadded Scan File Name: c084-003.bu1

Submit Form   Reset Form

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List all changes for COPERNICUS

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

Target Search Error
2001 June 12
An error was discovered in the target search available from the main MAST page. Searches would fail for object names containing special characters (such as a "+" symbol as in BD +28 4211). The error was fixed on the above date.

Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

New Coadded Scan Browse Files
2000 August 30
The Copernicus coadded scan browse files have been revised to use the same format used by the other MAST missions. The new pages include several new links as well as a new help page, and are accessible from the Copernicus coadded scan search page.

Cross Correlations with Sky2000 Catalog
2000 August 16
Cross correlations of MAST missions with the SKYMAP Sky2000 catalog (version 3) are now possible from the MAST Cross Correlation page.

Updated Copernicus Bibliography
2000 August 8
The Copernicus Bibliography list has been updated. The new list includes papers from 1972 to July, 2000, and includes links to online ADS papers.

Links to ADS Spectral Atlas Papers
2000 June 19
Links to the Copernicus spectral atlas papers available from the ADS have been added to the Spectral Atlas pages. Links from the ADS papers to the MAST spectral atlas pages are also available.

New Copyright Notice
2000 May 12
STScI has adopted a new Copyright statement. Most, if not all, MAST web pages should now include a link to the new page.

More IDL Copernicus Routines
1999 May 6
Selected IDL Routines have been added to the anonymous ftp area on archive.stsci.edu. A summary of all the available programs is contained in the README file.

Early Copernicus Memos Scanned and Online
1999 February 09
Selected Copernicus memos provided by Ed Jenkins form the Princeton University Observatory, have been scanned (courtesy of Jim Caplinger, CSC) and are now available online.

Customized Coadded Scan Option
1998 October 30
There is now an option to customize coadded scans. To use, search the coadded scan database for the desired data, click on the object name for a particular coadded scan shown on the results page, click on the button labeled "customize coadded scans" on the page showing a plot of counts versus wavelength. This will display a forms page with an editable list of scan numbers which comprised the original coadded scan. Several processing options and plot display modes are also offered. Clicking the "submit form" button will display a new plot of the counts versus wavelength and show an option to download the new coadded spectrum as an ASCII table.

If the coadded scan file name is already known, start at the Copernicus Spectral Scans page and enter the file name. This will display the same forms page described above.

Acknowledgments Page added
1998 October 30

Revised Spectral Atlas Files
1998 October 9
Errors were corrected in the Copernicus Spectral Atlas FITS headers. Incorrect keyword values in the FITS extension headers caused floating point values to be displayed as integers, and the Tau Sco normalized counts to be incorrectly scaled from 1 to 1000 (rather than 0 to 1). The corrected Spectral Atlas files are now available online.

FAQ Page
1998 August 5
A Copernicus "Frequently Asked Questions" (FAQ) page is now available. Users should send additional questions to archive@stsci.edu.

New Documentation
1998 August 4
Excerpts from the Copernicus Ultraviolet Spectral Atlas of Tau Scorpii paper describing the photometric reductions used to produce the atlases are now online. Included is a general discussion on correcting for guidance variations.

Copernicus (OAO-3)
1998 January 30
The Copernicus archive of raw, coadded, and

spectral atlas data is now online and accessible from MAST. The ability to coadd user-specified scans and display the results will be coming soon.

Frequently Asked Questions

Data Requests

- Where do I get Copernicus archival data?
- How do I download the Copernicus Spectral Atlas Files?

Instruments

- What are the wavelength ranges of the Copernicus detectors?
- Did the instrument sensitivity significantly degrade with time?

Data Analysis

- How do I read a Copernicus FITS file?
- How do I coadd Copernicus Scans?
- How do I know what wavelength regions were observed for a particular object?

Data Requests

- ***Where do I get Copernicus archival data?***
  At the end of the mission, Princeton provided the National Space Science Data Center (**NSSDC**) with a compact set of data on 9-track tapes as the final archive of the *Copernicus* science mission. The data were formatted in such a manner that special programs were needed to extract the information, bit by bit, from the archive. Under a grant from NASA's Astrophysics Data Program, the **Laboratory for Astronomy and Solar Physics** and the **IUE Data Analysis Center** have converted the tape files into **FITS** format disk files and created an on-line archive of *Copernicus* ultraviolet spectra.

  There is one FITS file of raw scans for each of the 551 objects observed by *Copernicus*. These files can be retrieved from the **raw target list**, the **Copernicus search page**, and via the anonymous FTP at archive.stsci.edu in the **/pub/copernicus/raw** subdirectory. The FITS files containing the raw spectral scans are constructed using a Binary table extension and the proposed "variable length array facility" as described in the NOST FITS Draft Standard. Each row of the binary table contains the data from one spectral scan.

  In addition to the raw data files, coadded contemporaneous scans from the U1 high resolution channel (900-1560 Å) and U2 (900-1650 Å) channel are available from the **Copernicus Coadded Scan search page**, and via the anonymous ftp at archive.stsci.edu in the **U1 coadded scan directory** and the **U2 coadded scan directory** The files are stored as standard Binary table FITS files using fixed length vector fields. The files are intended primarily for quick-look data analysis.

- ***How do I download the Copernicus Spectral Atlas Files?***
  The spectral atlas files are available online from the **Copernicus spectral atlas page**. References to the original published papaers are also given. The files can also be retrieved via anonymous ftp at archive.stsci.edu in the **spectral atlas directory**. All the spectral atlas files use FITS binary table extensions with scalar fields.

Instruments

- ***What are the wavelength ranges of the Copernicus detectors?***
  The table below shows the spectral coverage of each detector. Note however that the individual scans generally covered a much smaller wavelength range.

Name	Exit Slit* (Å)	Wavelength (Å)	Step Size* (Å)
1 - U1	0.05	710-1500**	0.025
2 - V1	0.10	1640-3185	0.05
3 - U2	0.20	750-1645	0.20
4 - V2	0.40	1480-3275	0.40
5 - V3	?	3430 (fixed)	-
6 - U3	?	1320 (fixed)	-

  *****Note: Exit slit and step size vary slightly with wavelength.
  ******For brighter stars, the 1500-1560 angstrom range can be scanned with U1 in the first order.

- ***Did the instrument sensitivity significantly degrade with time?***
  The principal malfunction in the Copernicus instrumentation was the rapid decline in the far-UV sensitivity. The decision to terminate the spacecraft was based partly on the loss of far-UV sensitivity. The following **figure** shows the relative sensitivity of the high-resolution far-UV phototube U1 from orbits 100 to 44000. A rapid (approximately 50 percent) decline at shorter wavelengths was experienced during the first year followed by smaller declines in subsequent years. The low-resolution far-UV phototube U2 exhibited a behavior similar to that of U1. The near-UV phototubes, V1 and V2, did not exhibit the rapid decline seen in the far-UV phototube. For further information, see the **Final Operations Report**.

Data Analysis

- ***How do I read a Copernicus FITS file?***
  The raw data sets are probably the most difficult files to read since they use the proposed variable length array facility for storing vectors in a binary table extension. In any event, of how to read all the Copernicus data sets using a variety of FITS readers are available. Many users will want to work with individual scans. Examples of how to work with them are on the page just cited.

- ***How do I coadd Copernicus Scans?***
  The IDL program **STACK** allows U1 or U2 Copernicus scans to be coadded. This software was used to create the "quick-look" coadded scan files and is available to users from either the **Copernicus Spectral Scan** page (which currently requires you to know the name of a coadded scan file), or from the browse files accessible after searching the **coadded scan database**. In principle, STACK can coadd any Copernicus scans, however only scans taken close in time and using the same detector can produce meaningful results. For this reason, use of STACK is restricted to addiing or subtracting the existing sets of coadded scans.

- ***How do I know what wavelength regions were observed for a particular object?***
  The min and max wavelength for each scan is stored as scalar fields in the raw data sets (note wavelengths could be scanned in either direction, so some vectors are in order of decreasing wavelength). However, to help users determine wavelength coverage for U1 and U2 scans, a **spectral coverage table** was created. This can be a useful tool since most U1 scans only cover a couple of Angstroms, and U2 scans normally covered less than 50 Angstroms. The rows of the spectral coverage table represent the observed targets, while the columns list various wavelength regions. Each entry in the table shows the number of scans obtained in that particular spectral region and is also a link to a gif-format plot file showing the spectral range of each scan within that spectral region.

Copernicus Bibliography

Following is a list of 689 papers, published between 1972 and 2000, referencing the Copernicus mission. The listed bibcodes are links to the online ADS papers. Some references were obtained from the SIMBAD bibliographic database operated at CDS, Strasbourg, France. ADS links for some of these papers may not work.

Savage, Blair D.
"Hot Gas In The Galactic Halo"
2000IAUJD..11E...4S

Shull, J. Michael et al.
"Far Ultraviolet Spectroscopic Explorer Observations of Diffuse Interstellar Molecular Hydrogen"
2000ApJ...538L..73S

Savage, B. D. et al.
"Far Ultraviolet Spectroscopic Explorer Observations of O VI Absorption in the Galactic Halo"
2000ApJ...538L..27S

Cranmer, Steven R. et al.
"A Multiwavelength Campaign on gamma Cassiopeiae. IV. The Case for Illuminated Disk-enhanced Wind Streams"
2000ApJ...537..433C

Richter, Ph.
"ORFEUS II echelle spectra: H_2 measurements in the Magellanic Clouds"
2000A&A...359.1111R

Sembach, Kenneth R.
"The Far Ultraviolet Spectroscopic Explorer: Mission Overview and Prospects for Studies of the Interstellar Medium and High-Velocity Clouds"
1999hvc..work..243S

Snow, Theodore P.
"Ultraviolet Observations of Molecular Hydrogen in Interstellar Space"
1999h2sp.confE..27S

Christian, Damian et al.
"The Multimission Archive at Space Telescope"
1999adass...8..233C

Arabadjis, J. S. et al.
"X-Ray Absorption and the Galactic ISM"
1999HEAD...31.3507A

Welty, Daniel E. et al.
"The Diffuse Interstellar Clouds toward 23 Orionis"
1999ApJS..124..465W

Roth, Katherine C. et al.
"The Z = 1.6748 C I Absorber toward PKS 1756+237"
1999ApJ...515L..57R

Brandt, J. C. et al.
"Echelle Spectroscopy of Interstellar Absorption toward MU Columbae with the Goddard High Resolution Spectrograph"
1999AJ....117..400B

Dixon, W. V. et al.
"A Survey of Interstellar Molecular Hydrogen with the Berkeley Extreme and Far-Ultraviolet Spectrometer on the ORFEUS-SPAS I and II Missions"
1999AAS...195.7303D

Savage, B. D. et al.
"O VI Absorption in the Galactic Halo"
1999AAS...195.0611S

Imhoff, C. et al.
"Resources Available through the Multimission Archive at Space Telescope (MAST)"
1999AAS...194.8302I

Angelini, L. et al.
"Recent data restoration additions to the HEASARC archive"
1999AAS...194.8301A

Kaper, Lex
"O-Star Wind Variability in the Ultraviolet and Optical Range"
1998vnsw.coll..193K

Vidal-Madjar, A. et al.
"Deuterium Observations in the Galaxy"
1998SSRv...84..297V

Field, George B.
"Lyman Spitzer, Jr. (1914-1997)"
1998PASP..110..215F

Dixon, W. V. D. et al.
"ORFEUS-I Observations of Molecular Hydrogen in the Galactic Disk"
1998LNP...506..261D

Richter, P. et al.
"Detection of H2 in UV absorption in the LMC"
1998IAUS..190E..74P

Jenkins, E. B. et al.
"IMAPS Observations Of Atomic Deuterium Toward Delta ORI A"
1998AAS...193.6517J

Morse, J. A. et al.
"The Cosmic Origins Spectrograph for the Hubble Space Telescope COS Instrument Definition Team"
1998AAS...193.3610M

Smith, M. A.
"Analysis of Apparent Velocities from High-Resolution NEWSIPS-Processed IUE Data"
1998AAS...192.6705S

O'Neal, D. et al.
"Simulations of FUSE spectra of A-type and cooler stars: D/H and warm plasma emission"
1998AAS...192.5602O

Sofia, Ulysses J.
"Far Ultraviolet Observations of the Neutral Interstellar Medium"
1998AAS...192.4907S

Snow, Theodore P.
"Far-Ultraviolet Spectroscopy of Interstellar Molecular Hydrogen"
1998AAS...192.4906S

Jenkins, E. B.
"Observations of Hot, O VI-bearing Gases in Space: Past Conclusions and Future Prospects"
1998AAS...192.4905J

Sembach, K. R.
"Deuterium in the Galaxy"
1998AAS...192.4903S

Linsky, J. L.
"The Fascination of Far-UV Astrophysics"
1998AAS...192.4902L

Levshakov, Sergei A. et al.
"New aspects of absorption line formation in intervening turbulent clouds - II. Monte Carlo simulation of interstellar H+D Lyalpha absorption profiles"
1997MNRAS.288..802L

Choe, Seung-Urn et al.
"Comparison of Sobolev Approximation with the Exact ALI in P Cygni type Profile"
1997JKAS...30...13C

Gonzalez Delgado, Rosa M. et al.
"O VI + LY beta + C II from Starburst and Poststarburst Galaxies. I. Stellar Library and Evolutionary Synthesis Profiles"
1997ApJ...489..601G

Sorokin, P. P. et al.
"Evidence for Nonlinear Generation of VUV Light by Four-Wave Parametric Oscillation (FWPO) in H_2-Containing Clouds Near B-Type Supergiants"
1997AAS...191.5116S

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1997AAS...191.5011D

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1997AAS...191.4101M

Oliversen, N. et al.
"UV/Optical Archive Data Services of the GSFC Astrophysics Data Facility (ADF)"
1997AAS...191.1702O

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1997AAS...190.4203S

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1997A&A...325..664O

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1996csc..reptQ....T

Klinglesmith, Daniel A., III et al.
"Availability of Copernicus UV Data in FITS Format"
1996adass...5..521K

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"The Interstellar Medium in Our Galaxy: a New Interpretation of the Distribution of Hot/cool Gas Boundaries in the Disk, and Models of Supernova Remnants in the Halo."
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1996DLN.........44M

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1996ApJ...465..296H

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1996ApJ...458L..29S

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1996AAS...188.4701S

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1996AAS...188.4405W

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1996AAS...188.0707D

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1995chst.conf..242O

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1995AAS...18712005S

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1995AAS...187.4516H

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1995AAS...187.1505S

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1995AAS...187.0401C

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1995AAS...186.3504H

Shelton, R. L. et al.
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1994ApJ...434..599S

Diplas, Athanassios et al.
"An IUE survey of interstellar H I LY alpha absorption. 2: Interpretations"
1994ApJ...427..274D

Fitzpatrick, Edward L. et al.
"Composition of interstellar clouds in the disk and halo. 2: Gamma2 Velorum"
1994ApJ...427..232F

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"A statistical equilibrium analysis of interstellar CO toward zeta Ophiuchi as recorded by the Goddard High Resolution Spectrograph"
1994ApJ...426..254L

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"Observations of Interstellar Argon with IMAPS"
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1993AAS...183.1410F

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1993AAS...182.4128S

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Copernicus

- Copernicus x-ray experiment - The copernicus satellite included both a UV spectrograph and a x-ray experiment. The x-ray data is available from HEASARC.

Raw Data Search
Coadd Data Search

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- **"Access to the Far-Ultraviolet Universe: Three Far-UV Mission Data Sets"** (NRA 92-OSSA-15)
  - PI: George Sonneborn (NASA/GSFC),
  - Co-I's: Ron Polidan (NASA/GSFC), Susan Neff (NASA/GSFC), Dan Klinglesmith (NASA/GSFC), Michael Van Steenberg (NASA/GSFC), Randy Thompson (CSC), Carol Christian (EUVE), and Tim Carone (EUVE),
- **"Access to the Far-Ultraviolet Universe: Copernicus and Voyager/UVS Data Sets"** (NRA 94-OSSA-17)
  - PI: George Sonneborn,
  - Co-I's: Ron Polidan, Susan Neff, Dan Klinglesmith, Michael Van Steenberg, Ron Oliversen (NASA/GSFC), Randy Thompson, and Jay Holberg (LPL).

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- Ron Polidan and Ed Jenkins (Princeton), for invaluable advice, documentation, and information in general, on the Copernicus project,
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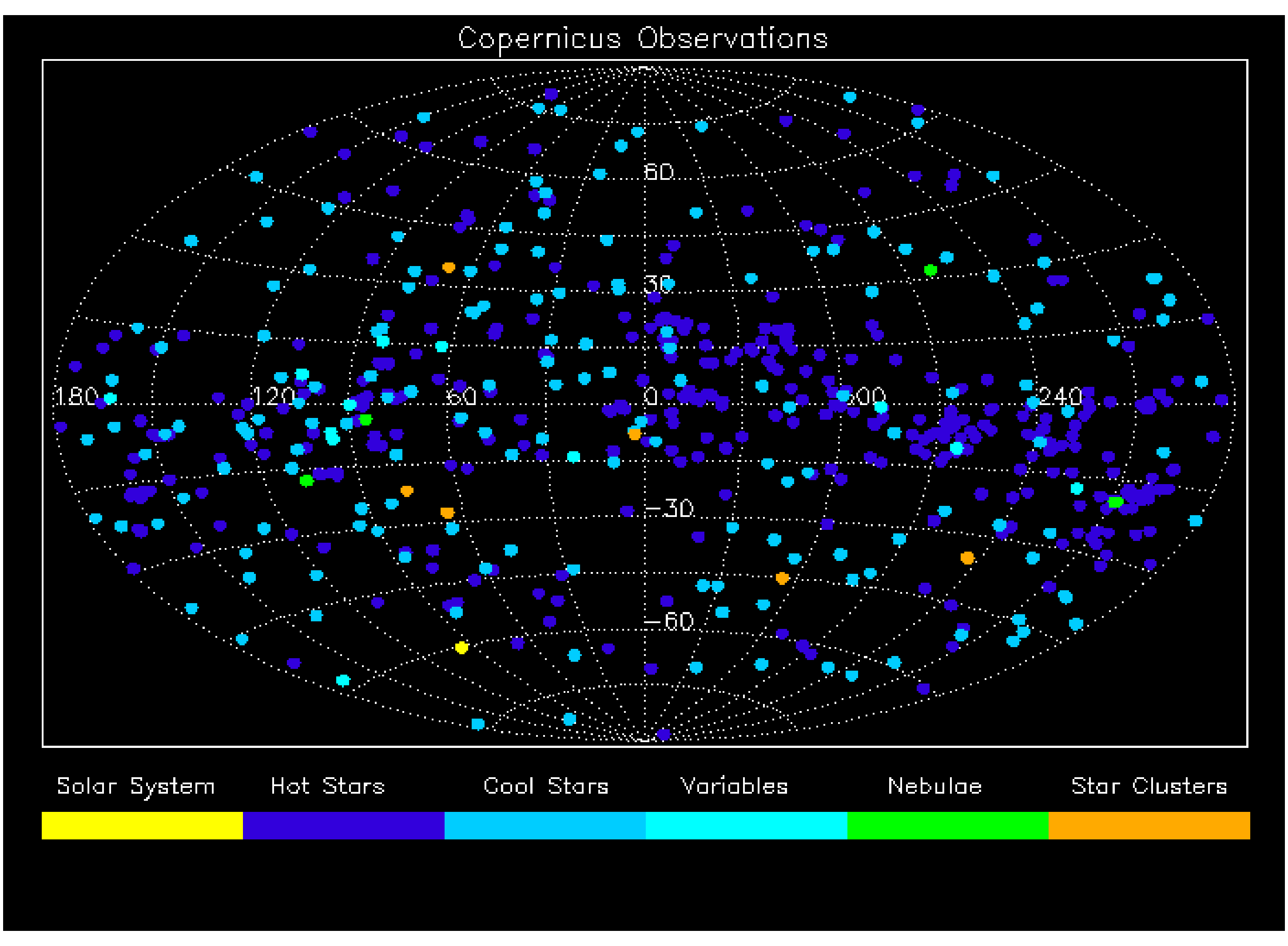
- The former CSC IUE Data Analysis Center staff including Jim Caplinger, Lyla Taylor, Pat Lawton, Mike Carini, and Terry Teays, for software and database development, creating the original Copernicus WEB site, and general testing.
- the Raytheon/STX ADF staff including Nancy Oliversen, Derck Massa, and Pat Lawton, for general advice on archiving mission data sets,
- Jim Lauroesch (Northwestern University), for describing and documenting several Copernicus data analysis problems and techniques, and
- John Rogerson (Princeton), for permission to reprint information from his Copernicus Spectral Atlas papers.


Copernicus Observations
60
30
180
120
60
0
300
240
-30
-60
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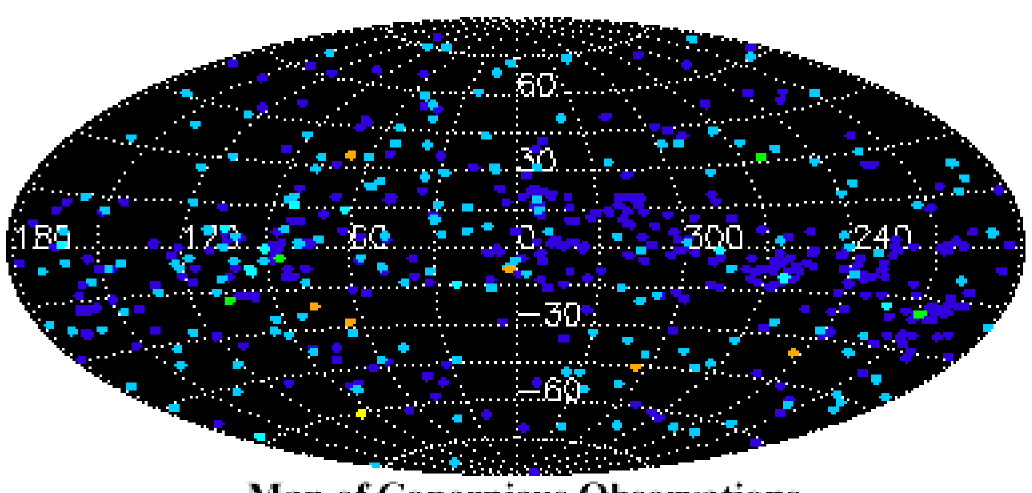
Hot Stars
Cool Stars
Variables
Nebulae
Star Clusters

http://archive.stsci.edu/copernicus/

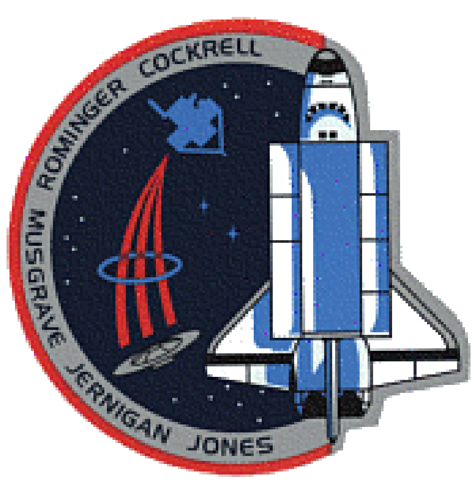
The ***Copernicus*** satellite, otherwise known as the Orbiting Astronomical Observatory 3 (OAO-3), obtained a series of high resolution far- (900-1560 Å) and near- (1650-3150 Å) ultraviolet spectral scans of 551 objects, primarily bright stars, from 1972 to 1981.



Map of Copernicus Observations

http://archive.stsci.edu/orfeus/

The ***Orbiting Retrievable Far and Extreme Ultraviolet Spectrometers (ORFEUS)-SPAS*** payloads were joint DARA (German Space Agency)/NASA missions flown on two shuttle flights. The first flight was September 12-22, 1993 aboard the shuttle Discovery. The second flight, aboard Columbia, was from November 19, through December 7, 1996.



The free-flying ORFEUS-SPAS platform was designed to be deployed and and retreived from the shuttle.

The three instruments on the ORFEUS were designed to provide astronomical ultraviolet spectroscopic observations over the wavelength range from 40 to 140 nanometers. The three instruments were:

- Tübingen Ultraviolet Echelle Spectrometer (TUES); (PI) Prof. Michael Grewing; University of Tübingen
- Berkeley Extreme and Far-UV Spectrometer (BEFS); (PI) Dr. Mark Hurwitz; University of California, Berkeley. This instrument was called the Extreme Ultraviolet (EUV) Spectrometer in the ORFEUS-SPAS II Mission Research Announcement. It was later renamed.
- Interstellar Medium Absorption Profile Spectrograph (IMAPS); (PI) Dr. Edward Jenkins; Princeton University

The largest science instrument onboard was a 1-meter telescope. The telescope primary was coated with iridium to improve its light gathering power in the ultraviolet. Incoming light was focused to a movable mirror which deflected the light rays into the FUV Spectrometer (i.e., TUES), which operated in the 90-140 nanometer range. When the pick-off mirror was moved out of the beam, light fell instead onto the BEFS Spectrometer, which covered wavelengths between 39 and 120 nanometers. A second, separate instrument, the IMAPS Spectrograph, recorded extremely high resolution spectral data in the 95-115 nanometer range.

This information came from the ORFEUS-SPAS II Mission Research Announcement. A postscript version of this research announcement is located in [/archive.stsci.edu/pub/pub/orfeus/orfeus_nra.ps]

BEFS Target Search

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Acknowledgments

Getting Started

The Berkeley Extreme and Far-UV Spectrometer (BEFS), flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS for 5 days in September 1993 and again for 14 days in November 1996.

The first BEFS mission obtained spectra of about 75 objects, and the second mission (BEFS II) obtained spectra of about 102 objects. The BEFS spectrograph's full bandpass is 390 - 1218 Å, but most observations were done in the FUV region (900 - 1250 Å) with a mean spectral resolution of 95 km/s FWHM for point sources.

A table of the BEFS I & II observations by type/spectral class is given below.

Table of BEFS Observations

Type	BEFS I & II
Early Type Stars	87
Coronae/Late Stars	30
White Dwarf	14
Cataclysmic Variable	9
Extragalactic Object	11
Planetary Nebulae	8
Solar System	5
Other	9

Search and Retrieval

BEFS data of interest may be found by searching the MAST BEFS database. As explained in the Search Help page, users may specify search criteria and output format. On the search results page, users may mark datasets of interest to be downloaded as a tar file.

A "quick search" of the BEFS catalog may be performed by entering a target name or coordinates in the form labeled BEFS Target Search at the top of the left navigation menu.

Users may also peruse a "catalog" of BEFS data. Click on the Data ID in the table to bring up a preview plot and some associated information. Click on the grating entry to obtain the other files (including the time-tagged spectral-photon data). The user may find it useful to read an overview of the data file types. To save the data to disk, hold down the SHIFT key while clicking on the link. (This should work for most browsers. Others may require you to click the second or third mouse button instead of the first.) The data are all gzipped. Some browsers may unzip the data. The files are all in FITS format.

BEFS Catalog of Observations

The following catalog lists the objects observed by the Berkeley Extreme and Far_Ultraviolet Spectrometer (BEFS) during both ORFEUS missions. A preview plot of the spectrum may be views by clicking on the Data ID in the table. The user may click on the grating entry to obtain the other files (including the time-tagged spectral-photon data). The user may find it useful to read an overview of the data file types. To save the data to disk, hold down the SHIFT key while clicking on the link. (This should work for most browsers. Others may require you to click the second or third mouse button instead of the first.) The data are all gzipped. Some browsers may unzip the data. The files are all in FITS format.

Data Identifier	Object	Ra & Dec (2000)	Observation Date/Time	Spectral Type	Exp Length (s)	Gratings	
befs2087	SATURN	00 05 26.81 -02 00 43.20	26 Nov 1996 12:04:54	--	1203	abcd	
befs2156	KPD 0005+5106	00 08 16.99 +51 22 54.11	30 Nov 1996 07:40:00	DA	1027	cd	
befs2181	SX CAS	00 10 42.07 +54 53 29.39	01 Dec 1996 05:10:41	G6	1267	cd	
befs2214	SX CAS	00 10 42.07 +54 53 29.39	03 Dec 1996 15:20:30	G6	528	cd	
befs2109	PG 0009+036	00 12 28.01 +03 54 29.88	28 Nov 1996 07:07:33	B	703	cd	
befs2111	PG 0009+036	00 12 28.01 +03 54 29.88	28 Nov 1996 08:33:54	B	2141	cd	
befs2117	PG 0009+036	00 12 28.01 +03 54 29.88	28 Nov 1996 12:56:03	B	1875	cd	
befs2121	PG 0009+036	00 12 28.01 +03 54 29.88	28 Nov 1996 15:58:52	B	1143	cd	
befs2101	RX J0019.8+2156	00 19 50.11 +21 56 53.88	27 Nov 1996 07:52:09	Ss	1166	cd	
befs2175	RX J0019.8+2156	00 19 50.11 +21 56 53.88	01 Dec 1996 02:05:28	Ss	2550	cd	
befs1013	HD 3827	00 41 12.16 +39 36 13.71	15 Sep 1993 19:12:15	B0.7 Vn	1621	cd	
befs2016	ABELL 85	00 41 37.01 -09 20 35.88	22 Nov 1996 06:15:42		--	2001	raw only
befs2170	ABELL 85	00 41 37.01 -09 20 35.88	30 Nov 1996 23:19:32		--	1600	raw only
befs1107	NGC 246	00 47 03.34 -11 52 18.91	18 Sep 1993 21:11:37	Op/PN	382	cd	
befs2199	NGC 346	00 59 00.41 -72 10 37.92	02 Dec 1996 05:24:20		--	1930	cd
befs2195	NGC 346	00 59 01.10 -72 10 27.84	02 Dec 1996 02:23:43		--	1568	cd
befs2014	IC 63	00 59 01.37 +60 53 17.89	21 Nov 1996 17:38:06	B0p	1291	cd	
befs2023	IC 63	00 59 01.37 +60 53 17.89	22 Nov 1996 12:11:55	B0p	1920	cd	
befs1017	Cl* NGC 346 WB 1	00 59 03.20 -72 10 27.02	15 Sep 1993 21:42:47	O4III	2146	cd	
befs1019	Cl* NGC 346 WB 1	00 59 03.20 -72 10 27.02	15 Sep 1993 23:13:49	O4III	2457	cd	
befs1068	HD 5980	00 59 26.57 -72 09 53.89	17 Sep 1993 12:48:49	WRp	1810	cd	
befs2197	SK 80	00 59 30.00 -72 10 59.87	02 Dec 1996 03:52:56	O9	1984	cd	
befs2105	AV 232	00 59 32.21 -72 10 45.83	27 Nov 1996 11:05:52	O9	1695	cd	
befs2186	AV 232	00 59 32.21 -72 10 45.83	01 Dec 1996 20:38:00	O9	870	cd	
befs2151	FAIRALL 9	01 23 46.08 -58 48 23.04	30 Nov 1996 04:46:00		--	2401	cd
befs1095	HD 14633	02 22 54.29 +41 28 47.71	18 Sep 1993 10:53:39	O8.5 V	161	cd	
befs2010	HD 18100	02 53 40.80 -26 09 20.52	21 Nov 1996 15:25:06	B5II/III	716	cd	
befs1039	KAP CET	03 19 21.70 +03 22 12.72	16 Sep 1993 09:06:27	G5 Vvar	309	abcd	
befs2049	UX ARI	03 26 35.40 +28 42 54.36	24 Nov 1996 14:37:14	G5IV	1958	cd	
befs1033	EPS ERI	03 32 55.84 -09 27 29.73	16 Sep 1993 07:39:00	K2 V	120	abcd	
befs1042	EPS ERI	03 32 55.84 -09 27 29.73	16 Sep 1993 10:25:00	K2 V	1698	abcd	
befs2006	HR 1099	03 36 47.28 +00 35 16.08	21 Nov 1996 13:17:29	G9V	1783	cd	
befs2165	IC 349	03 46 18.70 +23 56 25.08	30 Nov 1996 20:29:00		--	1301	cd
befs2166	IC 349	03 46 18.70 +23 56 25.08	30 Nov 1996 20:51:00		--	413	cd
befs2164	IC 349	03 46 19.08 +23 56 35.16	30 Nov 1996 20:08:51		--	794	cd
befs2095	HD 23480	03 46 19.15 +23 56 40.20	27 Nov 1996 03:44:31		--	1894	cd
befs1086	V471 TAU	03 50 24.97 +17 14 47.43	18 Sep 1993 04:35:12	K0	952	cd	
befs1084	VW HYI	04 09 12.06 -71 17 45.81	18 Sep 1993 03:33:51	DWARF NOVA	1186	abcd	
befs1104	VW HYI	04 09 12.06 -71 17 45.81	18 Sep 1993 20:05:28	DWARF NOVA	873	abcd	
befs1073	HD 29138	04 13 46.72 -84 29 08.83	17 Sep 1993 20:15:34	B1 Iab	922	cd	
befs1029	NGC 1535	04 14 16.00 -12 44 21.01	16 Sep 1993 05:45:00	?npe...	1562	cd	
befs2097	HD 28052	04 26 20.74 +15 37 05.88	27 Nov 1996 05:14:38	F0V	2065	cd	
befs2047	ABELL 496	04 33 37.01 -13 14 48.12	24 Nov 1996 13:06:57		--	2249	cd
befs1055	MCT 0455-2812	04 57 12.70 -28 08 10.00	17 Sep 1993 04:23:26	DA:	2338	abcd	
befs1072	MCT 0455-2812	04 57 12.70 -28 08 10.00	17 Sep 1993 19:25:38	DA:	2254	abcd	
befs1074	MCT 0455-2812	04 57 12.70 -28 08 10.00	17 Sep 1993 20:56:09	DA:	2556	abcd	
befs1076	MCT 0455-2812	04 57 12.70 -28 08 10.00	17 Sep 1993 22:27:08	DA:	1550	abcd	
befs1047	AIRGLOW	05 03 53.90 -28 55 04.01	16 Sep 1993 13:18:00		--	2457	cd
befs1053	AIRGLOW	05 03 53.90 -28 55 04.01	17 Sep 1993 02:52:00		--	2398	cd
befs1002	MCT 0501-2858	05 03 53.90 -28 55 04.01	14 Sep 1993 09:07:25	DO	475	abcd	
befs1008	MCT 0501-2858	05 03 53.90 -28 55 04.01	15 Sep 1993 15:14:19	DO	251	abcd	
befs2003	MCT 0501-2858	05 03 53.90 -28 55 04.08	21 Nov 1996 12:21:41	DO	1329	abcd	
befs2122	MCT 0501-2858	05 03 53.90 -28 55 04.08	28 Nov 1996 16:26:23	DO	2273	abcd	
befs2126	MCT 0501-2858	05 03 53.90 -28 55 04.08	28 Nov 1996 19:32:52	DO	1279	abcd	
befs2128	MCT 0501-2858	05 03 53.90 -28 55 04.08	29 Nov 1996 14:01:30	DO	1446	abcd	
befs2133	MCT 0501-2858	05 03 53.90 -28 55 04.08	29 Nov 1996 16:44:29	DO	1314	abcd	
befs2173	MCT 0501-2858	05 03 53.90 -28 55 04.08	01 Dec 1996 00:53:20	DO	1458	bcd	
befs2191	G 191-B2B	05 05 30.60 +52 49 51.96	01 Dec 1996 23:55:46	DAw...	327	abcd	
befs1005	G 191-B2B	05 05 30.61 +52 49 51.92	15 Sep 1993 13:18:39	DAw...	1940	abcd	
befs1045	G 191-B2B	05 05 30.61 +52 49 51.92	16 Sep 1993 11:48:45	DAw...	2242	abcd	
befs1057	G 191-B2B	05 05 30.61 +52 49 51.92	17 Sep 1993 05:53:45	DAw...	1850	abcd	
befs1059	G 191-B2B	05 05 30.61 +52 49 51.92	17 Sep 1993 07:16:48	DAw...	2069	abcd	
befs2054	HE 0504-2408	05 06 18.70 -24 04 17.04	24 Nov 1996 17:51:21	DO	1801	cd	
befs2179	HD 33599	05 07 12.94 -61 48 18.36	01 Dec 1996 03:55:41	B5psh	1295	cd	
befs1024	ALF AUR	05 16 41.36 +45 59 52.76	16 Sep 1993 02:55:39	G5 IIIe+...	1660	abcd	
befs1101	HD 36402	05 26 03.95 -67 29 56.98	18 Sep 1993 18:25:59	WC:	1306	cd	
befs1070	HD 269546	05 26 45.31 -68 49 52.81	17 Sep 1993 14:01:36	B3 Iabp...	661	cd	
befs1108	HD 269546	05 26 45.31 -68 49 52.81	18 Sep 1993 21:26:57	B3 Iabp...	1289	cd	
befs2160	IC 418	05 27 28.20 -12 41 50.28	30 Nov 1996 09:41:00	?npe...	1114	cd	
befs1087	AB DOR	05 28 44.83 -65 26 54.85	18 Sep 1993 05:00:04	K1 IIIp...	1732	abcd	
befs2069	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 00:14:46	K1IIIp...	2287	cd	
befs2071	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 01:38:28	K1IIIp...	2897	cd	
befs2073	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 03:25:23	K1IIIp...	1951	cd	
befs2075	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 04:55:30	K1IIIp...	1911	cd	
befs2077	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 06:25:36	K1IIIp...	1754	cd	
befs2080	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 08:04:39	K1IIIp...	1990	cd	
befs2082	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 09:33:47	K1IIIp...	1384	cd	
befs2088	AB DOR	05 28 44.83 -65 26 54.96	26 Nov 1996 12:34:20	K1IIIp...	1604	cd	
befs1081	TV COL	05 29 25.57 -32 49 05.20	18 Sep 1993 01:39:11	K1	1911	abcd	
befs2162	LB 3459	05 31 40.34 -69 53 02.05	30 Nov 1996 18:53:00	B	1112	cd	
befs2147	HD 269698	05 31 42.19 -67 38 07.08	30 Nov 1996 01:50:06	O7	2095	cd	
befs2149	SK -67 167	05 31 52.01 -67 39 41.04	30 Nov 1996 03:20:50	O4	2407	cd	
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befs2057	SK -67 211	05 35 13.90 -67 33 27.01	24 Nov 1996 19:17:03	O7	2517	cd	
befs2193	SK -67 211	05 35 13.90 -67 33 27.01	02 Dec 1996 00:57:52	O7	2110	cd	
befs2154	HD 269810	05 35 14.81 -67 33 27.01	30 Nov 1996 06:44:00		--	1568	cd

befs2212	HD 36819	05 35 27.12 +24 02 22.56	03 Dec 1996 14:05:55	B2.5IV	213	cd	
befs2168	HD 37903	05 41 38.40 -02 15 32.40	30 Nov 1996 22:01:57	B1.5V	1722	cd	
befs2015	BY CAM	05 42 49.06 +60 51 30.96	21 Nov 1996 18:03:33		--	3896	cd
befs1051	SS LEP	06 04 59.13 -16 29 03.95	17 Sep 1993 01:22:54	Ap sh	2346	abcd	
befs1079	SS LEP	06 04 59.13 -16 29 03.95	18 Sep 1993 00:04:10	Ap sh	2196	abcd	
befs1062	HD 41161	06 05 52.46 +48 14 57.40	17 Sep 1993 09:18:03	O8 V	914	cd	
befs2065	NU ORI	06 07 34.32 +14 46 06.60	25 Nov 1996 22:43:45	B3V	1876	cd	
befs2032	HD 44179	06 19 58.22 -10 38 14.64	23 Nov 1996 18:56:00	B8V	2791	cd	
befs2034	HD 44179	06 19 58.22 -10 38 14.64	23 Nov 1996 20:29:32	B8V	2836	cd	
befs2184	DIA2BCMA	06 22 41.90 -17 57 21.96	01 Dec 1996 17:41:00		--	706	raw only
befs2185	DIA2BCMA	06 22 41.90 -17 57 20.88	01 Dec 1996 17:54:00		--	1139	raw only
befs1098	HD 45595	06 30 28.24 +43 56 16.11	18 Sep 1993 12:26:00	F5	960	cd	
befs1034	HD 50896	06 54 13.04 -23 55 42.03	16 Sep 1993 07:47:56	WN...	492	cd	
befs1040	HD 50896	06 54 13.04 -23 55 42.03	16 Sep 1993 09:19:14	WN...	969	cd	
befs2007	AU MON	06 54 54.72 -01 22 32.88	21 Nov 1996 14:02:23	B5	1013	cd	
befs1016	EPS CMA	06 58 37.55 -28 58 19.49	15 Sep 1993 21:00:16	B2 Iab:	2040	ab	
befs1018	EPS CMA	06 58 37.55 -28 58 19.49	15 Sep 1993 22:33:51	B2 Iab:	1889	ab	
befs2093	EPS CMA	06 58 37.56 -28 58 19.56	27 Nov 1996 02:33:00	B2Iab:	774	bcd	
befs2114	EPS CMA	06 58 37.56 -28 58 19.56	28 Nov 1996 10:27:53	B2Iab:	1881	bcd	
befs2116	EPS CMA	06 58 37.56 -28 58 19.56	28 Nov 1996 11:46:35	B2Iab:	2711	bcd	
befs2120	EPS CMA	06 58 37.56 -28 58 19.56	28 Nov 1996 15:09:06	B2Iab:	1401	bcd	
befs2143	EPS CMA	06 58 37.56 -28 58 19.56	29 Nov 1996 22:51:11	B2Iab:	2680	bcd	
befs1014	HD 54911	07 10 08.87 -15 41 05.06	15 Sep 1993 19:50:05	B1 III	1107	cd	
befs1089	HD 54911	07 10 08.87 -15 41 05.06	18 Sep 1993 06:21:14	B1 III	1001	cd	
befs2157	HS 0713+3958	07 17 03.00 +39 53 24.00	30 Nov 1996 08:12:00	DO	600	cd	
befs2158	NGC 2392	07 29 10.78 +20 54 42.48	30 Nov 1996 08:29:00	O6	1200	cd	
befs1027	HD 60848	07 37 05.73 +16 54 15.30	16 Sep 1993 04:54:36	O8 V:pevar	250	cd	
befs1020	ALF CMI	07 39 18.12 +05 13 29.96	16 Sep 1993 00:05:33	F5 IV-V	1526	abcd	
befs2118	ALF CMI	07 39 18.12 +05 13 30.00	28 Nov 1996 13:35:45	F5IV-V	2084	abcd	
befs2124	ALF CMI	07 39 18.12 +05 13 30.00	28 Nov 1996 18:06:13	F5IV-V	1880	abcd	
befs2136	ALF CMI	07 39 18.12 +05 13 30.00	29 Nov 1996 18:28:30	F5IV-V	2590	abcd	
befs2140	ALF CMI	07 39 18.12 +05 13 30.00	29 Nov 1996 21:31:46	F5IV-V	499	abcd	
befs1069	NGC 2440	07 41 55.40 -18 12 33.01	17 Sep 1993 13:31:24	?npe...	1270	cd	
befs2100	PQ GEM	07 51 17.30 +14 44 22.92	27 Nov 1996 06:53:16	CV	2854	cd	
befs2102	PQ GEM	07 51 17.30 +14 44 22.92	27 Nov 1996 08:27:11	CV	2852	cd	
befs2104	PQ GEM	07 51 17.30 +14 44 22.92	27 Nov 1996 10:15:34	CV	1925	cd	
befs2036	BD+75 325	08 10 49.49 +74 57 57.97	23 Nov 1996 22:22:22	O5pvar	1119	cd	
befs1030	IX VEL	08 15 18.97 -49 13 20.67	16 Sep 1993 06:19:45	B+...	1114	cd	
befs2145	MOON	08 19 42.60 +15 05 10.32	30 Nov 1996 00:39:34		--	2011	abcd
befs1097	Z CAM	08 25 13.42 +73 06 38.58	18 Sep 1993 11:55:22	DWARF NOVA	1477	cd	
befs2013	HD 75750	08 52 20.02 +19 21 02.88	21 Nov 1996 17:09:10	B5	817	cd	
befs1049	HD 233622	09 21 33.60 +50 05 56.37	16 Sep 1993 15:00:26	B5	2072	cd	
befs2041	HD 233622	09 21 33.60 +50 05 56.40	23 Nov 1996 23:46:20	B2 V	1297	cd	
befs2086	HD 233622	09 21 33.60 +50 05 56.40	26 Nov 1996 11:44:37	B2 V	479	cd	
befs2196	MOON	09 58 44.81 +08 53 35.88	02 Dec 1996 03:10:49		--	1948	cd
befs1058	HD 88115	10 07 31.78 -62 39 12.85	17 Sep 1993 06:37:15	B1 Ib/II	1433	cd	
befs2161	FEIGE 34	10 39 36.75 +43 06 09.36	30 Nov 1996 10:10:00	DA:	1528	cd	
befs1012	HD 93129A	10 43 57.50 -59 32 51.00	15 Sep 1993 18:09:29	O3 Iab:...	2951	cd	
befs1035	HD 93250	10 44 45.03 -59 33 54.68	16 Sep 1993 08:03:51	O6/O7	372	cd	
befs1067	HD 93250	10 44 45.03 -59 33 54.68	17 Sep 1993 12:22:14	O6/O7	1054	cd	
befs1093	HD 303308	10 45 05.85 -59 40 06.35	18 Sep 1993 09:20:54	O+...	1771	cd	
befs2171	TX UMA	10 45 20.50 +45 33 58.68	30 Nov 1996 23:57:39	B8V	527	cd	
befs2174	TX UMA	10 45 20.50 +45 33 58.68	01 Dec 1996 01:28:30	B8V	1542	cd	
befs2028	HD 93521	10 48 23.52 +37 34 13.08	22 Nov 1996 16:08:36	O9Vp	235	cd	
befs1060	HD 94493	10 53 15.10 -60 48 53.24	17 Sep 1993 08:10:27	B0.5 Iab/Ib	674	cd	
befs1077	HD 94493	10 53 15.10 -60 48 53.24	17 Sep 1993 23:06:42	B0.5 Iab/Ib	601	cd	
befs2066	HD 94473	10 53 58.63 -26 44 45.96	25 Nov 1996 23:19:58	B5III	288	cd	
befs2106	MARS	11 07 12.10 +07 50 11.76	27 Nov 1996 11:46:20		--	2622	abcd
befs2026	TT HYA	11 13 12.50 -26 27 54.36	22 Nov 1996 14:12:50	A1III	875	cd	
befs2055	TT HYA	11 13 12.50 -26 27 54.36	24 Nov 1996 18:31:54	A1III	463	cd	
befs2204	TT HYA	11 13 12.50 -26 27 54.36	03 Dec 1996 09:26:54	A1III	370	cd	
befs2067	HD 97991	11 16 11.71 -03 28 19.20	25 Nov 1996 23:33:39	B1V	500	cd	
befs1046	HD 99857	11 28 27.20 -66 29 21.38	16 Sep 1993 12:39:10	B1 Ib	1371	cd	
befs1010	HD 99890	11 29 05.76 -56 38 39.30	15 Sep 1993 16:42:09	B0.5 V:	2385	cd	
befs2001	HD 100340	11 32 49.94 +05 16 36.12	21 Nov 1996 09:39:34	B9	791	cd	
befs2216	HD 103779	11 56 57.55 -63 14 56.76	03 Dec 1996 16:40:07	B0.5II	401	cd	
befs1091	HD 104705	12 03 23.91 -62 41 45.82	18 Sep 1993 07:50:04	B0 III/IV	1785	cd	
befs2004	NGC 4151	12 10 32.64 +39 24 20.52	21 Nov 1996 12:51:29		--	601	cd
befs2029	NGC 4151	12 10 32.64 +39 24 20.52	22 Nov 1996 16:17:46		--	1057	cd
befs2031	NGC 4151	12 10 32.64 +39 24 20.52	23 Nov 1996 18:02:00		--	2228	cd
befs2089	NGC 4151	12 10 32.64 +39 24 20.52	26 Nov 1996 13:11:59		--	1900	cd
befs2127	NGC 4151	12 10 32.64 +39 24 20.52	28 Nov 1996 20:05:08		--	1892	cd
befs2141	NGC 4151	12 10 32.64 +39 24 20.52	29 Nov 1996 21:49:06		--	1968	cd
befs2150	NGC 4151	12 10 32.64 +39 24 20.52	30 Nov 1996 04:12:00		--	1320	cd
befs2152	NGC 4151	12 10 32.64 +39 24 20.52	30 Nov 1996 05:38:00		--	1077	cd
befs2163	NGC 4151	12 10 32.64 +39 24 20.52	30 Nov 1996 19:21:53		--	1786	cd
befs2201	NGC 4151	12 10 32.64 +39 24 20.52	02 Dec 1996 06:40:05		--	998	cd
befs2218	NGC 4151	12 10 32.64 +39 24 20.52	03 Dec 1996 17:46:50		--	831	cd
befs1006	HD 107446	12 21 21.61 -60 24 04.10	15 Sep 1993 14:04:00	K3.5 III	1886	abcd	
befs2091	HZ 25	12 25 23.45 +35 58 33.61	27 Nov 1996 01:13:08	B3V	670	cd	
befs2177	HZ 25	12 25 23.45 +35 58 33.61	01 Dec 1996 03:07:00	B3V	1094	cd	
befs2052	HD 108230	12 26 11.59 -32 19 16.32	24 Nov 1996 16:31:50	B5II	1222	cd	
befs2063	3C 273	12 29 06.69 +02 03 08.64	25 Nov 1996 21:40:18	S...	2408	cd	
befs2078	3C 273	12 29 06.69 +02 03 08.64	26 Nov 1996 07:04:37	S...	1863	cd	
befs2083	3C 273	12 29 06.69 +02 03 08.64	26 Nov 1996 10:06:48	S...	1456	cd	
befs2182	3C 273	12 29 06.69 +02 03 08.64	01 Dec 1996 05:43:54	S...	2029	cd	
befs2215	3C 273	12 29 06.69 +02 03 08.64	03 Dec 1996 15:40:50	S...	3041	cd	
befs2108	AM CVN	12 34 54.65 +37 37 43.32	27 Nov 1996 13:25:32	DBp	2643	cd	
befs2134	AM CVN	12 34 54.65 +37 37 43.32	29 Nov 1996 17:17:24	DBp	2460	cd	
befs2192	AM CVN	12 34 54.65 +37 37 43.32	02 Dec 1996 00:09:32	DBp	2262	cd	
befs2202	AM CVN	12 34 54.65 +37 37 43.32	03 Dec 1996 08:41:07	DBp	817	cd	
befs2205	AM CVN	12 34 54.65 +37 37 43.32	03 Dec 1996 09:41:26	DBp	2459	cd	
befs2207	AM CVN	12 34 54.65 +37 37 43.32	03 Dec 1996 11:13:56	DBp	2604	cd	
befs1025	HD 109399	12 35 16.53 -72 43 00.85	16 Sep 1993 03:38:51	B0.5 III	1533	cd	
befs2024	NGC 4631	12 42 05.93 +32 32 21.83	22 Nov 1996 12:54:26		--	1727	cd
befs2187	EX HYA	12 52 24.55 -29 14 57.84	01 Dec 1996 21:10:39	M5/M6:...	1717	cd	
befs2194	EX HYA	12 52 24.55 -29 14 57.84	02 Dec 1996 01:41:17	M5/M6:...	2018	cd	

befs2198	EX HYA	12 52 24.55 -29 14 57.84	02 Dec 1996 04:34:30	M5/M6:...	2328	cd	
befs2200	EX HYA	12 52 24.55 -29 14 57.84	02 Dec 1996 06:05:49	M5/M6:...	1342	cd	
befs2209	EX HYA	12 52 24.55 -29 14 57.84	03 Dec 1996 12:44:59	M5/M6:...	1549	cd	
befs2043	AIRGLOW	13 01 41.54 -60 04 35.04	24 Nov 1996 01:16:00		--	2520	cd
befs2206	HD 113012	13 01 41.54 -60 04 35.04	03 Dec 1996 10:31:05	B0III	1863	cd	
befs2017	HZ 43	13 16 21.86 +29 05 55.32	22 Nov 1996 06:59:25	DAw...	1359	abcd	
befs2045	HZ 43	13 16 21.86 +29 05 55.32	24 Nov 1996 03:15:30	DAw...	1701	abcd	
befs2050	HZ 43	13 16 21.86 +29 05 55.32	24 Nov 1996 15:23:00	DAw...	1908	abcd	
befs2061	HZ 43	13 16 21.86 +29 05 55.32	25 Nov 1996 20:51:20	DAw...	260	abcd	
befs2070	HZ 43	13 16 21.86 +29 05 55.32	26 Nov 1996 01:02:49	DAw...	1493	abcd	
befs2131	HZ 43	13 16 21.86 +29 05 55.32	29 Nov 1996 15:57:07	DAw...	807	abcd	
befs2132	HZ 43	13 16 21.86 +29 05 55.32	29 Nov 1996 16:13:47	DAw...	854	bcd	
befs2189	HZ 43	13 16 21.86 +29 05 55.32	01 Dec 1996 22:40:41	DAw...	1442	abcd	
befs1036	HD 116852	13 30 23.52 -78 51 20.57	16 Sep 1993 08:15:46	O9 III	776	cd	
befs2019	HD 116852	13 30 23.52 -78 51 20.51	22 Nov 1996 08:25:50	O9III	849	cd	
befs2138	HD 119608	13 44 31.32 -17 56 13.20	29 Nov 1996 20:11:52	B1Ib	1801	cd	
befs1022	HD 121800	13 55 15.45 +66 07 00.61	16 Sep 1993 01:33:35	G7	1672	cd	
befs2025	HD 121800	13 55 15.46 +66 07 00.47	22 Nov 1996 13:34:26	B1.5 V	751	cd	
befs1043	ALF CEN B	14 39 35.08 -60 50 13.77	16 Sep 1993 11:04:00	K1 V	360	abcd	
befs1065	ALF CEN B	14 39 35.08 -60 50 13.77	17 Sep 1993 10:59:15	K1 V	1667	abcd	
befs1102	ALF CEN B	14 39 35.08 -60 50 13.77	18 Sep 1993 18:56:38	K1 V	744	ab	
befs1004	ALF CEN A	14 39 36.49 -60 50 02.29	15 Sep 1993 12:47:54	G2 V	424	abcd	
befs1052	ALF CEN A	14 39 36.49 -60 50 02.29	17 Sep 1993 02:15:16	G2 V	1510	abcd	
befs1054	ALF CEN A	14 39 36.49 -60 50 02.29	17 Sep 1993 03:40:10	G2 V	1864	abcd	
befs1056	ALF CEN A	14 39 36.49 -60 50 02.29	17 Sep 1993 05:11:05	G2 V	1748	abcd	
befs2148	H 1504+65	15 02 08.40 +66 12 25.92	30 Nov 1996 02:37:00	DZ...	1921	cd	
befs2048	HD 133640	15 03 47.30 +47 39 14.75	24 Nov 1996 13:54:19	G0Vnvar	2015	cd	
befs2053	HD 133640	15 03 47.30 +47 39 14.75	24 Nov 1996 17:14:38	G0Vnvar	1533	cd	
befs2011	U CRB	15 18 11.35 +31 38 49.56	21 Nov 1996 15:47:36	B7Vvar...	1458	cd	
befs1050	BD+33 2642	15 51 59.89 +32 56 54.32	17 Sep 1993 00:58:04	B2	684	cd	
befs1096	BD+33 2642	15 51 59.89 +32 56 54.32	18 Sep 1993 11:07:13	B2	2223	cd	
befs1103	AG DRA	16 01 41.01 +66 48 10.12	18 Sep 1993 19:19:44	K0	1896	cd	
befs1023	SIG CRB	16 14 40.75 +33 51 30.61	16 Sep 1993 02:10:10	G0	1927	abcd	
befs1023	HD 146361	16 14 41.70 +33 51 34.99	16 Sep 1993 02:10:10	G0Ve	1927	abcd	
befs1003	HD 149881	16 36 58.21 +14 28 30.90	14 Sep 1993 09:26:40	B0.5 III	1560	cd	
befs1048	HD 149499B	16 38 30.00 -57 28 12.00	16 Sep 1993 14:07:26	DO	1201	abcd	
befs2037	HD 151067	16 41 06.29 +62 18 28.80	23 Nov 1996 22:48:15		--	620	cd
befs2042	CL* NGC 6205 BARN 29	16 41 34.01 +36 26 06.00	24 Nov 1996 00:17:06	B2p	344	cd	
befs2213	CL* NGC 6205 BARN 29	16 41 34.01 +36 26 06.00	03 Dec 1996 14:20:30	B2p	2958	cd	
befs2085	ALF TRA	16 48 39.89 -69 01 39.73	26 Nov 1996 11:01:16	K2II-III	1899	cd	
befs1044	HD 156110	17 13 27.72 +45 22 20.06	16 Sep 1993 11:24:15	B3 Vn	840	cd	
befs2022	BET DRA	17 30 25.96 +52 18 05.04	22 Nov 1996 11:34:22	G2Iab:	1887	cd	
befs1100	NGC 6543	17 58 33.42 +66 37 59.53	18 Sep 1993 17:47:53	?p...	1375	cd	
befs1037	HD 164794	18 03 52.44 -24 21 38.63	16 Sep 1993 08:37:07	O8 Iab:...	267	cd	
befs1015	70 OPH A	18 05 27.10 +02 29 58.99	15 Sep 1993 20:21:00	K0 V	1579	abcd	
befs2074	AM HER	18 16 13.51 +49 52 03.36	26 Nov 1996 04:05:26	M4.5	1876	cd	
befs2076	AM HER	18 16 13.51 +49 52 03.36	26 Nov 1996 05:40:33	M4.5	1951	cd	
befs2096	AM HER	18 16 13.51 +49 52 03.36	27 Nov 1996 04:26:33	M4.5	1953	cd	
befs2098	AM HER	18 16 13.51 +49 52 03.36	27 Nov 1996 05:58:00	M4.5	1772	cd	
befs2110	AM HER	18 16 13.51 +49 52 03.36	28 Nov 1996 07:52:07	M4.5	1990	cd	
befs2112	AM HER	18 16 13.51 +49 52 03.36	28 Nov 1996 09:23:41	M4.5	2007	cd	
befs1026	AM HER	18 16 13.52 +49 52 03.22	16 Sep 1993 04:19:40	M4.5	892	cd	
befs1061	AM HER	18 16 13.52 +49 52 03.22	17 Sep 1993 08:34:03	M4.5	1941	cd	
befs1028	HD 167756	18 18 40.16 -42 17 18.24	16 Sep 1993 05:10:22	B0.5 Ia	866	cd	
befs1063	BY DRA	18 33 55.77 +51 43 08.90	17 Sep 1993 09:54:00	K6 Ve	1488	abcd	
befs2094	ALF LYR	18 36 56.33 +38 47 01.32	27 Nov 1996 02:57:24	A0V	2168	cd	
befs1080	NOVA SGR 1994	18 50 42.00 -21 23 60.00	18 Sep 1993 00:51:00	NOVA	911	cd	
befs2203	HD 175863	18 53 44.69 +60 01 04.43	03 Dec 1996 09:02:23	B4Ve	386	cd	
befs2020	JUPITER	19 12 21.41 -22 40 48.36	22 Nov 1996 09:22:10		--	185	abcd
befs2038	HD 181653	19 16 24.21 +67 08 06.72	23 Nov 1996 23:03:33	B1II/III	645	cd	
befs2018	ESO 141-55	19 21 14.42 -58 40 12.72	22 Nov 1996 07:44:48		--	2063	cd
befs2021	ESO 141-55	19 21 14.42 -58 40 12.72	22 Nov 1996 10:26:58		--	3396	cd
befs2027	ESO 141-55	19 21 14.42 -58 40 12.72	22 Nov 1996 14:57:28		--	3531	cd
befs2030	ESO 141-55	19 21 14.42 -58 40 12.72	23 Nov 1996 17:16:00		--	1551	cd
befs2044	ESO 141-55	19 21 14.42 -58 40 12.72	24 Nov 1996 02:03:59		--	3287	cd
befs2172	Z VUL	19 21 39.10 +25 34 29.28	01 Dec 1996 00:16:15	B4V+...	1647	cd	
befs1038	NGC 6826	19 44 48.15 +50 31 30.25	16 Sep 1993 08:49:43	?p...	380	cd	
befs2039	HD 186994	19 45 37.97 +44 57 49.32	23 Nov 1996 23:18:45	B0III	282	cd	
befs1011	V3885 SGR	19 47 40.52 -42 00 26.39	15 Sep 1993 17:39:16	DB:p	506	cd	
befs1021	V3885 SGR	19 47 40.52 -42 00 26.39	16 Sep 1993 00:42:56	DB:p	1569	cd	
befs2115	ALTAIR	19 50 46.99 +08 52 05.88	28 Nov 1996 11:13:46	A7V	1306	cd	
befs2167	ALTAIR	19 50 46.99 +08 52 05.88	30 Nov 1996 21:09:43	A7V	2334	cd	
befs2107	HD 187311	19 51 04.70 -41 01 23.52	27 Nov 1996 12:42:08	B5II	873	cd	
befs2159	V 1016 CYG	19 57 04.89 +39 49 33.96	30 Nov 1996 08:59:00	M6.5:	1847	cd	
befs2153	NGC 6853	19 59 36.19 +22 43 00.84	30 Nov 1996 06:05:00		--	1708	cd
befs1099	NGC 6853	19 59 36.20 +22 43 00.98	18 Sep 1993 17:28:00	PN	286	cd	
befs1041	RR TEL	20 04 18.60 -55 43 33.99	16 Sep 1993 09:47:00	F5pe var	1579	cd	
befs2002	RR TEL	20 04 18.60 -55 43 33.96	21 Nov 1996 10:04:03	F5pevar	778	cd	
befs2033	RR TEL	20 04 18.60 -55 43 33.96	23 Nov 1996 19:55:11	F5pevar	1061	cd	
befs2051	RR TEL	20 04 18.60 -55 43 33.96	24 Nov 1996 16:06:23	F5pevar	962	cd	
befs2068	RR TEL	20 04 18.60 -55 43 33.96	25 Nov 1996 23:50:54	F5pevar	943	cd	
befs2146	RR TEL	20 04 18.60 -55 43 33.96	30 Nov 1996 01:23:07	F5pevar	1117	cd	
befs2183	HD 192035	20 10 49.58 +47 48 47.16	01 Dec 1996 06:27:46	B0III-IVn...	873	cd	
befs2040	HD 192575	20 10 56.90 +68 16 19.93	23 Nov 1996 23:28:54	B0.5V	311	cd	
befs1109	V444 CYG	20 19 32.42 +38 43 53.97	18 Sep 1993 22:00:28	WN+...	1948	cd	
befs1066	NOVA CYG 1992	20 30 31.75 +52 37 50.92	17 Sep 1993 11:36:31	NOVA	2041	cd	
befs2079	HD 195455	20 32 14.69 -24 04 03.72	26 Nov 1996 07:48:42	B1/B2III	435	cd	
befs2084	HD 195455	20 32 14.69 -24 04 03.72	26 Nov 1996 10:41:49	B1/B2III	494	cd	
befs1075	HD 195455	20 32 14.69 -24 04 03.65	17 Sep 1993 21:49:22	B1/B2 III	961	cd	
befs2005	AE AQR	20 40 09.17 -00 52 15.24	21 Nov 1996 13:16:14	K5IV-Vvar	22	cd	
befs2056	AE AQR	20 40 09.17 -00 52 15.24	24 Nov 1996 18:51:18	K5IV-Vvar	890	cd	
befs2113	AE AQR	20 40 09.17 -00 52 15.24	28 Nov 1996 10:04:34	K5IV-Vvar	780	cd	
befs2144	AE AQR	20 40 09.17 -00 52 15.24	29 Nov 1996 23:51:09	K5IV-Vvar	2216	cd	
befs1031	AU MIC	20 45 09.53 -31 20 27.24	16 Sep 1993 06:49:00	M0	850	abcd	
befs1105	NGC 7009	21 04 10.90 -11 21 50.00	18 Sep 1993 20:30:01	PN	303	cd	
befs2155	GD 394	21 12 43.61 +50 06 16.91	30 Nov 1996 07:22:00	DAw...	990	cd	
befs2188	RX J2117.1+3412	21 17 06.00 +34 12 00.00	01 Dec 1996 21:49:46		--	1594	cd

befs1085	AIRGLOW	21 17 07.60 +34 12 21.99	18 Sep 1993 04:05:21		--	944	cd
befs1106	RX J2117.1+3412	21 17 07.60 +34 12 21.99	18 Sep 1993 20:47:19	WD	547	cd	
befs2169	ALF CEP	21 18 34.78 +62 35 08.17	30 Nov 1996 22:42:28	A7IV	1642	cd	
befs2180	ALF CEP	21 18 34.78 +62 35 08.17	01 Dec 1996 04:29:54	A7IV	2163	cd	
befs2208	ALF CEP	21 18 34.78 +62 35 08.17	03 Dec 1996 12:05:16	A7IV	1204	cd	
befs2210	ALF CEP	21 18 34.78 +62 35 08.17	03 Dec 1996 13:21:56	A7IV	1039	cd	
befs2211	HD 203664	21 23 28.80 +09 55 54.84	03 Dec 1996 13:45:57	B0.5IIIn	652	cd	
befs2190	PN A66 78	21 35 29.81 +31 41 39.84	01 Dec 1996 23:14:00		--	1936	cd
befs2035	NGC 7094	21 36 52.71 +12 47 20.04	23 Nov 1996 21:27:36		--	2014	cd
befs1032	AG PEG	21 51 01.97 +12 37 32.13	16 Sep 1993 07:18:38	WN+...	581	cd	
befs1082	AG PEG	21 51 01.97 +12 37 32.13	18 Sep 1993 02:25:10	WN+...	493	cd	
befs1078	BD +28 4211	21 51 11.02 +28 51 50.37	17 Sep 1993 23:32:30	Op	712	cd	
befs1083	BD +28 4211	21 51 11.02 +28 51 50.37	18 Sep 1993 02:50:16	Op	1241	cd	
befs1007	PKS 2155-304	21 58 52.16 -30 13 31.80	15 Sep 1993 14:46:46	BL LAC	634	cd	
befs1088	PKS 2155-304	21 58 52.16 -30 13 31.80	18 Sep 1993 05:38:07	BL LAC	1379	cd	
befs1090	PKS 2155-304	21 58 52.16 -30 13 31.80	18 Sep 1993 06:57:51	BL LAC	1215	cd	
befs1092	PKS 2155-304	21 58 52.16 -30 13 31.80	18 Sep 1993 08:45:51	BL LAC	1004	cd	
befs1094	PKS 2155-304	21 58 52.16 -30 13 31.80	18 Sep 1993 10:01:10	BL LAC	1382	cd	
befs2009	ALF AQR	22 05 47.04 -00 19 11.64	21 Nov 1996 15:11:20	G2Ib	121	cd	
befs2090	ALF AQR	22 05 47.04 -00 19 11.64	27 Nov 1996 00:16:37	G2Ib	2770	cd	
befs2062	AR LAC	22 08 40.83 +45 44 32.27	25 Nov 1996 20:59:26	G2IV+...	1504	cd	
befs2072	AR LAC	22 08 40.83 +45 44 32.27	26 Nov 1996 02:43:20	G2IV+...	1824	cd	
befs2081	AR LAC	22 08 40.83 +45 44 32.27	26 Nov 1996 08:48:48	G2IV+...	1931	cd	
befs2092	AR LAC	22 08 40.83 +45 44 32.27	27 Nov 1996 01:33:54	G2IV+...	1891	cd	
befs2103	AR LAC	22 08 40.83 +45 44 32.27	27 Nov 1996 09:24:17	G2IV+...	2296	cd	
befs2119	AR LAC	22 08 40.83 +45 44 32.27	28 Nov 1996 14:23:32	G2IV+...	2008	cd	
befs2125	AR LAC	22 08 40.83 +45 44 32.27	28 Nov 1996 18:51:10	G2IV+...	1862	cd	
befs2129	AR LAC	22 08 40.83 +45 44 32.27	29 Nov 1996 14:35:53	G2IV+...	2138	cd	
befs2012	FO AQR	22 17 57.19 -08 21 11.16	21 Nov 1996 16:21:53		--	1988	cd
befs2137	FO AQR	22 17 57.19 -08 21 11.16	29 Nov 1996 19:23:02		--	2219	cd
befs2139	FO AQR	22 17 57.19 -08 21 11.16	29 Nov 1996 20:54:30		--	1139	cd
befs1009	HD 214080	22 36 06.44 -16 23 16.77	15 Sep 1993 15:43:18	B1/B2 Ib	1550	cd	
befs2142	HD 215733	22 47 02.50 +17 13 59.16	29 Nov 1996 22:32:54	B1II	437	cd	
befs1071	HD 217505	23 02 02.48 -59 27 46.23	17 Sep 1993 18:55:14	B2 III/IV	1019	cd	
befs2178	HD 218624	23 09 22.68 +18 44 09.24	01 Dec 1996 03:39:00	B9V	402	cd	
befs2099	HD 219188	23 14 00.53 +04 59 49.56	27 Nov 1996 06:38:56	B0.5III	186	cd	
befs1001	HD 220172	23 21 50.86 -09 45 41.00	14 Sep 1993 08:23:57	B3 Vn	1397	cd	
befs2130	HD 220582	23 24 45.38 +25 29 47.04	29 Nov 1996 15:17:49	B9	1083	cd	
befs1064	Z AND	23 33 39.95 +48 49 05.96	17 Sep 1993 10:30:56	M6.5	977	cd	
befs2123	LAM AND	23 37 33.84 +46 27 29.51	28 Nov 1996 17:15:11	G8III	2431	cd	

List all changes for BEFS

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

New BEFS IDL Programs
2001 August 15
Two new IDL programs are now available for BEFS users: extract_tt.pro is an IDL version of the c program which creates time-tagged spectral-photon lists for any spectrum, and makeair.pro reads an off-axis (SPD2) spectrum and uses the observed airglow lines to scale a synthetic airglow spectrum. See the README file for more information.

BEFS spectra added to Scrapbook
2001 August 1
Representative spectra from the ORFEUS BEFS mission have now been added to the MAST scrapbook.

Change in BEFS Preview Data for eps CMa
2001 July 31
The BEFS preview data for eps CMA which was originally created using data from the D grating has been replaced with data from the B grating when it was discovered that the D grating fluxes were of questionable quality. The affected data sets include: BEFS2093, BEFS2120, BEFS2114, BEFS2143, BEFS2116

BEFS Data Reduction Software
2001 July 23
The BEFS1 and BEFS2 data reduction software is now available. The software is described and accessible from the BEFS Data Analysis/Reduction page.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

Target Search Error
2001 June 12
An error was discovered in the target search available from the main MAST page. Searches would fail for object names containing special characters (such as a "+" symbol as in BD +28 4211). The error was fixed on the above date.

Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

BEFS 2 Data now available
2001 May 16
The BEFS data from the second ORFEUS flight (Nov. 19, 1996 - Dec. 7, 1996) is now available.

Customized BEFS preview plots now available
2001 March 6
The BEFS preview pages now offer an interactive plotting option to customize plots of flux versus wavelength using data extracted from the BEFS ASCII table files.

BEFS-1 Literature Links Updated
2001 January 25
The BEFS-1 reference database table entries (and ADS data links) are now complete through year 2000.

BEFS Journal References now available
2000 December 12
A new "Ref" field has been added to the BEFS search results page which lists the number of published papers referencing the particular BEFS data set. Clicking on the number will display the list of references with links to the online ADS papers. The references currently include only papers from the first BEFS mission; the BEFS-II archive has not yet been reviewed.

Improved Wavelengths in BEFS ASCII files
2000 November 27
An error was discovered in the wavelength assignments derived from the expression listed in the BEFS ASCII files. Differences as large as 10 Angstroms (between the ASCII wavelengths and the BEFS .spd1 FITS files) could occur at the short wavelength end of the spectra. New ASCII files have been implemented which replace the wavelength expression with a new column of wavelengths.

Corrections to BEFS ASCII Files of Fluxes and Wavelengths
2000 November 15
An error was discovered in the way fluxes and error estimates were stored in the BEFS ASCII table files. Instead of values being written as two columns of flux1, error1, flux2, error2, ..., the entries were stored as flux1, flux2, flux3, flux4,... error1, error2,... Corrected files are now available. The file creation date listed on the first line of the file can be used to distinguish the old and new files.

Cross Correlations with Sky2000 Catalog
2000 August 16
Cross correlations of MAST missions with the SKYMAP Sky2000 catalog (version 3) are now possible from the MAST Cross Correlation page.

New Copyright Notice
2000 May 12
STScI has adopted a new Copyright statement. Most, if not all, MAST web pages should now include a link to the new page.

BEFS preview spectra online.
1999 November 11
Preview spectra, gzipped ASCII files of flux and wavelength, and display of the BEFS FITS headers are now available from the BEFS search results page.

Catalog search and Data Retrieval now available.
1999 October 13
The BEFS-1 search page is now available. Data can be downloaded from the search results page.

MAST BEFS web site development.
1999 August 11

Frequently Asked Questions

Archive Data

- Where do I get BEFS archival data?

Instruments

- What are the differences between BEFS I and BEFS II?

Archive Data

- ***Where do I get BEFS archival data?***
  Both BEFS I and II data can be obtained by searching the on-line catalog at click here to search the BEFS archive. Or by ftp access (please see the obtaining BEFS data page.

Instruments

- ***What are the differences between BEFS I and BEFS II?***
  For BEFS II, two of the four diffraction grating were overcoated with silicon carbide and the instrument electronics were modified for improved imaging at high count rates. Three apertures were added for spectroscopy: 1) with an on-axis 26" hole, 2) a second clear hole displaced by 2.4' and 1.4 times larger for diffuse sky glow or serendipitous spectroscopy, and 3) a large 2' aperture with a tin filter opaque to FUV radiation, but transparent in the EUV and used primarily for observations of epsilon CMa.

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BEFS Data Reduction and Analysis

BEFS data consists of spectroscopic data in FITS format. The FITS spectra contain binary table extensions with both 1st and 2nd order spectra. Please see:

Reading in IDL for information on reading BEFS data with IDL.
Reading in IRAF for information on reading BEFS data with IRAF, and please see
Data Caveats for details about nuances in the data.

Time-tagged spectral-photon lists for any spectrum can be produced using the extract-tt routine. See the Time-Tagged Data page for more information. The extract-tt routine (and other project-provided data analysis software) can be downloaded from the archive.stsci.edu/pub/orfeus/befs/software directory via the web or anonymous ftp.

Instrumentation and Operations

The general design of the Berkeley spectrograph (BEFS) is discussed by Hurwitz & Bowyer (1986), while its calibration and performance on the ORFEUS-SPAS I and II missions are described by Hurwitz & Bowyer (1996) and Hurwitz et al. (1998), respectively

Another description of the instrument was published in

"Bowyer, S., & Hurwitz, M., "ORFEUS-SPAS: The Berkeley EUV Spectrometer" in *Observatories in Earth Orbit and Beyond*, ed. Y. Kondo (Kluwer Academic Publishers), 475-480, 1990

The BEFS final calibration paper:

Dixon, W.V., Dupuis, J., & Hurwitz, M., "Final Calibration of the Berkeley Extreme and Far-Ultraviolet Spectrometer on the ORFEUS-SPAS I and II Missions" will appear in the January, 2002 issue of PASP.

Project Publications

There are over 150 citations to ORFEUS papers and conference proceedings at ADS. Descriptions of the instruments and their performances are listed below.

- **Instrument Description 1986**
- **Instrument Description 1990**
- **ORFEUS 1 Inst. Performance**
- **ORFEUS 2 Inst. Performance**
- Final Calibration for ORFEUS I & II Missions

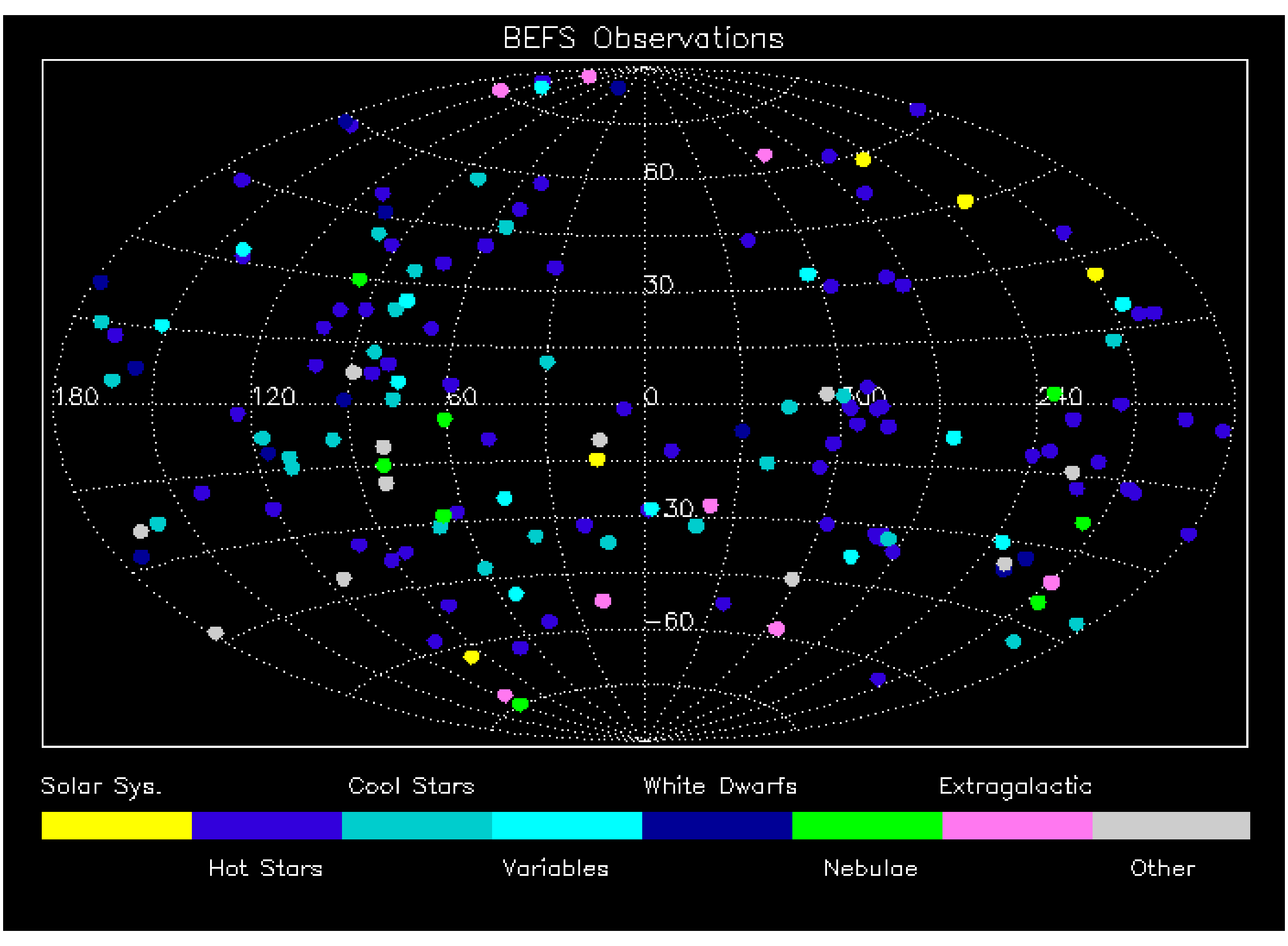
BEFS Berkeley Extreme and Far-UV Spectrometer

- Berkeley Spectrometer (BEFS) home page
- NASA's ORFEUS-SPAS II Mission page

Acknowledgments

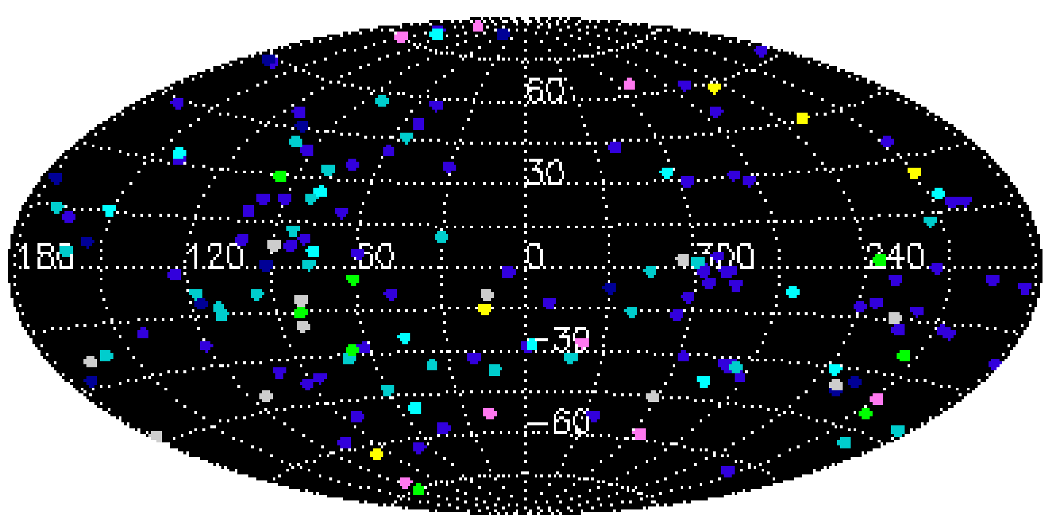
The MAST staff would like to thank the following groups and individuals for help in making the BEFS data, documentation, and WEB site available to the public:

- BEFS Project members **Mark Hurwitz**, **Stuart Bowyer**, and **Van Dixon** (University of California, Berkeley) for advice, permissions to reprint some documentation and information in general on the BEFS project;
- **Kluwer Academic Publishers**, publishers of "Astrophysics in the Extreme Ultraviolet", for permission to reprint the article "The Berkeley Spectrometer for *ORFEUS*: Laboratory and In-Flight Performance" by Hurwitz and Bowyer (1996,601). Special thanks go to **Berendina Schermers-van Straalen**, Rights and Permissions Manager for Kluwer Academic Publishers.

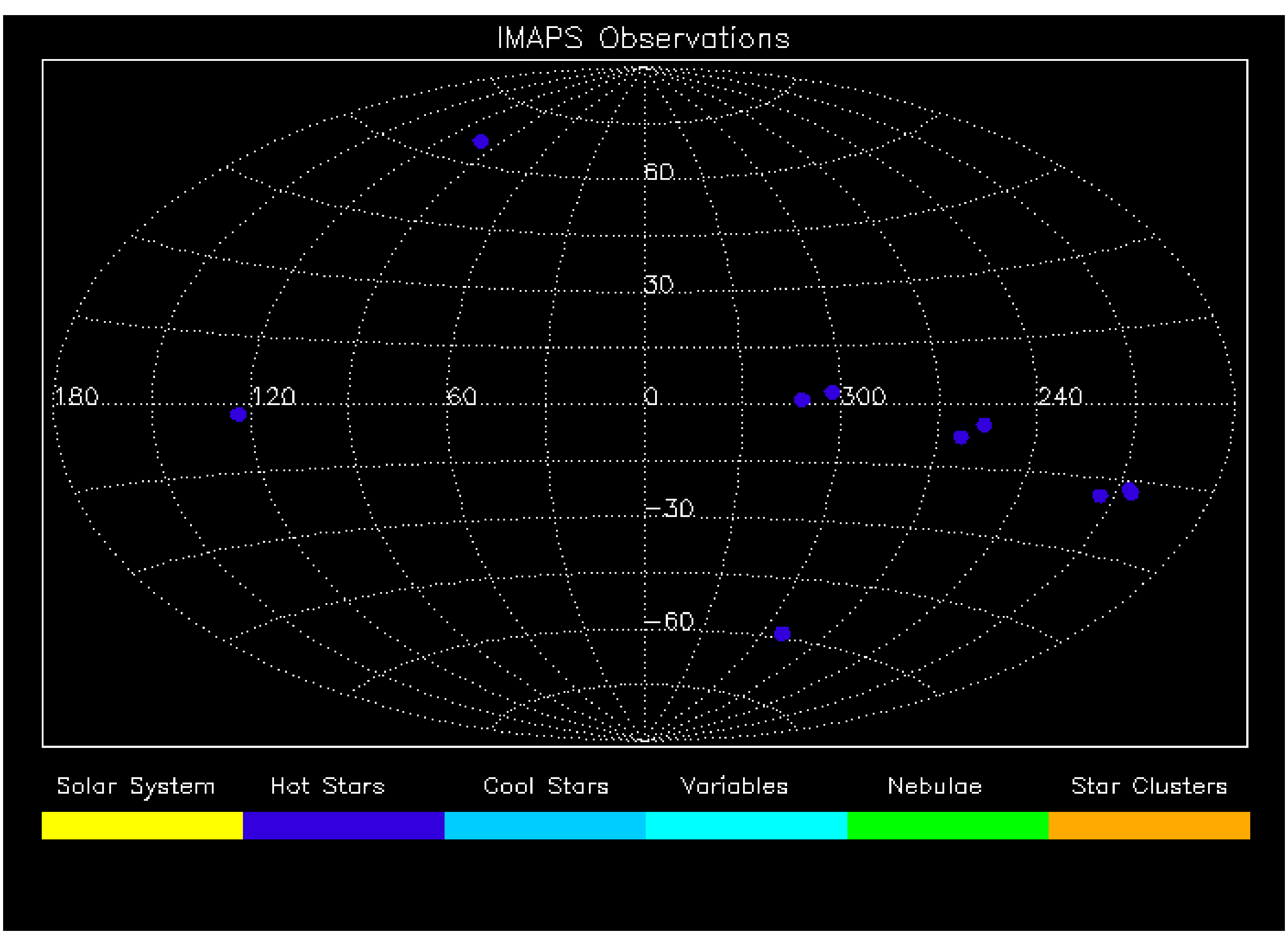

BEFS Observations
60
30
180
120
60
0
300
240
-30
-60
Solar Sys.
Cool Stars
White Dwarfs
Extragalactic
Hot Stars
Variables
Nebulae
Other

http://archive.stsci.edu/befs/

The ***Berkeley Extreme and Far-UV Spectrometer (BEFS)***, flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS I and II space shuttle missions in 1993 and 1996, returning high-resolution (λ/3000) FUV spectra (900-1200 Å) of 75 astrophysical objects from the first flight and more than 100 from the second. EUV spectra (400-900 Å) were obtained for a subset of these targets.

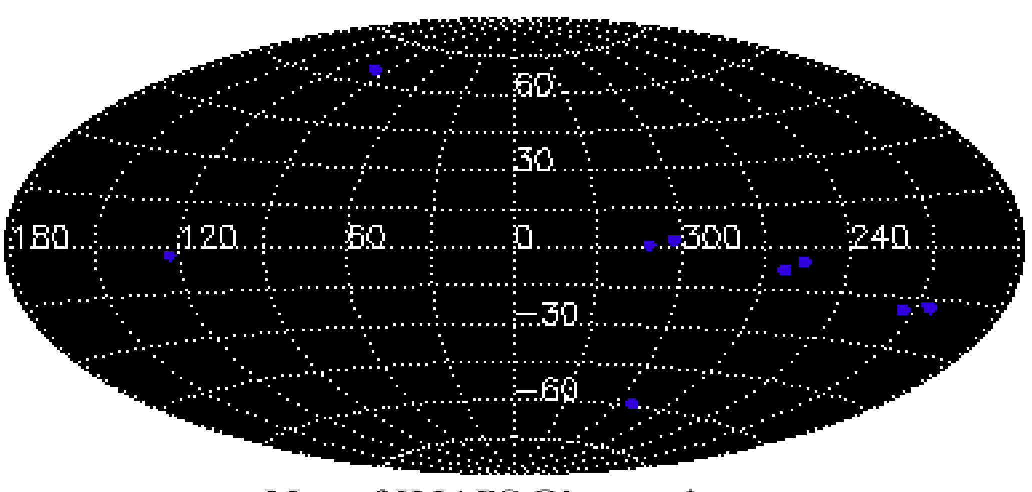


Map of BEFS Observations



IMAPS Observations
60
30
180
120
60
0
300
240
-30
-60
Solar System
Hot Stars
Cool Stars
Variables
Nebulae
Star Clusters

The **Interstellar Medium Absorption Profile Spectrograph (IMAPS)** obtained high resolution (R=75,000 for IMAPS-1) objective-grating echelle spectra of hot stars, over the spectral region 950-1150 Å. The Principal Investigator was Dr. Edward Jenkins from Princeton University. IMAPS was one of 3 spectrographs comprising the ORFEUS-SPAS mission. The ORFEUS-SPAS platform was deployed from the Space Shuttle Discovery in September, 1993 and from the Space Shuttle Columbia in November, 1996. The IMAPS archive currently contains roughly 600 spectral images of 10 hot stars from the first shuttle flight. Once the proprietary period ends for the second IMAPS mission, the archive will include an additional 3,900 spectral images of 29 stars.



Map of IMAPS Observations

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Getting Started

The Tübingen Echelle (TUES) obtained moderate dispersion observations (R=13,000) using an echelle grating including orders 40 - 61 from 910 - 1410 Angstroms. The instrument was designed and built by the University of Tübingen (PI: M. Grewing) and flew as one of three spectrographs on the ORFEUS/SPAS-2 mission for 14 days in November/December 1996. The instrumental resolution was about 10,000 and the effective aperture peaks at 1.3 cm^2 near 1100 Angstroms. Objects were observed in a 10 arcsec entrance aperture. The wavelength calibration was established by means of interstellar molecular hydrogen lines.

The mission observed 62 targets (all stars or planetary nebulae) during a total of 169 hours on target. Most of these observations were of a monitoring nature. The data are fully calibrated and ripple corrections applied, so that merging of data (when overlapping) in adjacent echelle orders is possible.

The search form may be used to select data from the TUES catalog by object name, coordinates, and date of observation. In addition, users may browse the "catalog" or download the image using anonymous ftp. The images are archived as FITS files.

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Search and Retrieval

TUES data of interest may be found by searching the MAST TUES database. As explained in the Search Help page, users may specify search criteria and output format. On the search results page, users may mark datasets of interest to be downloaded as a tar file.

A "quick search" of the TUES catalog may be performed by entering a target name or coordinates in the form labeled TUES Target Search at the top of the left navigation menu.

Users may also peruse a "catalog" of TUES data. Click on the object name in the table to bring up a preview plot and some associated information. Click on the data ID entry to obtain the other files. To save the data to disk, hold down the SHIFT key while clicking on the link. (This should work for most browsers. Others may require you to click the second or third mouse button instead of the first.) The data are all gzipped. Some browsers may unzip the data. The files are all in FITS format.

TUES Catalog of Observations

The following catalog lists the objects observed by the TUES during the second ORFEUS missions. A preview plot of the spectrum may be views by clicking on the object name in the table. The user may click on the data ID entry to obtain the other files.

To save the data to disk, hold down the SHIFT key while clicking on the link. (This should work for most browsers. Others may require you to click the second or third mouse button instead of the first.) The data are all gzipped. Some browsers may unzip the data. The files are all in FITS format.

Data ID	Object	Ra & Dec (2000)	Observation Date/Time	Exp Length (s)	Count Rates	Wavelength Range
tues5214_2	SB 290	00 42 58.30 -38 07 36.80	02 Dec 1996 22:15:44	562	656.4000	919.65 - 1410.36
tues5214_1_1	SB 290	00 42 58.30 -38 07 36.80	30 Nov 1996 10:52:00	445	344.3000	919.63 - 1410.32
tues5214_1_2	SB 290	00 42 58.30 -38 07 36.80	30 Nov 1996 11:00:16	1849	506.8000	919.60 - 1410.28
tues2217_1	HD5980	00 59 26.78 -72 09 54.80	01 Dec 1996 06:53:39	1586	172.3000	919.64 - 1410.33
tues2217_2	HD5980	00 59 26.78 -72 09 54.80	01 Dec 1996 08:13:37	2248	177.5000	919.64 - 1410.34
tues2217_3	HD5980	00 59 26.78 -72 09 54.80	02 Dec 1996 14:41:13	2332	186.6000	919.66 - 1410.38
tues2217_4	HD5980	00 59 26.78 -72 09 54.80	02 Dec 1996 17:51:54	671	187.8000	919.67 - 1410.39
tues5209_3	BD+37 442	01 58 33.40 +38 34 24.00	30 Nov 1996 12:29:04	2341	965.5000	904.57 - 1410.34
tues5264_3_1	HD14633	02 22 54.20 +41 28 49.00	02 Dec 1996 22:34:11	5	364.2000	-
tues5264_1	HD14633	02 22 54.20 +41 28 49.00	28 Nov 1996 04:03:14	1010	2709.8000	904.58 - 1410.37
tues5264_2	HD14633	02 22 54.20 +41 28 49.00	02 Dec 1996 19:51:12	1013	4711.1001	904.58 - 1410.37
tues5264_3_2	HD14633	02 22 54.20 +41 28 49.00	02 Dec 1996 22:35:00	545	3791.1001	904.60 - 1410.39
tues2205_3	HD 18100	02 53 40.80 -26 09 20.00	03 Dec 1996 07:31:18	586	2651.2000	919.68 - 1410.39
tues2205_1_1	HD 18100	02 53 40.80 -26 09 20.00	22 Nov 1996 18:43:09	570	2240.8000	919.62 - 1410.31
tues2205_1_2	HD 18100	02 53 40.80 -26 09 20.00	22 Nov 1996 18:53:30	515	2054.5000	919.61 - 1410.29
tues2205_2_1	HD 18100	02 53 40.80 -26 09 20.00	29 Nov 1996 03:15:33	175	998.0000	919.63 - 1410.33
tues2205_2_2	HD 18100	02 53 40.80 -26 09 20.00	29 Nov 1996 03:19:19	1006	1127.5000	919.62 - 1410.31
tues2244_1	beta Persii	03 08 10.10 +40 57 20.00	23 Nov 1996 11:25:23	1205	18064.0996	935.23 - 1410.35
tues5227_1	REJ0317-8	03 17 32.00 -85 32 24.00	02 Dec 1996 07:09:47	2058	22.1000	-
tues5227_2	REJ0317-8	03 17 32.00 -85 32 24.00	02 Dec 1996 08:40:11	1914	31.1000	904.61 - 1410.41
tues2209_1	HD 22586	03 35 37.90 -52 33 24.00	01 Dec 1996 14:48:53	912	1234.7000	904.56 - 1410.34
tues4201_1	X Per	03 55 23.10 +31 02 45.00	25 Nov 1996 10:33:16	2089	40.9000	951.41 - 1410.42
tues4201_3	X Per	03 55 23.10 +31 02 45.00	28 Nov 1996 02:52:54	1631	569.9000	951.39 - 1410.39
tues4201_4	X Per	03 55 23.10 +31 02 45.00	28 Nov 1996 04:27:30	1176	620.6000	951.39 - 1410.39
tues4201_5	X Per	03 55 23.10 +31 02 45.00	28 Nov 1996 05:48:27	1838	446.5000	951.39 - 1410.39
tues4201_6	X Per	03 55 23.10 +31 02 45.00	28 Nov 1996 20:53:50	2415	400.5000	951.39 - 1410.39
tues4201_8	X Per	03 55 23.10 +31 02 45.00	29 Nov 1996 00:13:14	1432	363.1000	951.38 - 1410.38
tues4201_7_1	X Per	03 55 23.10 +31 02 45.00	28 Nov 1996 22:31:01	68	545.2000	951.40 - 1410.41
tues4201_7_2	X Per	03 55 23.10 +31 02 45.00	28 Nov 1996 22:32:53	2352	353.0000	951.39 - 1410.39
tues2242_1	HD 29138	04 13 47.60 -84 29 09.00	03 Dec 1996 01:21:31	634	1358.2000	904.62 - 1410.43
tues2242_2	HD 29138	04 13 47.60 -84 29 09.00	03 Dec 1996 02:52:56	1149	1425.8000	904.62 - 1410.42
tues5222_1	WD0413-07	04 15 22.51 -07 39 21.60	02 Dec 1996 13:19:50	1995	218.9000	985.39 - 1410.42
tues5220_1	LH10 3120	04 56 46.84 -66 24 46.59	01 Dec 1996 09:51:50	2295	49.6000	919.67 - 1410.38
tues5220_2	LH10 3120	04 56 46.84 -66 24 46.59	01 Dec 1996 11:19:32	2553	51.9000	919.67 - 1410.39
tues5220_3_ph	LH10 3120	04 56 46.84 -66 24 46.59	02 Dec 1996 21:05:00	1680	44.6000	919.69 - 1410.41
tues5208_2_2	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:11:37	452	28.0000	-
tues5208_2_3	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:20:00	56	94.8000	-
tues5208_2_4	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:21:47	63	41.7000	-
tues5208_2_1	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:06:53	233	1538.8000	935.30 - 1410.45
tues5208_2_5	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:23:41	67	1392.0000	935.30 - 1410.44
tues5208_2_6	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:25:39	46	829.3000	935.30 - 1410.44
tues5208_2_8	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:28:41	48	1189.9000	935.29 - 1410.44
tues5208_2_9	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:30:20	72	1230.5000	935.29 - 1410.44
tues5208_2_10	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:32:23	169	786.4000	935.29 - 1410.43
tues5208_2_11	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:36:03	312	878.0000	935.29 - 1410.43
tues5208_2_12	Zet Aur	05 02 28.60 +41 04 33.00	26 Nov 1996 17:42:06	719	1669.7000	935.28 - 1410.42
tues2288_1	G191 B2B	05 05 30.30 +52 49 53.99	21 Nov 1996 21:14:01	1444	566.6000	904.63 - 1410.44
tues2288_2	G191 B2B	05 05 30.30 +52 49 53.99	22 Nov 1996 17:08:07	1379	512.8000	904.61 - 1410.41
tues2288_3	G191 B2B	05 05 30.30 +52 49 53.99	02 Dec 1996 22:50:49	1816	512.5000	904.63 - 1410.45
tues2288_4	G191 B2B	05 05 30.30 +52 49 53.99	03 Dec 1996 00:14:49	616	266.8000	904.65 - 1410.47
tues2214_1	HD 33599	05 07 13.00 -61 48 18.00	01 Dec 1996 13:00:23	2022	307.4000	919.67 - 1410.38
tues2231_1	HD 36402	05 26 04.00 -67 29 48.00	23 Nov 1996 00:49:35	1590	139.5000	919.65 - 1410.35
tues2231_3	HD 36402	05 26 04.00 -67 29 48.00	23 Nov 1996 05:11:00	1925	177.4000	919.66 - 1410.37
tues2231_4	HD 36402	05 26 04.00 -67 29 48.00	03 Dec 1996 06:09:05	1740	78.4000	919.69 - 1410.42
tues2231_2_1	HD 36402	05 26 04.00 -67 29 48.00	23 Nov 1996 03:43:32	731	145.7000	919.67 - 1410.38
tues2231_2_2	HD 36402	05 26 04.00 -67 29 48.00	23 Nov 1996 03:56:27	1778	174.8000	919.65 - 1410.35
tues2219_1	HD 269546	05 26 45.10 -68 49 55.01	02 Dec 1996 10:22:30	2075	69.3000	919.69 - 1410.42
tues2219_2	HD 269546	05 26 45.10 -68 49 55.01	02 Dec 1996 11:44:31	2434	92.9000	919.69 - 1410.42
tues2219_3	HD 269546	05 26 45.10 -68 49 55.01	02 Dec 1996 16:34:01	664	93.0000	919.69 - 1410.42
tues2219_4	HD 269546	05 26 45.10 -68 49 55.01	03 Dec 1996 03:16:50	1215	120.9000	919.69 - 1410.41
tues5221_1	Sk-67 166	05 31 44.18 -67 38 00.90	23 Nov 1996 08:18:37	2068	79.4000	919.66 - 1410.36
tues5221_2	Sk-67 166	05 31 44.18 -67 38 00.90	23 Nov 1996 09:40:31	2733	74.4000	919.66 - 1410.37
tues5221_3	Sk-67 166	05 31 44.18 -67 38 00.90	02 Dec 1996 18:07:58	1387	97.7000	919.69 - 1410.41
tues5223_1	WD0644+37	06 47 38.03 +37 30 59.81	22 Nov 1996 20:11:15	2330	66.7000	968.13 - 1410.46
tues5223_2	WD0644+37	06 47 38.03 +37 30 59.81	22 Nov 1996 21:46:02	1983	67.8000	968.13 - 1410.46
tues2255_1	HD 49798	06 48 04.80 -44 18 58.99	03 Dec 1996 08:04:36	1292	6221.2998	904.63 - 1410.45
tues2291_2_1	BD +75 325	08 10 49.30 +74 57 57.01	26 Nov 1996 16:21:48	163	36.9000	-
tues2291_2_4	BD +75 325	08 10 49.30 +74 57 57.01	26 Nov 1996 16:47:45	24	431.6000	-
tues2291_2_5	BD +75 325	08 10 49.30 +74 57 57.01	26 Nov 1996 16:49:07	22	153.9000	-
tues2291_1	BD +75 325	08 10 49.30 +74 57 57.01	22 Nov 1996 22:26:33	752	2015.2000	904.62 - 1410.43
tues2291_2_2	BD +75 325	08 10 49.30 +74 57 57.01	26 Nov 1996 16:25:29	1184	896.7000	904.63 - 1410.45
tues2291_2_3	BD +75 325	08 10 49.30 +74 57 57.01	26 Nov 1996 16:46:04	43	2652.2000	904.63 - 1410.44
tues2291_2_6	BD +75 325	08 10 49.30 +74 57 57.01	26 Nov 1996 16:50:20	155	551.8000	904.63 - 1410.44
tues2236_1	IX Vel	08 15 19.00 -49 13 21.00	03 Dec 1996 04:47:17	1908	303.9000	904.66 - 1410.49
tues2236_2	IX Vel	08 15 19.00 -49 13 21.00	03 Dec 1996 07:50:29	576	312.0000	904.67 - 1410.50
tues2203_1	Z Cam	08 25 13.40 +73 06 39.00	22 Nov 1996 17:38:01	1084	35.7000	904.63 - 1410.44
tues6003_1_2	HD72089	08 29 07.00 -45 33 27.00	02 Dec 1996 09:20:39	38	208.8000	-
tues6003_1_4	HD72089	08 29 07.00 -45 33 27.00	02 Dec 1996 09:25:43	58	119.4000	-
tues6003_2	HD72089	08 29 07.00 -45 33 27.00	02 Dec 1996 16:50:57	668	506.8000	935.33 - 1410.49
tues6003_3	HD72089	08 29 07.00 -45 33 27.00	03 Dec 1996 01:38:21	1664	383.9000	935.34 - 1410.51
tues6003_1_1	HD72089	08 29 07.00 -45 33 27.00	02 Dec 1996 09:18:21	87	302.5000	935.33 - 1410.49
tues6003_1_3	HD72089	08 29 07.00 -45 33 27.00	02 Dec 1996 09:22:08	164	495.9000	935.33 - 1410.49
tues6003_1_5	HD72089	08 29 07.00 -45 33 27.00	02 Dec 1996 09:27:32	273	473.1000	935.32 - 1410.48
tues2272_1	HD 77770	09 06 22.50 +49 36 41.00	25 Nov 1996 11:16:45	800	160.5000	919.76 - 1410.52

tues2272_2	HD 77770	09 06 22.50 +49 36 41.00	02 Dec 1996 20:17:08	717	2200.1001	919.75 - 1410.50
tues2272_3	HD 77770	09 06 22.50 +49 36 41.00	02 Dec 1996 21:43:52	1153	2248.6001	919.75 - 1410.51
tues2252_1	HD 78316	09 07 44.80 +10 40 06.00	29 Nov 1996 03:46:27	698	771.2000	935.34 - 1410.51
tues2252_2	HD 78316	09 07 44.80 +10 40 06.00	02 Dec 1996 12:34:15	830	1788.4000	935.36 - 1410.53
tues2252_3	HD 78316	09 07 44.80 +10 40 06.00	02 Dec 1996 14:02:19	586	1715.1000	935.36 - 1410.54
tues2215_1	LS 1275	09 20 09.80 -45 31 52.01	23 Nov 1996 07:12:33	1232	696.4000	904.62 - 1410.43
tues5247_6	BD+37 197	09 24 26.40 +36 42 54.00	29 Nov 1996 00:46:06	779	46.4000	-
tues5247_3_1	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:20:16	74	12.3000	-
tues5247_3_2	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:22:20	132	11.1000	-
tues5247_3_3	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:25:23	44	1.1000	-
tues5247_3_4	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:26:57	46	0.0000	-
tues5247_3_5	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:28:34	92	8.2000	-
tues5247_3_6	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:30:57	352	1547.9000	-
tues5247_3_7	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:37:39	48	0.0000	-
tues5247_3_8	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:39:18	99	5.1000	-
tues5247_3_9	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:41:48	60	13.5000	-
tues5247_4_1	BD+37 197	09 24 26.40 +36 42 54.00	27 Nov 1996 23:55:18	1448	27.9000	-
tues5247_4_3	BD+37 197	09 24 26.40 +36 42 54.00	28 Nov 1996 00:21:44	74	22.5000	-
tues5247_4_4	BD+37 197	09 24 26.40 +36 42 54.00	28 Nov 1996 00:23:49	38	15.9000	-
tues5247_3_10	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:43:39	92	12.6000	-
tues5247_3_11	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:46:02	372	29.0000	-
tues5247_3_12	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:53:05	119	36.9000	-
tues5247_5	BD+37 197	09 24 26.40 +36 42 54.00	28 Nov 1996 21:43:05	781	552.9000	904.67 - 1410.50
tues5247_7	BD+37 197	09 24 26.40 +36 42 54.00	29 Nov 1996 01:55:14	1671	618.0000	904.68 - 1410.53
tues5247_8	BD+37 197	09 24 26.40 +36 42 54.00	02 Dec 1996 17:11:04	901	1263.2000	904.68 - 1410.52
tues5247_9	BD+37 197	09 24 26.40 +36 42 54.00	02 Dec 1996 18:41:20	585	1251.1000	904.69 - 1410.53
tues5247_4_5	BD+37 197	09 24 26.40 +36 42 54.00	28 Nov 1996 00:25:17	199	306.3000	904.67 - 1410.50
tues5247_4_6	BD+37 197	09 24 26.40 +36 42 54.00	28 Nov 1996 00:29:27	69	517.9000	904.67 - 1410.50
tues5247_4_8	BD+37 197	09 24 26.40 +36 42 54.00	28 Nov 1996 00:32:49	33	689.7000	904.67 - 1410.50
tues5247_4_9	BD+37 197	09 24 26.40 +36 42 54.00	28 Nov 1996 00:34:13	52	1292.1000	904.66 - 1410.50
tues5247_3_13	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:55:55	96	466.8000	904.67 - 1410.50
tues5247_3_14	BD+37 197	09 24 26.40 +36 42 54.00	26 Nov 1996 14:58:22	103	115.3000	904.67 - 1410.50
tues2208_1	RW Sex	10 19 56.60 -08 41 56.00	21 Nov 1996 20:21:10	895	102.3000	919.75 - 1410.51
tues2208_2	RW Sex	10 19 56.60 -08 41 56.00	02 Dec 1996 15:29:25	880	103.5000	919.79 - 1410.56
tues2208_3	RW Sex	10 19 56.60 -08 41 56.00	03 Dec 1996 03:45:36	1169	114.8000	919.78 - 1410.55
tues2208_4	RW Sex	10 19 56.60 -08 41 56.00	03 Dec 1996 05:25:49	676	121.4000	919.77 - 1410.54
tues2294_2_1	WD 1031-11	10 33 42.84 -11 41 39.40	23 Nov 1996 02:23:55	364	148.0000	-
tues2294_1	WD 1031-11	10 33 42.84 -11 41 39.40	22 Nov 1996 23:24:34	2611	59.4000	951.46 - 1410.50
tues2294_2_2	WD 1031-11	10 33 42.84 -11 41 39.40	23 Nov 1996 02:30:43	1522	62.5000	951.47 - 1410.51
tues2276_2	HD 93521	10 48 23.40 +37 34 13.00	28 Nov 1996 04:56:05	1080	5169.1001	904.67 - 1410.51
tues2276_3	HD 93521	10 48 23.40 +37 34 13.00	28 Nov 1996 06:28:05	660	5154.7002	904.68 - 1410.51
tues2226_1	HD 93840	10 49 08.70 -46 46 41.99	23 Nov 1996 05:50:20	885	370.6000	904.65 - 1410.48
tues2226_2	HD 93840	10 49 08.70 -46 46 41.99	25 Nov 1996 14:05:07	778	174.7000	919.75 - 1410.50
tues2226_3	HD 93840	10 49 08.70 -46 46 41.99	02 Dec 1996 07:50:39	926	536.4000	904.67 - 1410.51
tues1008_1	HD 94473	10 53 58.58 -26 44 45.80	25 Nov 1996 12:27:26	2259	104.7000	951.48 - 1410.53
tues1008_2	HD 94473	10 53 58.58 -26 44 45.80	01 Dec 1996 12:09:57	908	515.9000	951.46 - 1410.50
tues1008_3	HD 94473	10 53 58.58 -26 44 45.80	01 Dec 1996 15:12:54	611	523.9000	951.47 - 1410.51
tues5233_3_1	HD96715	11 07 32.90 -59 57 48.00	26 Nov 1996 15:40:46	243	2199.0000	-
tues5233_3_2	HD96715	11 07 32.90 -59 57 48.00	26 Nov 1996 16:00:17	625	1039.6000	-
tues5233_4	HD96715	11 07 32.90 -59 57 48.00	28 Nov 1996 01:17:39	2006	133.9000	951.43 - 1410.46
tues2241_1	xi UMa	11 18 12.50 +31 32 14.00	21 Nov 1996 21:46:41	1884	18.3000	-
tues5255_2_1	WD1134+30	11 37 05.31 +29 47 58.50	03 Dec 1996 02:15:11	28	21.6000	-
tues5255_1	WD1134+30	11 37 05.31 +29 47 58.50	03 Dec 1996 00:34:54	2171	37.1000	968.19 - 1410.56
tues5255_3	WD1134+30	11 37 05.31 +29 47 58.50	03 Dec 1996 06:48:42	563	60.8000	968.20 - 1410.57
tues5255_2_2	WD1134+30	11 37 05.31 +29 47 58.50	03 Dec 1996 02:16:23	1542	56.1000	968.19 - 1410.55
tues2292_1_2	PG 1159	12 01 46.00 -03 45 36.00	23 Nov 1996 09:22:12	186	56.2000	-
tues2292_1_1	PG 1159	12 01 46.00 -03 45 36.00	23 Nov 1996 09:04:15	1034	53.4000	904.65 - 1410.47
tues5256_1	Feige 67	12 41 51.80 +17 31 20.00	01 Dec 1996 07:30:34	1951	426.7000	904.68 - 1410.52
tues5256_2	Feige 67	12 41 51.80 +17 31 20.00	03 Dec 1996 07:03:22	1003	446.0000	904.69 - 1410.53
tues2285_1	HD 116852	13 30 23.50 -78 51 19.99	21 Nov 1996 19:55:59	1026	997.2000	904.60 - 1410.39
tues2285_2	HD 116852	13 30 23.50 -78 51 19.99	21 Nov 1996 23:04:25	1060	969.8000	904.59 - 1410.39
tues2285_3	HD 116852	13 30 23.50 -78 51 19.99	02 Dec 1996 16:13:22	883	1030.4000	904.63 - 1410.44
tues5211_1	HD128220	14 35 15.80 +19 12 54.00	01 Dec 1996 09:02:14	2331	1302.1000	904.65 - 1410.48
tues5211_2	HD128220	14 35 15.80 +19 12 54.00	02 Dec 1996 12:56:15	710	1264.2000	904.66 - 1410.48
tues5211_3	HD128220	14 35 15.80 +19 12 54.00	02 Dec 1996 15:51:35	690	1292.1000	904.67 - 1410.50
tues2204_1	AG Dra	16 01 40.90 +66 48 10.01	21 Nov 1996 23:33:39	740	37.9000	904.63 - 1410.44
tues2204_2_1	AG Dra	16 01 40.90 +66 48 10.01	23 Nov 1996 11:57:05	1206	35.3000	904.62 - 1410.42
tues2204_2_2	AG Dra	16 01 40.90 +66 48 10.01	23 Nov 1996 12:17:55	610	31.1000	904.60 - 1410.39
tues2258_1	HD 146813	16 15 14.70 +55 47 58.01	25 Nov 1996 10:15:01	484	190.1000	919.69 - 1410.42
tues2258_2	HD 146813	16 15 14.70 +55 47 58.01	30 Nov 1996 13:16:54	791	930.0000	919.71 - 1410.45
tues2258_3	HD 146813	16 15 14.70 +55 47 58.01	02 Dec 1996 18:58:33	632	958.8000	919.71 - 1410.44
tues5210_1	BD+39 322	17 46 31.90 +39 19 09.01	22 Nov 1996 16:45:57	668	1254.5000	904.55 - 1410.32
tues5210_2	BD+39 322	17 46 31.90 +39 19 09.01	22 Nov 1996 19:20:12	2333	1196.6000	904.57 - 1410.34
tues5210_3	BD+39 322	17 46 31.90 +39 19 09.01	03 Dec 1996 04:15:14	951	1609.7000	904.60 - 1410.40
tues5210_4	BD+39 322	17 46 31.90 +39 19 09.01	03 Dec 1996 05:47:14	591	1601.5000	904.60 - 1410.40
tues2206_1	NGC 6543	17 58 33.30 +66 37 59.00	21 Nov 1996 20:45:27	1238	313.4000	904.59 - 1410.39
tues2206_2	NGC 6543	17 58 33.30 +66 37 59.00	30 Nov 1996 11:41:39	1106	342.3000	904.62 - 1410.42
tues2206_3	NGC 6543	17 58 33.30 +66 37 59.00	01 Dec 1996 13:46:17	1188	404.5000	904.61 - 1410.41
tues2232_1	CH Cyg	19 24 33.10 +50 14 29.99	25 Nov 1996 14:30:14	1311	40.2000	-
tues2216_1	NGC 6826	19 44 48.10 +50 31 30.01	22 Nov 1996 21:01:58	1927	430.2000	904.55 - 1410.32
tues2216_2	NGC 6826	19 44 48.10 +50 31 30.01	02 Dec 1996 11:08:32	1473	523.9000	904.60 - 1410.39
tues2216_3	NGC 6826	19 44 48.10 +50 31 30.01	02 Dec 1996 23:29:35	570	511.2000	904.60 - 1410.39
tues2218_2_2	RR Tel	20 04 18.40 -55 43 34.00	26 Nov 1996 15:18:01	150	40.4000	-
tues2218_2_4	RR Tel	20 04 18.40 -55 43 34.00	26 Nov 1996 15:22:59	104	28.6000	-
tues2218_2_6	RR Tel	20 04 18.40 -55 43 34.00	26 Nov 1996 15:27:54	312	2037.5000	-
tues2218_1	RR Tel	20 04 18.40 -55 43 34.00	21 Nov 1996 22:29:20	1725	60.9000	904.54 - 1410.31
tues2218_3	RR Tel	20 04 18.40 -55 43 34.00	29 Nov 1996 01:22:01	1264	100.3000	904.55 - 1410.31
tues2218_2_1	RR Tel	20 04 18.40 -55 43 34.00	26 Nov 1996 15:12:19	291	64.8000	904.56 - 1410.34
tues2218_2_5	RR Tel	20 04 18.40 -55 43 34.00	26 Nov 1996 15:25:34	90	25.2000	904.56 - 1410.33
tues5206_1	31 Cyg	20 13 37.80 +46 44 28.00	22 Nov 1996 22:47:40	1285	2385.8999	935.19 - 1410.29
tues5206_3	31 Cyg	20 13 37.80 +46 44 28.00	28 Nov 1996 03:29:16	1549	1722.7000	935.24 - 1410.36
tues5207_3	47 Cyg	20 33 54.10 +35 15 02.99	28 Nov 1996 02:03:35	2370	456.1000	935.21 - 1410.32
tues5207_4	47 Cyg	20 33 54.10 +35 15 02.99	28 Nov 1996 23:22:11	2454	381.6000	935.21 - 1410.32

tues5232_1	HD201345	21 07 55.30 +33 23 49.01	23 Nov 1996 01:35:08	1917	1258.0000	904.53 - 1410.28
tues5213_1	HD205805	21 39 10.70 -46 05 51.30	25 Nov 1996 13:15:28	2436	150.4000	919.62 - 1410.31
tues5213_2	HD205805	21 39 10.70 -46 05 51.30	28 Nov 1996 00:47:39	1286	445.0000	919.62 - 1410.31
tues5213_3	HD205805	21 39 10.70 -46 05 51.30	29 Nov 1996 04:09:46	740	393.3000	919.63 - 1410.32
tues5213_4	HD205805	21 39 10.70 -46 05 51.30	01 Dec 1996 12:34:53	1092	773.6000	919.63 - 1410.32
tues2223_1	SS Cyg	21 42 43.00 +43 35 08.00	01 Dec 1996 15:34:33	1232	42.2000	-
tues2211_1	AG Peg	21 51 01.90 +12 37 32.00	23 Nov 1996 04:39:24	1121	124.2000	904.52 - 1410.27
tues2213_1	CD-43 14304	21 00 06.20 -42 38 50.00	23 Nov 1996 06:17:08	2637	35.3000	904.50 - 1410.24
tues2213_2	CD-43 14304	21 00 06.20 -42 38 50.00	29 Nov 1996 02:36:53	1812	65.4000	904.53 - 1410.28
tues2290_2_7	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:19:17	87	188.8000	-
tues2290_2_9	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:23:49	45	659.0000	-
tues2290_5_3	BD +284211	21 51 11.50 +28 51 49.00	27 Nov 1996 23:31:32	42	62.5000	-
tues2290_7_2	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 08:21:01	18	103.9000	-
tues2290_7_3	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 08:22:09	22	383.2000	-
tues2290_1	BD +284211	21 51 11.50 +28 51 49.00	21 Nov 1996 19:34:01	724	2107.0000	904.52 - 1410.27
tues2290_3	BD +284211	21 51 11.50 +28 51 49.00	26 Nov 1996 13:54:49	916	118.6000	904.52 - 1410.27
tues2290_6	BD +284211	21 51 11.50 +28 51 49.00	28 Nov 1996 22:06:29	936	2034.6000	904.54 - 1410.30
tues2290_2_1	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:06:33	92	917.2000	904.53 - 1410.29
tues2290_2_2	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:08:56	49	1310.5000	904.53 - 1410.29
tues2290_2_3	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:10:36	34	749.2000	904.53 - 1410.28
tues2290_2_4	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:12:01	63	903.2000	904.53 - 1410.28
tues2290_2_5	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:13:55	43	1339.6000	904.52 - 1410.28
tues2290_2_6	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:15:28	178	1239.4000	904.52 - 1410.27
tues2290_2_8	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:21:34	84	523.1000	904.51 - 1410.26
tues2290_5_1	BD +284211	21 51 11.50 +28 51 49.00	27 Nov 1996 23:25:28	203	1161.8000	904.53 - 1410.29
tues2290_5_2	BD +284211	21 51 11.50 +28 51 49.00	27 Nov 1996 23:29:42	59	425.5000	904.53 - 1410.28
tues2290_5_4	BD +284211	21 51 11.50 +28 51 49.00	27 Nov 1996 23:33:05	121	574.1000	904.52 - 1410.28
tues2290_5_5	BD +284211	21 51 11.50 +28 51 49.00	27 Nov 1996 23:35:57	99	2294.7000	904.52 - 1410.27
tues2290_5_6	BD +284211	21 51 11.50 +28 51 49.00	27 Nov 1996 23:39:02	226	2531.8000	904.52 - 1410.27
tues2290_5_7	BD +284211	21 51 11.50 +28 51 49.00	27 Nov 1996 23:43:39	87	2189.7000	904.52 - 1410.27
tues2290_7_1	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 08:18:04	119	1169.6000	904.57 - 1410.35
tues2290_7_4	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 08:23:22	403	1226.3000	904.56 - 1410.34
tues2290_8_1	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 23:45:00	41	1378.9000	904.56 - 1410.33
tues2290_8_3	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 23:47:35	72	994.1000	904.56 - 1410.33
tues2290_8_5	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 23:51:12	31	1346.0000	904.55 - 1410.33
tues2290_8_6	BD +284211	21 51 11.50 +28 51 49.00	02 Dec 1996 23:53:25	632	1888.2000	904.55 - 1410.31
tues2290_8_7	BD +284211	21 51 11.50 +28 51 49.00	03 Dec 1996 00:04:48	77	1614.0000	904.54 - 1410.31
tues2290_2_10	BD +284211	21 51 11.50 +28 51 49.00	22 Nov 1996 18:25:25	340	169.5000	904.50 - 1410.25
tues2290_4_2_ph	BD +284211	21 51 11.50 +28 51 49.00	26 Nov 1996 18:03:33	1051	1881.1000	904.55 - 1410.32
tues2222_1	FF Aqr	22 00 36.40 -02 44 26.00	23 Nov 1996 07:47:48	1157	234.9000	919.58 - 1410.25
tues2222_2	FF Aqr	22 00 36.40 -02 44 26.00	30 Nov 1996 13:39:22	1064	257.9000	919.61 - 1410.29
tues2207_1	AR Lac	22 08 40.80 +45 44 32.00	23 Nov 1996 10:41:47	2118	28.5000	-
tues2248_1	HD 214080	22 36 06.30 -16 23 17.00	23 Nov 1996 03:13:08	1197	1584.8000	904.54 - 1410.29
tues2248_2	HD 214080	22 36 06.30 -16 23 17.00	02 Dec 1996 20:40:31	574	2222.7000	904.55 - 1410.32
tues2273_1_ph	HD 214930	22 41 25.70 +23 50 48.00	28 Nov 1996 05:26:58	666	812.5000	919.61 - 1410.29
tues2273_2_ph	HD 214930	22 41 25.70 +23 50 48.00	30 Nov 1996 12:16:40	324	878.6000	919.61 - 1410.30
tues2254_1	HD 217505	23 02 02.40 -59 27 47.00	23 Nov 1996 00:21:21	1304	525.4000	919.61 - 1410.29
tues2254_2	HD 217505	23 02 02.40 -59 27 47.00	02 Dec 1996 17:37:36	570	861.9000	919.66 - 1410.37
tues1012_1	HD 219188	23 14 00.56 +04 59 49.52	25 Nov 1996 11:41:21	2024	188.9000	904.54 - 1410.30
tues1012_2	HD 219188	23 14 00.56 +04 59 49.52	01 Dec 1996 14:14:53	1512	2605.6001	904.52 - 1410.27
tues2227_2	Z And	23 33 40.10 +48 49 06.00	28 Nov 1996 06:49:16	622	33.5000	904.57 - 1410.34
tues2227_3	Z And	23 33 40.10 +48 49 06.00	02 Dec 1996 19:16:18	1727	77.1000	904.57 - 1410.35

What's New for TUES during last 6 months

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

Name Resolver Option Available in Cross Correlation search
2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Frequently Asked Questions

Data Handling

Data Characteristics

Data Handling

- ***Where can I get TUES archival data?***
  See the obtaining TUES data web page.

- ***Can you explain the TUES file naming conventions?***
  Basically names are of the form TUESnnnn_m_o.fits where the target ID ("nnnn") is a special 4-digit target identification number and the observation number ("m") refers to the order in which the exposures (for a given target) were obtained. A third number ("o") indicates several pointings were obtained during a single observation (sometimes to improve the alignment of the telescope). A "_PH" denotes an integration from single photon events recorded onboard but integrated after the mission. See also the TUES file naming conventions described in the data products page.

Data Characteristics

- ***How accurate are the calibrated flux values?***
  A HST archive model of G191B2B http://garnet.stsci.edu/STIS/models/tables/g191b2b_mod_002.tab" was used as a reference for the absolute flux calibration. The calibration was additionally checked with a model of BD +28°4211 (R.Napiwotzki). We guess an accuracy of ±10% for the flux calibration. This is valid, if the object was fully centered within the diaphragm. There are, however, some observations for which the object was not completely centered. The reasons are probably due to temperature drifts of the telescope causing a shift of the alignment. In some cases also slightly wrong coordinates of the target might have led to a decentralization.

- ***What is the wavelength coverage of the echelle spectra?***
  The Tübingen Echelle (TUES) obtained moderate dispersion observations (R= 13,000) using an echelle grating including orders 40-61 covering the wavelength range from 910 to 1410 Angstroms.

ORFEUS II Echelle Data Reduction

By J. Barnstedt

Contents

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1. Steps of data processing

A) Extraction

All orders were extracted automatically from the images, i.e. during extraction a centering in y-direction (cross dispersion direction) was applied according to the center of gravity for each individual echelle order. The extraction is done in x-direction (main dispersion direction) by summing up a well defined number of pixels in y-direction. The number of pixels used for extraction in y-direction varies with the echelle order and is indicated in the header of the data file for each echelle order ("cut width"). The center for the extraction in y-direction follows a straight line along each order and is located on whole pixel numbers.

Some echelle images show tilted absorption lines within the strip of the echelle orders. In such cases the extraction was done summing up the pixels tilted by 45 degrees, which results in a significant increase in resolution.

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B) Background

Between the echelle orders a line of 3 pixels width was used to estimate the background. With exception of orders 40, 41 and 42 the background was calculated as average of the strip above and below the corresponding order. For the first three orders only the background values below each order were calculated. The so calculated background was smoothed twice with a width of 21 pixels: First a median filter was applied and as a second step a boxcar smoothing was used. This smoothing works fine if the counts within the background pixels are not too low. For very low counts within the background field other smoothing methods might be more satisfying.

Within very broad absorption lines (e.g. Ly-alpha) the background subtracted is in general overestimated. The reason might be that by far the strongest contribution to the background comes from stray light of the echelle grating:
This stray light is scattered exactly in horizontal direction on the detector while the echelle orders run slightly tilted across the detector. So within very broad absorption lines stray light is reduced within the echelle orders, and almost normal in the background extraction fields.

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C) Pixels 511/512

Due to arithmetic rounding errors at the calculation of the photon position within the echelle electronics an artefact is observed, especially in the middle of the detector image, which leads to a higher intensity in one of these two pixels while the other shows a corresponding loss of intensity. This means, that the pixel border between these two pixels seems to be somewhat shifted. This effect is eliminated by applying an averaging to these two pixels.

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D) Correction of the blaze function

The efficiency of echelle gratings has a maximum for one direction of diffraction (blaze angle), while the efficiency is reduced as a function of the deviation from this angle of diffraction (blaze function). The optimized diffraction direction was pre flight adjusted to point to the center of the echelle detector. What we find now is that the center of maximum efficiency is different for each echelle order. Furthermore we found that both the position and the width of the blaze function differ from observation to observation.

Therefore it was neccessary to introduce an individual blaze correction for each observation. Often only the overlap region between two adjacent orders could be used as a criterion for a good blaze correction.

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E) Wavelength calibration

The wavelength calibration was calculated from the positions of 814 interstellar absorption lines from 12 different echelle images. Using these data we determined the parameters for the dispersion function. Radial velocity values were not used for the calibration, the zero position of the dispersion function was determined seperately. The accuracy is better than ±0.005nm, i.e. better than the optical resolution of the instrument.

We used the position of the Ly-alpha geocoronal emission line as a reference for the absolute wavelength zero position. We found that for different observation blocks the position of the Ly-alpha line differed up to 0.006 nm. For this a wavelength correction for each observation block was applied.

Further wavelength corrections are:

a. Heliocentric radial velocity correction
b. Radial velocity correction due to the satellite's orbital velocity.

The given extractions use the on board integrated images, for these images only the average of the orbital velocity component during the observation was used for correction. In future we will extract the spectra of the individually registered photons for which the orbital radial velocity correction will be applied to each individual photon.

An additional wavelength error might occur, if the target was not exactly centered within the 20" diaphragm. The maximum resulting uncertainty is $\pm 1.2\ 10^{-4}$ as a relative wavelength error. This error was not corrected up to now.

To overcome this problem we will try to get a hint about the image position within the diaphragm from the count rates. Rapidly changing count rates indicate that the image was close to the edge of the diaphragm. In these cases, we can correlate the ASTRO-SPAS pointing data with the count rate fluctuations and thus find out the x/y-coordinates of the image in the diaphragm. Anyway this correction procedure will be complicated and tedious.

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F) Correction of loss of sensitivity in the detector edges

The corners of the detector image and the left edge show a loss of sensitivity which is probably due to a reduced efficiency of the repeller grid in front of the detector. The electrical field in front of the MCPs (about 50V/mm) is used to force those photo electrons back into the MCP channels, which are released from the areas in between the channels. This improves the quantum efficiency by about 30% (causing also a loss of 10% due to shading of the grid in front of the detector). Probably due to an inhomogenious field at the borders of the detector the efficiency of the repeller field is reduced, and there is a rather sharp step visible between lower and normal sensitivity. This is visible in some images as a circular shaped area. We estimated a loss of about 25% and corrected this by applying a "smooth" step function. The position, width and height of the step was estimated for each order from the sum of all echelle measurements. The actually used correction values are listed in the column "EDGE_CORR" (see below).

A detailed flat field correction was not applied. The reason is, that the optical light path of the spectrometer cannot be reproduced in our laboratory. This however would be essential for an exact estimation of the flat field behavior of the detector. Any other correction methods are too uncertain to be useful.

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G) Absolute flux calibration

We used a HST archive model of G191B2B "http://garnet.stsci.edu/STIS/models/tables/g191b2b_mod_002.tab" as a reference for the absolute flux calibration. The calibration was additionally checked with a model of BD +28°4211 (R.Napiwotzki). We guess an accuracy of ±10% for the flux calibration. This is valid, if the object was fully centered within the diaphragm. There are, however, some observations for which the object was not completely centered. The reasons are probably some temperature drifts of the telescope causing a shift of the alignment. In some cases also slightly wrong coordinates of the target might have led to a decentralization.

Observations with badly centered targets are identified by their strongly varying count rates. The flux calibration was calculated for the maximum observed count rate for the corresponding target (also from other observations of this target, if neccessary). This count rate was scaled with the registered count rate in the integrated image. The corresponding count rates are documented within the file headers.

The file headers contain a maximum count rate and an actual (average) count rate of the lower electronic threshold. The third value is the registered count rate in the actual image. The actual count rate of the lower threshold and the registered count rate differ for the following reasons:

a. The electronic upper threshold suppresses pulses too large to be processed.
b. Electronic dead time effects and dead time effects from the on board processor reduce the electronic efficiency.

The above page was written by Jürgen Barnstedt from the ORFEUS Group at Tübingen and is reproduced here for the MAST archive with his permission.

Instrumentation and Operations

The general design of the TUebingen Echelle Spectrograph (TUES) was discussed by Grewing et al. (1991; in Extreme Ultraviolet Astronomy, ed. R. Malina & S. Bowyer, p. 422), and a general review of the instrument and mission can be found in Appenzeller et al. (1998, in Ultraviolet Astrophysics: Beyond the Final IUE Archive, ed. W. Wamsteker & R. Gonzalez-Riestra, p. 757).

A summary of the in-flight and calibration results is given by Barnstedt et al. (1999). Wavelength calibration results from interstellar molecular lines are reported in Barnstedt et al. (2000).

Descriptions can be found in the Tuebingen project's home websites of the

- ORFEUS telescope/spectrograph
- echelle spectrograph
- detector

The TUES was deployed as part of the ORFEUS/SPAS-2 platform by the Columbia Space Shuttle on November 19, 1996, and operated for 14 days of the Shuttle's 17-day mission (STS-80). Once deployed, ORFEUS conducted program observations by receiving real-time ground commands from Drs. Ron Polidan, Richard Miller, and Peter Vedder at the Kennedy Spacecraft Center Operations & Control Center.

Project Publications

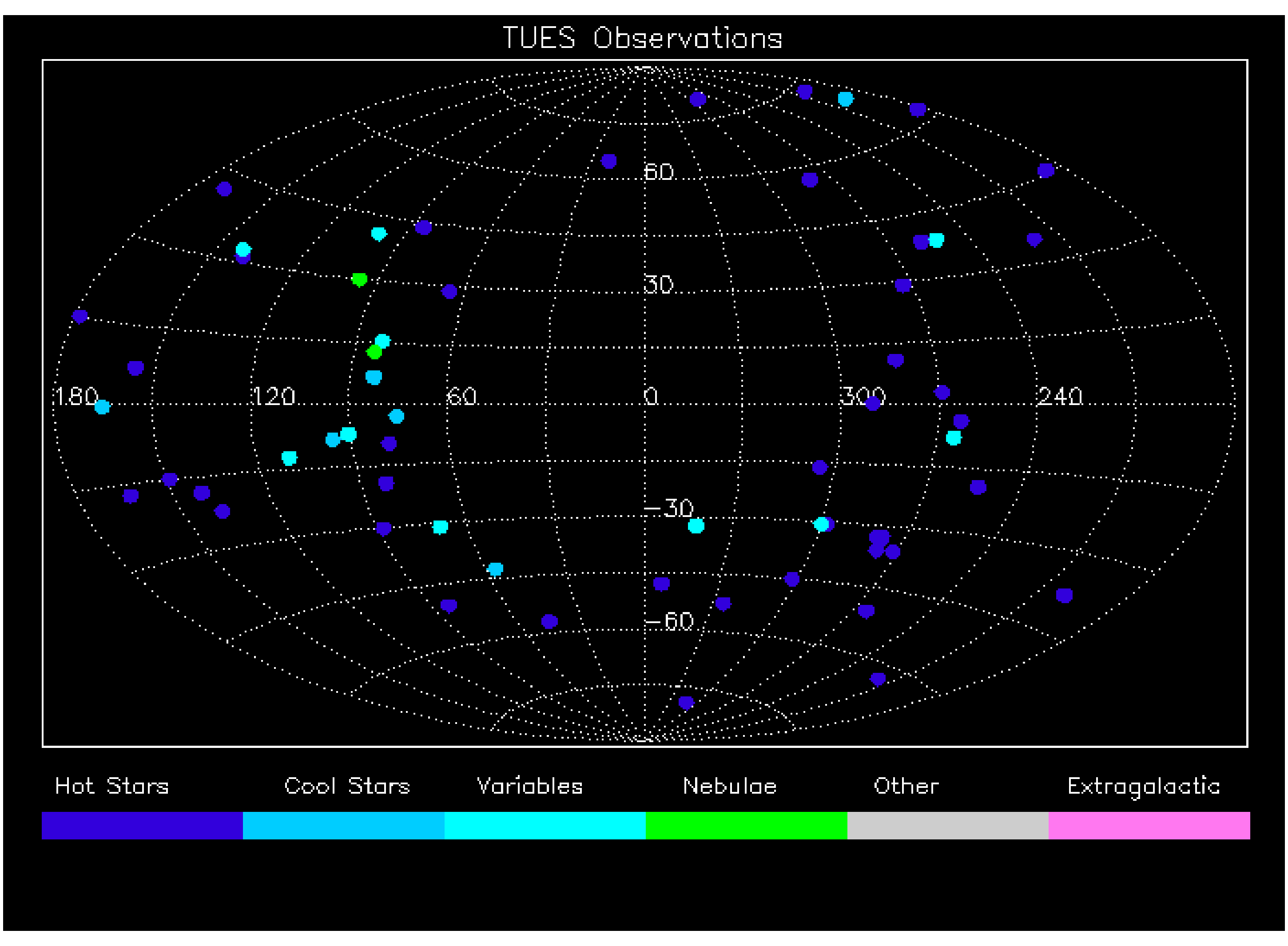
- J.Barnstedt, N.Kappelmann, I.Appenzeller et al., *The ORFEUS II Echelle Spectrometer: Instrument description, performance and data reduction* Astronomy & Astrophysics Suppl. Ser. **134**, 1998, 561-568
- J. Barnstedt, W. Gringel, N. Kappelman, & M. Grewing *The ORFEUS II Echelle spectrum of HD 93521: A reference for interstellar molecular hydrogen* A.&A.,**143**,193(Wavelength calibration)

TUES Tübingen Ultraviolet Echelle Spectrometer

- ORFEUS-Group at Tübingen
- NASA's ORFEUS-SPAS II Mission page

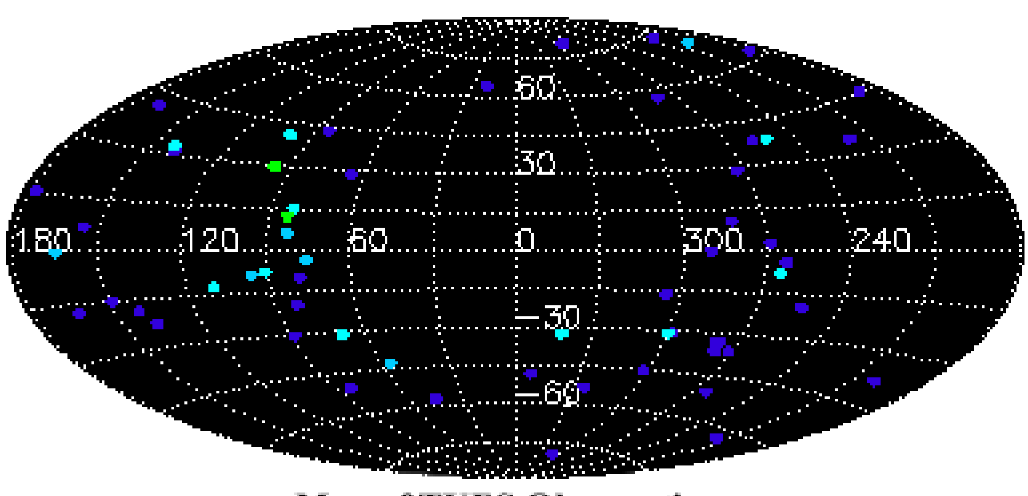
Acknowledgments

MAST made extensive use of the TUES pages from the Institute for Astronomy and Astrophysics Tübingen (IAAT) at the University of Tübingen in Tübingen, Germany. Special thanks go to Jürgen Barnstedt from the TUES project for providing software, data, numerous documents and answers to our almost infinite number of questions.



TUES Observations
60
30
180
120
60
0
300
240
-30
-60
Hot Stars
Cool Stars
Variables
Nebulae
Other
Extragalactic

The ***Tübingen Echelle Spectrograph (TUES)***, designed and managed at the University of Tübingen, flew on the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph (ORFEUS)-SPAS II space shuttle mission in 1996, returning spectra in the 900 Å to 1400 Å wavelength range. The instrument was designed to achieve a spectral resolution of $\lambda/\Delta\lambda$=10000 when used with an entrance aperture of 10" diameter. During the 17.7 day flight, TUES returned 239 spectra of 62 targets.



Map of TUES Observations

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Getting Started

The Digitized Sky Survey (DSS) is a ground-based imaging survey of the entire sky in several colors. The survey, performed with Palomar and UK Schmidt telescopes, produced photographic plates that were later digitized at STScI to produce the Hubble Guide Stars Catalog (GSC).

Each plate produced by the Survey covers 6.5 x 6.5 degrees of the sky, and the plates have been digitized using a modified PDS microdensitometer. The digital images have a pixel size of either 25 microns (1.7 arcsec per pixel) or 15 microns (1.0 arcsec per pixel), and are 14000 x 14000 or 23040 x 23040 npixels perl side. The images are stored on 12-inch optical media and are difficult to access quickly.

In order to provide convenient access to this valuable resource, the images have been compressed using a technique based on the H-transform to reduce the data volume. Although the technique is lossy, it is adaptive so that it preserves the signal very well. We typically compress the data by a factor of 10 but much higher compression ratios are possible. These compressed data are then written to CDROM which are then placed into jukeboxes for rapid access. Users can then easily retrieve image data for any part of the sky.

DSS images may be retrieved through the Web. To retrieve an image, you supply either a position (RA and Dec) or a target name, for which the position will be looked up in either the SIMBAD or NED online databases. You also specify the format and size of the image and the survey from which to extract, and the image will be delivered directly back though your browser. There is also an interface that will show you which plates your image could be extracted from, and allows you to select images from a particular plate.

Images are also accessible through StarView, and other interfaces such as the Visual Target Tuner (VTT), Aladin, and xephem access online versions of the DSS. The DSS is also available through the web from other web sites as well as at STScI.

Some information is available at this site for computing astrometry and photometry of DSS images.

DSS Target Search

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Plate Finder
HST Phase 2

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Retreival Options

- Simple Retrieval Form
- DSS Plate Finder
- HST Phase 2

DSS Plate Finder

Object Name			
[ ] [Get coordinates from:]			
◉ SIMBAD ○ NED ○ Region			
RA	Dec	Equinox	
		J2000	
Height (arcmin)	Width (arcmin)	Format	Save/Display
15.0	15.0	FITS	Display

Find plates	Clear form	Reset to defaults	Help...

archive@stsci.edu

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List all changes for DSS

More MAST mission data now on-line
2002 February 27
All IUE, UIT, BEFS and VLA-FIRST data are now on-line on a RAID array. The response time for data downloads for these missions should improve significantly. Data for missions HUT, WUPPE, TUES, and Copernicus were already on-line. HST and FUSE data remain on DADS and response times for data download for these two missions are not affected. EUVE data are held at HEASARC and this data is also not affected.

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2002 January 15
The cross correlation search option available from the top MAST page now allows a choice of NED or SIMBAD for resolving user-specified target names. (The previous version only used SIMBAD.)

New MAST/ADS Data Links
2002 January 11
The ADS data links to data archived winthin MAST have been revised. Now a link to a single MAST page is shown which displays all the known MAST references for a single bibcode. (See 1995ApJ...449..488R as an example.)

New Plotting Option Offered in MAST Scrapbook
2001 October 18
A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Data Characteristics Plots Updated
2001 June 13
The MAST Data Characteristics plots have been updated to include the FUSE, TUES, BEFS, and SDSS missions.

Target Search Error
2001 June 12
An error was discovered in the target search available from the main MAST page. Searches would fail for object names containing special characters (such as a "+" symbol as in BD +28 4211). The error was fixed on the above date.

Implementation of Redesigned MAST Web Site
2001 June 4
The MAST redesigned web site is now online. The new dynamically-generated pages feature a common page layout, options for site-wide index searches, mission-specific target name searches, easier site navigation, and a printer-friendly page display option.

Cross Correlations with Sky2000 Catalog
2000 August 16
Cross correlations of MAST missions with the SKYMAP Sky2000 catalog (version 3) are now possible from the MAST Cross Correlation page.

DSS CD Drive Replaced
2000 July 18
One of the 6 CD drives used to retrieve DSS images has been replaced and appears to have fixed most of the recent problems with downloading DSS files. A second drive is scheduled to be replaced next week.

New Copyright Notice
2000 May 12
STScI has adopted a new Copyright statement. Most, if not all, MAST web pages should now include a link to the new page.

DSS Plate Finder
1999 February 15
Using the Plate Finder, you can see all the plates available for a given position, and extract from them individually. You can also get a schematic map of the plate, with astronomical object & archive catalogs overplotted.

New DSS CDROM Jukebox
1998 November 6
We have replaced our 3.5 year old CDROM jukebox with a newer, faster model. Retrievals should be running a lot faster now.

New DSS Pages
1998 June 24
The DSS pages are being restructured to reflect the style used in the other MAST missions. The old retrieval form will still be available, but we will also be adding new forms and informational pages in the coming months.

SIMBAD Mirror at CfA
1998 June 24
Our SIMBAD name resolver is now using the Astrophysics Data System's new SIMBAD Mirror at the Center for Astrophysics (CfA) at Harvard. We used to go to the main SIMBAD server in Strasbourg, France, but the CfA mirror should be a lot faster (because of the faster network connection between Baltimore and Boston).

Busy Server
1998 June 24
As use of the DSS service increases, more users are getting messages that the jukebox is busy. We're ordering a faster jukebox and web server to acoomodate the increasing load.

Frequently Asked Questions

Web Access

Exposure and Survey

Image Anomalies

Using Images

Web Access

- ***Is there a way to retrieve DSS images in batches?***
  No. We know this would be a convenient service, and we would like to do it, but our jukebox is currently getting over 1500 hits a day (more like a thousand, if you count internal accesses and accesses to the Medium Deep Survey), and potential abuse of a batch service could easily put the jukebox into a perpetually busy state, denying the DSS to everyone.

- ***What are SIMBAD & NED?***
  SIMBAD (in Strasbourg, France) and NED (in Pasadena, California) are centralized astronomical databases that provide services like taking an object name and returning its coordinates. That's how they're used here: to redraw the DSS form with your object's RA and Dec in place, so you don't have to go look them up.

  Note: SIMBAD and NED only catalog fixed objects, like stars and galaxies. These databases don't track moving targets, like planets, comets, and asteroids. The Sky Surveys were designed to avoid bright solar-system objects anyway, so there won't be any images in the DSS of Saturn or Comet Hale-Bopp.

  Also, remember that NED only catalogs objects outside our own galaxy, like external galaxies, quasars, etc. NED doesn't catalog individual stars or nebulae.

  (For you acronym fans, SIMBAD stands for **S**et of **I**dentifications, **M**easurements, and **B**ibliography for **A**stronomical **D**ata; NED stands for **N**asa **E**xtragalactic **D**atabase.)

- ***I tried to use SIMBAD, but it never came back.***
  SIMBAD is a wonderful service, but unfortunately, the network connection between Baltimore and Strasbourg isn't the best it could be. Sometimes, the network hangs; other times, SIMBAD is just too busy to answer right away.

  If you're looking for extragalactic objects, and SIMBAD isn't working, try NED. Ned is in California, and our network connection is a bit better there.

- ***Are there other sites that offer DSS services?***
  Yes, there are. Here's a partial list.

Exposure and Survey

- ***How can I tell what telescope/filter was used for a given image?***
  The data are either from the UK Schmidt or the Oschin Schmidt (Palomar) telescopes. You can tell which survey the data come from by looking at the `REGION` keyword in the FITS header. You can also get the observatory ID from the header keyword `TELESCOP`.

  For the First Generation DSS, the emulsion/filter combinations are:

  - `XE` - POSS-E RED PLATE,
  - `XV` - SERC-V Equatorial extension,
  - `S` - SERC-J Survey

  (Also, see below about the short-exposure plates near M31 and the Magellanic Clouds.)

  For the Second Generation, these are:

  - `ER` - 'Equatorial Red' survey (UK Schmidt) IIIaF + RG610
  - `XS` - 'Second Epoch Southern' survey (UK Schmidt) IIIaF + RG610
  - `GR` - 'Galactic Red' survey (UK Schmidt) IIIaF + RG610 SHORT exposure in galactic plane
  - `XP` - POSS-II Red IIIaF + RG610
  - `XJ` - POSS-II Blue IIIaJ + GG385
  - `XF` - POSS-II Near-IR IVN + RG9

  (To get information about individual images, you'll need to get them in FITS format and look at the header. This information is not preserved in the GIF image.)

- ***What do the pixel values represent?***
  Scans in the DSS are digitizations of photographic plates. The pixel values in the scans are a measure of the photographic density of the original plate, which is non-linear with the intensity.

- ***Is a photometric calibration available?***
  Yes. The Catalogs and Surveys Branch (originators of the Digitized Sky Survey and the Guide Star Catalog) recently completed a photometric calibration for the First Generation survey (northern POSS-E, southern SERC-J, and southern Galactic Plane SERC-V).

  (There was a crude calibration done on the *southern* SERC plates; see Lasker, B., et al. 1990 AJ, 99, 2019. Equation 1 shows this solution. Table V lists coefficients for Palomar, too, but *don't use them!* They were for a Mini-J survey, not the actual POSS.)

- ***How about the exposure time?***
  That's in the `EXPOSURE` keyword in the FITS header. (Note that the exposure time there is in minutes.) All exposures are between 2400 and 4200 seconds.

- ***What's the plate scale?***
  For the First Generation scans, the plate scale is 1.7 arcsec per pixel; for the Second Generation scans, it's 1.0 arcsec per pixel. (The plate scale is derivable from the FITS keywords `PLTSCALE` and `XPIXELSZ` / `YPIXELSZ`).

- ***What Second-Generation survey plates are currently available?***
  A complete list of the plates currently available for the Second Generation survey is available at http://archive.stsci.edu/cgi-bin/dss2list.

Image Anomalies

- ***What's this funny line/feature/UFO in my scan?***
  These images were scanned from photographic plates, so every once in a while, you will encounter a scratch, internal telescope reflection, fingerprint, etc. in your image. So far, none have turned out to be aliens. I'm compiling an informal catalog of regions with plate anomalies, so if you run across one, let us know.

- ***I have a field near M31 that I know should have a lot of stars in it, but I only see a few.***
  This field was probably drawn from the special short-exposure plate of M31.

  There are three such plates, for the Large Magellenic Cloud, the Small Magellenic Cloud, and M31, exposed for 5 minutes instead of the usual 50 or so:

  - `XX001` - The Large Magellanic Cloud
  - `XX002` - The Small Magellanic Cloud
  - `XX005` - M31 (Andromeda Galaxy)

  These plates are in the V band; specifically, they were taken with IIaD emulsion and GG 495 filter.

  The Quick V version may look better; you can access it through the Phase II proposal preparation form.

- ***I tried to get an image of the Orion Nebula, but all I got was a big white spot!***
  It worked; you just need to extract a wider image to see it. The Orion Nebula is so big that all a 15'x15' extraction shows you is the very center, which in these scans *is* a big white spot. Go to a bigger scan size (if you don't mind handling the correspondingly bigger image file).

Using Images

- ***If I use the DSS in my published research, do I need to acknowledge it?***
  We request that you do. The Catalogs & Surveys Branch (CASB) has a recommended acknowledgment.

- ***Can I use images from the DSS in a CD-ROM or some software that I'm writing?***

If you're using images from the DSS for research, teaching purposes and other non-profit activities, you may use them freely, and we only request that you acknowledge the source. Commercial applications require a license. For information about licensing, contact the STScI Business Office:

Contract & Business Services
Space Telescope Science Institute
3700 San Martin Drive
Baltimore MD 21218

http://archive.stsci.edu/dss/

The **Digitized Sky Survey** comprises a set of all-sky photographic surveys in E, V, J, R, and N bands conducted with the Palomar and UK Schmidt telescopes. The Catalogs and Surveys Branch (CASB) is digitizing the photographic plates to support HST observing programs but also as a service to the astronomical community.

The 6.5-degree x 6.5-degree plates are scanned using a modified PDS microdensitometer to a pixel scale of about 1.7 arcseconds per pixel for the POSS, SERC, and Palomar Quick-V surveys, and to about 1.0 arcseconds per pixel for the POSS-II surveys.

Images of any part of the sky may be extracted from the DSS, in either FITS or GIF format.

Getting Started

Introduction

The Catalogs and Surveys Branch (CASB) of the Space Telescope Science Institute (STScI) digitized the photographic Sky survey plates from the Palomar and UK Schmidt telescopes to produce both the Digitized Sky Survey (DSS), and the Guide Star Catalogs (GSC). The catalogs support ground and space-based telescope operations and provide a valuable scientific resource to the astronomical community.

GSC-I was constructed primarily to support the operational requirements of the Hubble Space Telescope for off-axis guide stars. Production scanning began in 1985 and continued through 1988. Catalog construction was performed in parallel with the scanning. It proceeded in stages as production software became available, first for sky-following and object inventory, and later for classification plus photometric and astrometric calibrations. GSC-I contains approximately 19 million stars and other objects in the sixth to fifteenth magnitude range.

GSC-II will obtain proper motion and color information in addition to accurate coordinates, magnitudes and classifications for all objects down to at least 18th magnitude. The all-sky, magnitude-limited Telescope Operations version, GSC2.2, contains positions, classifications, and magnitudes for nearly a half billion objects, and is now available.

See the CASB home page for the latest news and developments. See also the CASB pages on:

- GSC1
- GSC2
- GSPC1
- GSPC2

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Search and Retrieval

A "quick search" of the GSC-2 catalog may be performed by entering a target name or coordinates in the form labeled GSC Target Search at the top of the left navigation menu.

- GSC-2 Search Form - coming soon
- Data Access

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Software Tools

- ShowSky - a java-based tool for querying point source catalogues and image archives.

Information on other available astronomical data reduction and analysis software packages may be found at the Astronomical Software and Documentation Service.

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What's New for GSC during last 6 months

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2001 October 18

A new option for coplotting multiple spectra and adjusting plot scales is now available in the MAST scrapbook.

Frequently Asked Questions

GSC I and II

GSPC

GSC I and II

- ***How were the Guide Star Catalogs created?***
  The basic steps involved include:
  - scanning and digitizing the Schmidt plate material,
  - image processing,
  - calibration for astrometry, photometry, and object classification,
  - Comparison to external catalogs

- ***What is the difference between GSC-I and GSC-II?***
  For a quick summary of the properties of these two catalogs see: http://www-gsss.stsci.edu/gsc/gsc2/CatalogProperites/GSCIIProperties.htm

  The GSC I catalog (version 1.0) was constructed to support pointing and target aquistion for the HST. The catalog contains approximately 19 million stars and other objects in the sixth to fifteenth magnitude range, primarily derived from an all-sky, single epoch collection of 6.4 degree by 6.4 degree Schmidt plates. The Schmidt plates for north of +6 degrees consists of a 1982-1984 epoch "Quick V" survey (IIaD, 20 minute exposure) obtained from the Palomar Observatory. The southern fields consist 0f 50-75 minute exposure IIIa-J Schmidt plates, from the UK SERC J/EJ survey (epoch 1975-1988) and a supplemental 4 minute IIa-D southern Galactic plane extension (epoch approximately 1988).

  For more information on the Schmidt plates used to construct the GSC I catalog see: http://www-gsss.stsci.edu/PlateMaterial/plateMaterial.htm

  GSC 1.1 is the catalog used for control and target acquistion for the HST. The improved catalog corrected a number of known problems in the GSC 1.0. The corrected defects included spurious entries (principally due to false detections on the diffraction spikes of bright objects), grossly incorrect entries for the brighter stars (V<7) that were produced from heavily over-exposed Schmidt images, and different entries for the same object having more than one image because of blend-resolution difficulties, as well as astrometric errors at the plate edges.

  GSC 1.2 An astrometric re-calibration of the GSC 1.1 reducing the systematic errors present in the GSC 1.1 positions. This catalog has not been been installed on the HST Guide Star Selection system, so it must not be used for HST observation planning.

  The GSC II will be an all-sky catalog based Schmidt plates at two epochs and three bandpasses, from the Palomar (POSS I and POSS II) and UK Schmidt telescopes (SERC/UK surveys). This catalog will contain postions, magnitudes, colors and proper motions for all objects to at least 18.5 in photographic F. The construction of the GSC II is in progress. A preliminary catalog, GSC 2.2 is now available.

  The GSC2.2 is an all-sky, magnitude-selected subset of this data that has been extracted to support telescope operations at the GEMINI and VLT telescopes. This Telescope Operations version contains positions, classifications, and magnitudes for 435,457,355 objects. The magnitude limits (18.5 in photographic F and 19.5 in photographic J) were implemented to ensure the photometric quality of the released data. Since bright objects are extremely overexposed on the Schmidt plates, positions from the Tycho-2 catalog were used.

  The final version (GSC 2.3), expected to be released in 2002, will also contain proper motions.

  For more information on the Schmidt plates used to construction the GSC I catalog see: http://www-gsss.stsci.edu/PlateMaterial/plateMaterial.htm

- ***When would one use GSC-I instead of GSC-II?***
  GSC-II has not been installed in HST Guide Star Selection system, so it should not be used for HST observation planning.

- ***What material is the GSC II based on?***
  See http://www-gsss.stsci.edu/PlateMaterial/plateMaterial.htm#GSCIIPlates

- ***What reference frame is used for the GSC II catalog?***
  The International Celestial Reference Frame (ICRF).

- ***What magnitude system is used with GSC II?***
  The magnitudes are in the natural system of the photographic plates. See http://www-gsss.stsci.edu/gsc/PlateMaterial/plateMaterial.htm for bandpass information.

- ***How were the positions, magnitudes, and classification selected for objects imaged on more than one plate ?***
  Although the database from which the catalog was constructed contains multiple epochs and observations for a given source, the GSC 2.2.0 exported catalog positions, magnitudes, and classifications for each unique source were selected by the following criteria:

  Positions and magnitudes from plate observations were selected by choosing the observation which occurs closest to the plate center prioritized by bandpass F,J,V, and N respectively. Magnitude cutoffs were applied (F=18.5, J=19.5, V=19.5). If the observation occurred at different plate scanning resolutions, the highest resolution (15 um pixels) was selected over the lower resolution (25 um pixels) for each bandpass regardless of plate location. Classifications were assigned by voting observations into star (0) or nonstar(3) codes.

  For more details see: http://www-gsss.stsci.edu/gsc/gsc2/gsc22_release_notes.htm

- ***What epoch was used for positions?***
  The positions are at the epoch from the plate that they were taken from. We did not take an average or combine in any way the positions imaged on more than one plate. The positions were selected by choosing the observation which occurs closet to the plate center prioritized by bandpass F, J, V, and N repectively.

- ***How were positions determined for bright stars?***
  Since bright objects are extremely overexposed on the Schmidt plates, positions obtained from the Tycho-2 catalog were used (see http://www.astro.ku.dk/%7Eerik/Tycho-2/).

- ***Can you provide the photometric transmission curves ?***
  Yes, here (http://www-gsss.stsci.edu/DSS/Transmission%20Curves/transmission_curves.HTML)

GSPC

- ***What is the GSPC?***
  To support the photometric calibration of the Guide Star catalogs, CASB produced the Guide Star Photometric Catalog. GSPC I is an all-sky set of photoelectrically determined BV sequences in the magnitude range from 9 to 15, generally near the centers of the fields of the GSC-I plates. The GSPC II, a joint project between CASB and Osservatorio Astronomico di Torino, is generally an extension of GSPC I sequences to V=19 in B, V, and R passbands based on CCD photometry.

  For more detailed information see: http://www-gsss.stsci.edu/gspc/GSPChome.htm

- ***What is the sky coverage of the GSPC II?***
  http://www-gsss.stsci.edu/gspc/gspc2_coverage_map.htm

- ***How do I obtain the GSPC data?***
  http://www-gsss.stsci.edu/support/data_access.htm#table

GSC-II Target Search
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Instrumentation/Operations

- Plate Scanning - Describes how the Schmidt plates were scanned.
- Staff page - List of CASB staff members.

Related Sites

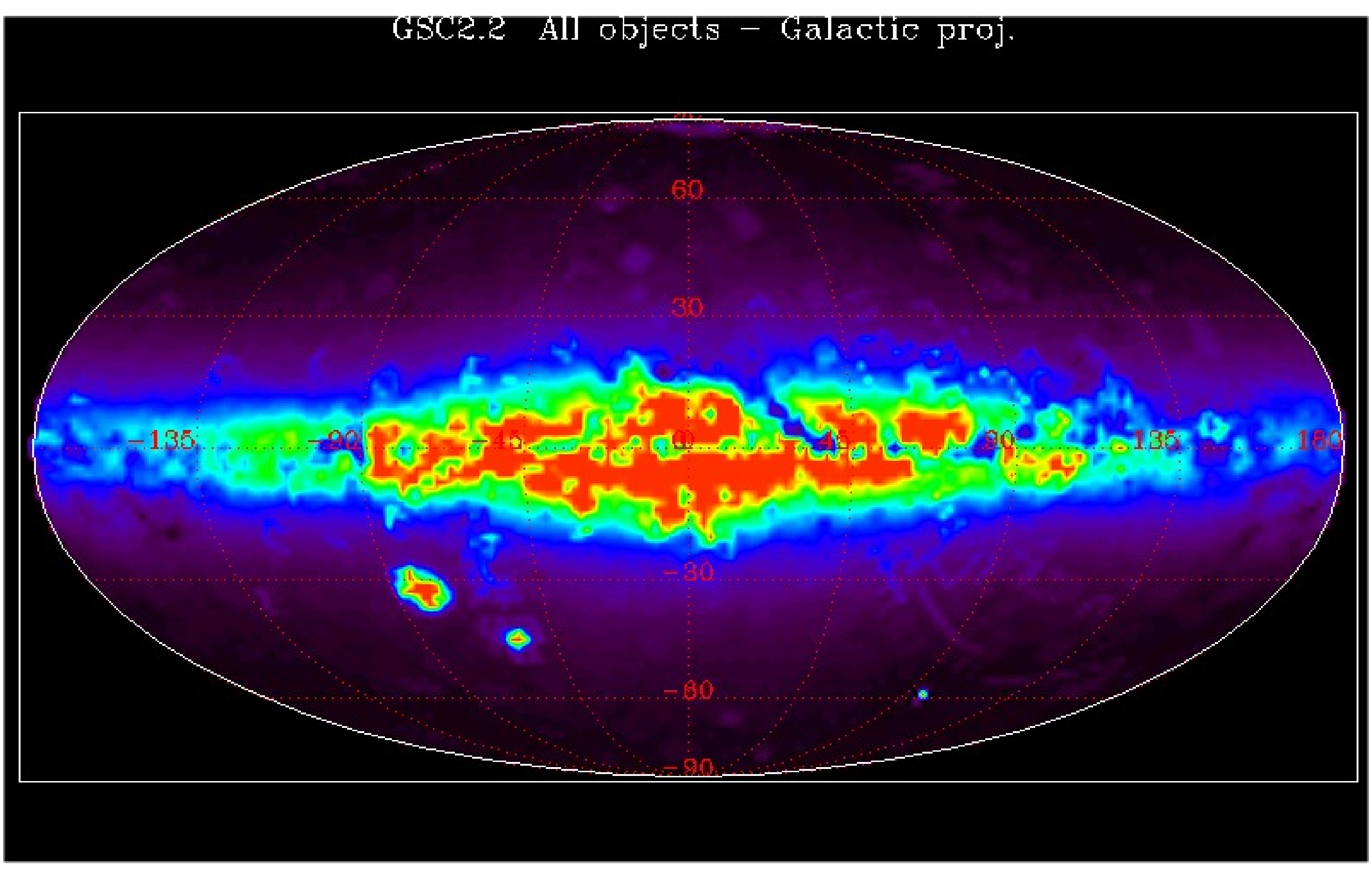
- Catalogs and Surveys Branch (CASB home page)
- CASB GSC home page
- CASB GSPC home page
- CADC GSC-I search form
- ESO GSC-I search form
- CASB DSS page
- Other science-related sites

Acknowledgments

We would like to acknowledge the CASB branch for providing the majority of online information available from MAST. We recommend that users consult the CASB website for the latest information on the Guide Star Catalogs.

Please e-mail questions regarding the Guide Star Catalogs to archive@stsci.edu.

- Data Copyrights
- Data Use Policy
- Data Acknowledgments

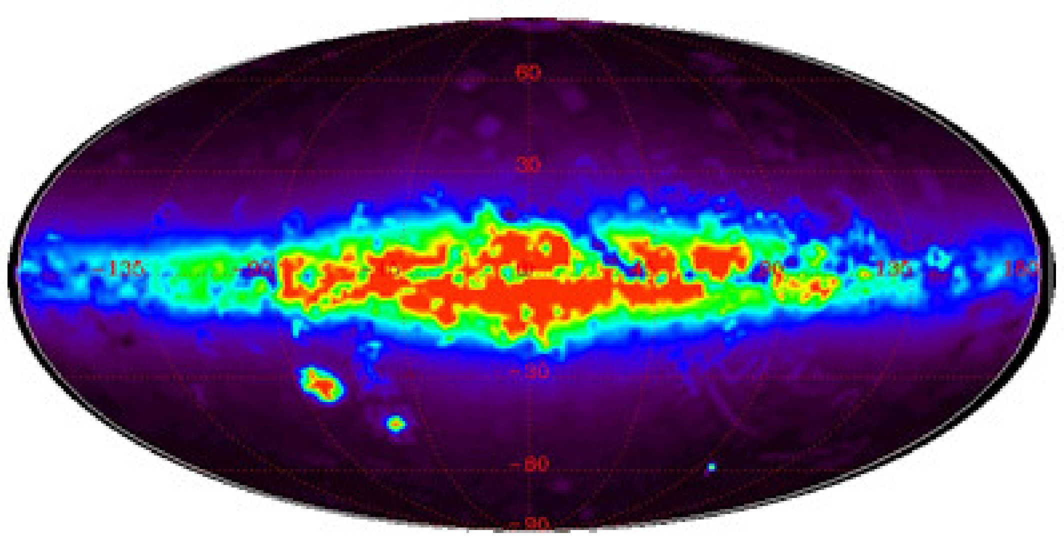

GSC2.2 All objects – Galactic proj.
60
30
-30
-60
-90
135
45
-45
-135

The Guide Star Catalogs were created by the staff of the Catalogs and Surveys Branch of the Space Telescope Science Institute.

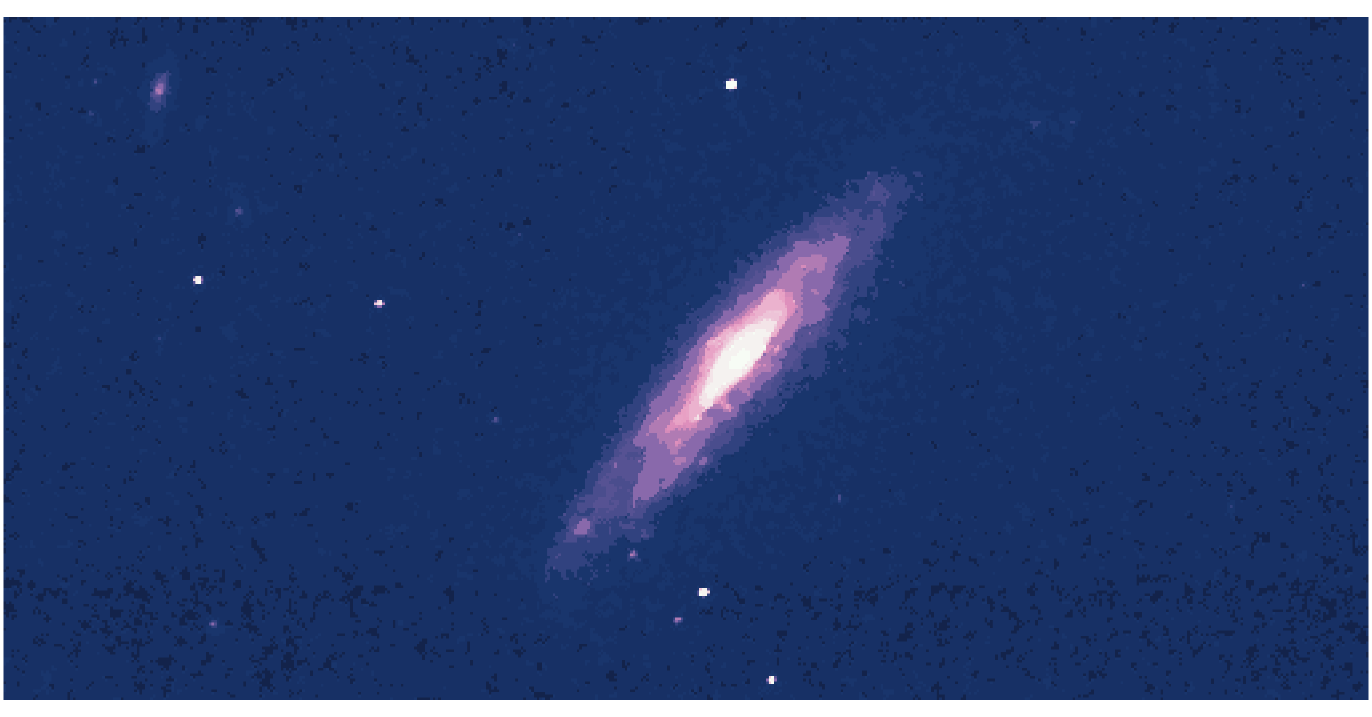
The **Guide Star Catalog I** (GSC I) is an all-sky optical catalog of positions and magnitudes of approximately 19 million stars and other objects in the 6th to 15th magnitude range. GSC I catalog is used for the control and target acquistion of the Hubble Space Telesope. The **Guide Star Catalog II** (GSC II) is currently in production and will soon be released to the public. The GSC II is an all-sky catalog of approximately 2 billion stars and galaxies containing positions, magnitudes,colors and proper motions complete to a minimum of V =18.

The **Guide Star Photometric Catalog** (GSPC-I) is an all-sky set of photoelectrically determined BV sequences in the magnitude range from 9 to 15, generally near the centers of the fields of the GSC-I plates. GSPC II is currently in production and will soon be released to the public. GSPC II is generally an extension of GSPC I sequences to V=19 in (B), V and R passbands based on CCD photometry. Its purpose is calibration of the GSC-II. New northern sequences are being added to support the POSS-II.

GSC 2.2 now available!.



GSC 2.2 - Galactic Coordinates



Sign-up for the SDSS User's Group and User's Forum

A. Sign-up for User's Group
This list will have announcements regarding scheduled archive downtime, required software upgrades, updated documentation availability. This list is not for general posting; *only the list owner can post to this list*. This list is the most important list for SDSS users to join, since it will provide our only means of keeping the users current with software changes and other time-critical information.

B. Sign-up for User's Forum
Anyone interested in the SDSS may post to this list regarding science, data, analysis, software and any other issues. This list is an open forum list, with discussion regarding scientific issues and other issues of interest to the SDSS community.

Both of these lists are standard LISTSERV mailing lists , with the usual listserver conventions of subscription, unsubscription, and posting.

Getting Started

Early Data Release

User's Guide

Contributed Data

Credits

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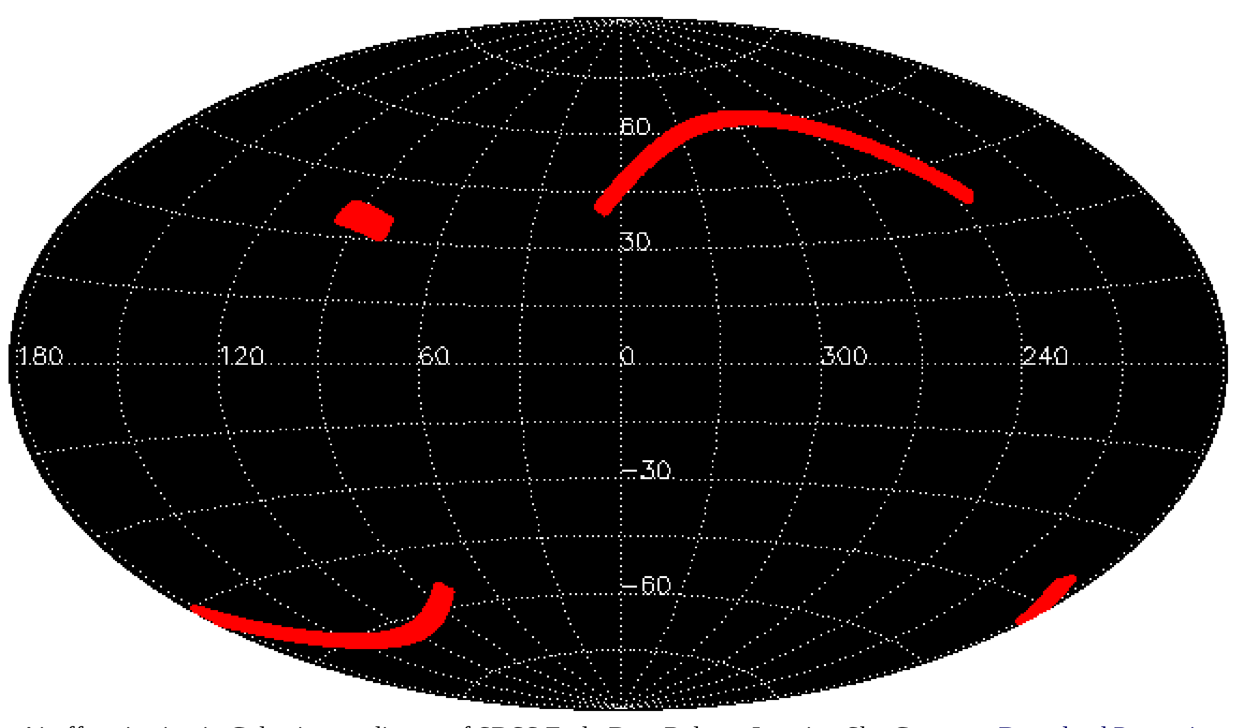
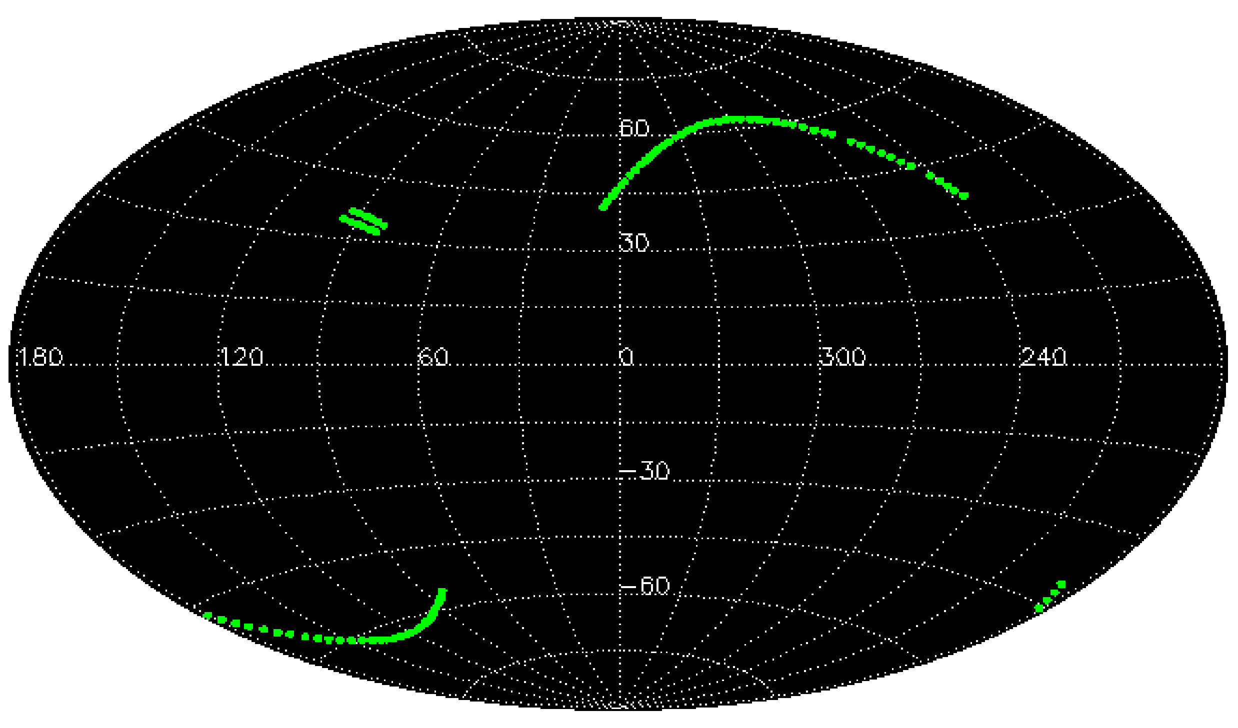
SDSS Links

SDSS SkyCoverage



Aitoff projection in Galactic coordinates of SDSS Early Data Release Imaging Sky Coverage Download Postscript version

Download ascii list of positions (RA, Dec; *l*, *b*; lambda, beta) for 15,000 imaging fields



Aitoff projection in Galactic Coordinate of SDSS Early Data Release Spectral Sky Coverage Download Postscript version

Download ascii list of positions (RA, Dec; *l*, *b*; lambda, beta) for 90 spectral plates

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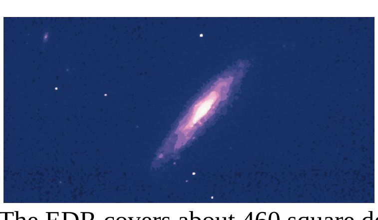
See also,

- Plot by Stripe number and list of imaging runs from FNAL.

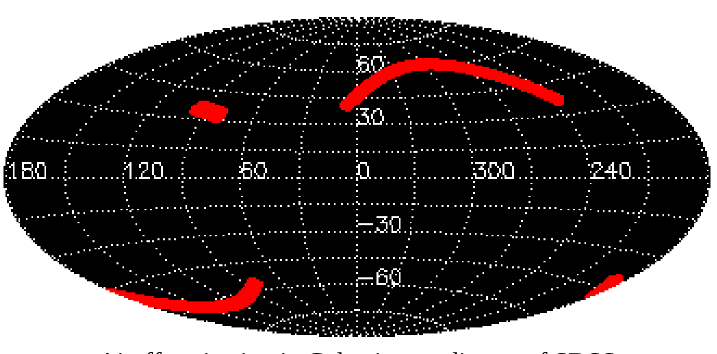
Welcome to the Sloan Digital Sky Survey Archive!



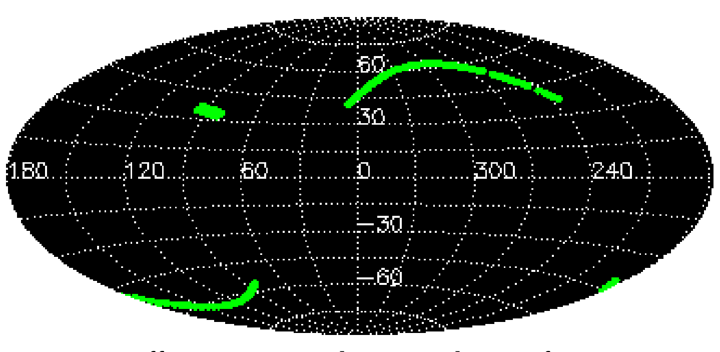
The **Sloan Digital Sky Survey** (SDSS) is using a dedicated 2.5 m telescope and a large format CCD camera to obtain images of over 10,000 square degrees of high Galactic latitude sky in five broad bands (u', g', r', i' and z', centered at 3540, 4770, 6230, 7630, and 9130 Å, respectively). Medium resolution spectra will be obtained for approximately 10^6 galaxies and 100,000 quasars. The early data release (EDR), on June 2001, includes searchable catalogs of images and spectra, images for display and scientific purpose in both 2-D FITS and JPEG formats, and spectra in both 1-D FITS and GIF formats. The EDR covers about 460 square degrees of sky. The next data releases will occur every 18 months or so.

Want to hear more? Sign up for one or both of our users' groups for the latest updates. All regular SDSS users must sign up for the Users' Group, or risk missing critical software and documentation updates.

Check the status of the SDSS archive server.



Aitoff projection in Galactic coordinates of SDSS
Early Data Release Imaging Sky Coverage



Aitoff projection in Galactic coordinates of SDSS
Early Data Release Spectral Sky Co verage

Navigations hints:
The upper left SDSS logo takes you to the Public SDSS site
The upper right MAST logo takes you to the main MAST page
The top most banner links you to MAST related topics
The lower top banner links you to SDSS specific links and data products

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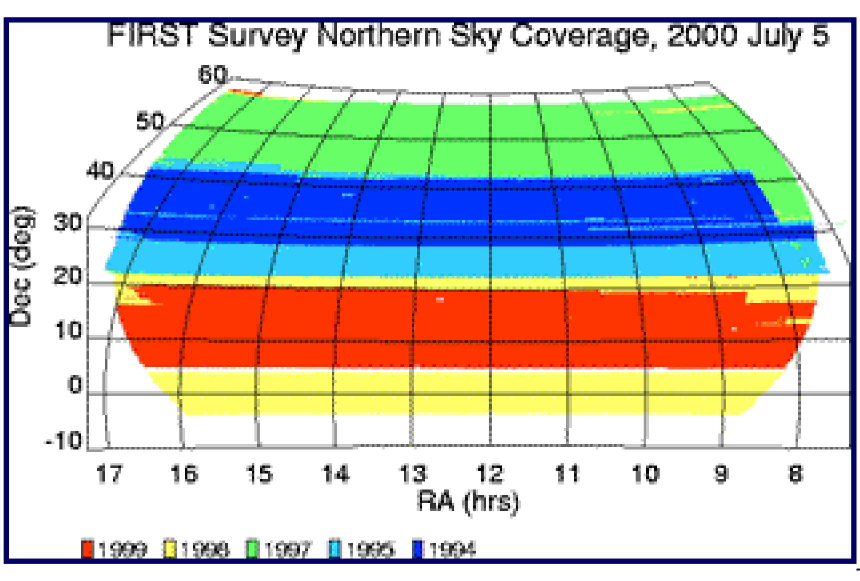
Faint Images of the Radio Sky at Twenty-cm **(FIRST)** is a systematic survey of the North and South Galactic caps begun in 1993, using the **NRAO** Very Large Array **(VLA)** . Typical images are comprised of 1150x1550 1.8" pixels with 5" resolution. Source catalogs are also available including peak and integrated flux densities generated from the high resolution coadded images. The survey yields very accurate (<1 arcsec rms) radio positions of faint (>1 mJy/beam) compact sources. The areas observed were chosen to coincide with the Sloan Digital Sky Survey. For more information, see the **VLA FIRST Web Site**.



Getting Started

ROSAT, the ROentgen SATellite, was an X-ray observatory developed through a cooperative program between Germany, the United States, and the United Kingdom. The satellite was designed and operated by Germany, and was launched by the United States on June 1, 1990. It was turned off on February 12, 1999. The scientific payload consisted of two coaligned experiments, the X-Ray Telescope, used in conjunction with one of the two focal plane instruments, the Position Sensitive Proportional Counter and the High Resolution Imager (covering the 0.1 - 2.4 keV energy range), and the Wide Field Camera (an EUV telescope), which had its own mirror system.

The ROSAT interface at MAST provides access to the ROSAT Master observations log (ROSMASTER) at the High Energy Astrophysics Science Archive Research Center (HEASARC) as a service to our optical/UV community. The MAST ROSAT interface is in fact very similar to the other MAST interfaces, so MAST users should find it easier to access the ROSAT archive through this channel.

The ROSAT Master observations log can be searched on a variety of parameters, ranging from position and object name to exposure time and PI name. Selected data can then be retrieved. Various data products are available, and we recommend our users to check the HEASARC Data Products page for detailed information.

In short, data products include: proposal abstracts (ABSTRACTS), basic products (BASIC: namely FITS files which allow one to extract images, light curves, and spectra using appropriate software [see below]), calibration files (CALIBRATION: response matrices, etc.), and images in GIF format in different bands (GIF IMAGES).

We recommend users using this interface to consult the ROSAT Guest Observer Facility page at HEASARC. There they will be able to find information about:

- the ROSAT mission;
- data analysis documentation and software;
- the ROSAT archive.

Please e-mail any question about ROSAT to rosathelp@athena.gsfc.nasa.gov. Comments about the ROSAT MAST interface should be sent to archive@stsci.edu.

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Search and Retrieval

ROSAT data reside at HEASARC but may be accessed electronically through either MAST or HEASARC retrieval sites. The MAST **ROSAT search form** has the same layout and similar query parameters as search forms of other MAST missions. Submission of this form initiates a query to the HEASARC "W3browse" master catalog of ROSAT observations (ROSMASTER), which includes data taken from the Position Sensitive Proportional Counter (PSPC) and High Resolution Imager (HRS) as well as the ROSAT All Sky Survey (RASS). Search help may be consulted for aid in using the search form. We also also provide help in understanding the query syntax transmitted to HEASARC.

Once the requested files are located, they are written to a data distribution disk area on the system, bundled into a tar or zip format file, and downloaded to the disk area specified by the user in the "save as.." pop-up window. The files are downloaded when the pop-up window disappears.

If you have problems retrieving your data, you can contact the help desk via the link at the bottom of this page.

- U.S. ROSAT Guest Observer Facility at HEASARC.
- SAO ROSAT Science Data Center.
- ROSAT at MPE.

We gratefully acknowledge the High Energy Astrophysics Science Archive Research Center (HEASARC) at Goddard Space Flight Center for allowing access to the ROSAT archive. The **ROSAT interface at MAST** provides access to the ROSAT Master observations log (ROSMASTER) at HEASARC as a service to our optical/UV community. The interface is in fact very similar to the other MAST interfaces, so MAST users should find it easier to access the ROSAT archive through this channel.

We recommend that users consult the ROSAT Guest Observer Facility page at HEASARC. There they will be able to find information about:

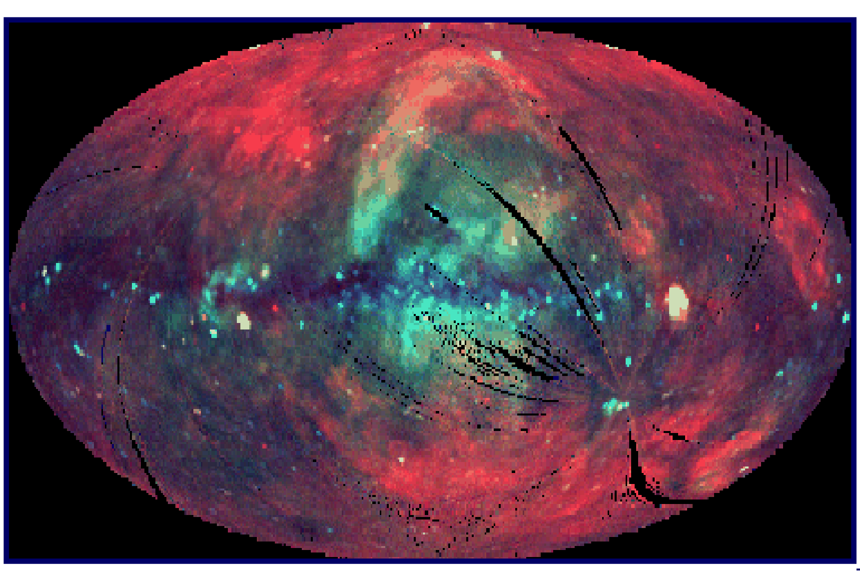
- the ROSAT mission;
- data analysis documentation and software;
- the ROSAT archive.

Please e-mail any question about ROSAT to rosathelp@athena.gsfc.nasa.gov. Comments about the ROSAT MAST interface should be sent to archive@stsci.edu.

http://archive.stsci.edu/rosat/

ROSAT,**the ROntgen SATellite**, was an X-ray observatory developed through a cooperative program between Germany, the United States, and the United Kingdom. The satellite was designed and operated by Germany, and was launched by the United States on June 1, 1990. It was turned off on February 12, 1999. The ROSAT mission began with a 6-month, all sky Position Sensitive Proportional Counter (PSPC) survey, after which the satellite began a series of pointed observations that continued for the duration of the project.

ROSAT data is maintained and archived at HEASARC. Except for the search and acknowledgments pages, all images and linked pages above are provided by HEASARC.



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Process Information: Scrapbook

The MAST Scrapbook is composed of three components: database tables of representative observations from MAST missions, query/search and display software, and thumbnails of spectral plots and images for display. The core element is the two database tables known as the "Table of Representative Spectra" (TORS) and the Table of Representative Images (TORI). The TORS/TORI catalogs contain entries of representative observations for most targets and instrument/mission combinations available in the MAST archives. The construction of these tables and the other components of the MAST scrapbook are described below.

Construction of the TORS/TORI Tables

The detailed selection of the representative observations to be included in the TORS/TORI catalogs varied with each instrument. Prior to the observation selection process, a set of "rules" or specifications were developed for the selection of "the" representative dataset of a multiply observed target in an automated and unbiased way. The specifications included parameters such as exposure lengths and dates of observations. For most missions, the observation choosen for a given grating/wavelength configuration was based on the maximum exposure time, and, to provide the broadest wavelength coverage, the lowest dispersion. For images, observations were selected for a given position on the sky based solely on exposure time.

The specifications for selecting the representative spectral observations are available for each of the following scrapbook missions:

- HST/FOS,
- HST/GHRS,
- HST/STIS,
- Astro/HUT,
- IUE,
- EUVE, and
- ORFEUS/TUES.
- ORFEUS/BEFS.

The specfications for the imaging missions included in the scrapbook are:

- HST/WFPC2
- HST/FOC
- Astro/UIT

Software to select representative spectra from the archives was written for each mission. A preliminary list of unique targets was first created and used as input to the selection software. The software queried the associated instrument database to obtain a list of all candidate observations, then used the specification rules to determine the "representative" observation. The selected observations were then ingested into the TORS/TORI catalogs.

In practice, the determination of entries for the TORS required subjective judgment whenever there was a possibility of target confusion, such as for close binaries, dense clusters, or uncertain optical identifications of UV_bright sources. Another potential source of confusion were extended objects such as resolved galaxies or nebulae, for which observations of a central region have been identified in SIMBAD or NED. Thus, for a supernova remnant filament, a representative observation was likely to be represented by the brightest knot within the extended structure. (The reader should recall that entrance apertures of various spectrographs will subtend different areas on the sky. Thus, spectra of multiple or extended targets from different instruments sometimes do not refer to the same source.) In cases of target confusion, a MAST astronomer compared the spectrum with the description of the object listed in the original proposal, published literature, and/or the spectral type, magnitude, and position given by SIMBAD/NED.

Another consideration preventing the complete automation of the TORS/TORI catalog construction was the assignment of "preferred" SIMBAD/NED object names. In some cases, the targets had not yet been added to the SIMBAD/NED catalogs, so the SIMBAD/NED names were left blank. Sometimes, the correct SIMBAD/NED name could not be assigned with complete confidence and were therefore left blank. The TORI table also included "random" exposures (e.g. parallels) for which no attempt was made to determine the observed objects.

The TORI table entries were based upon "pointings". (The definition of a pointing may differ for each mission and are dscribed in the individual mission specification pages.) After determining which observations were considered part of a pointing, the selection of representative observations was further refined using filters, exposure lengths, and observation dates. Each pointing was assigned a pointing number which was used during the selection process (and also by the display program) to group the representative images.

An example of the TORS table entries follows:

Mission	Dataset Name	Mission Object Name	SIMBAD Name	NED Name	RA (2000)	Dec (2000)	Comment
GHRS	Z2QM010XT	RR-TEL	V* RR Tel		20 04 18	-55 43 32	G270M - HARPER
GHRS	Z2QM0115R	RR-TEL	V* RR Tel		20 04 18	-55 43 32	G140L - HARPER
HUT	rr-tel_24701_a	RR-TEL	V* RR Tel		20 04 18	-55 43 33	probably airglow only
IUE	LWP08726	RR TEL	V* RR Tel		20 04 16	-55 43 18	
IUE	SWP28742	RR TEL	V* RR Tel		20 04 16	-55 43 18	

An example of the TORI table entries:

Mission	Dataset Name	Mission Object Name	SIMBAD Name	NED Name	Comment	RA (2000)	Dec (2000)	Pointing
WFPC2	U2SU1002T	PG1226+023	[VV96] J122906.7+020308	3C 273	V BAND F606W WF3	12 29 08	+02 02 24	W3284
WFPC2	U2NZ0104T	3C273-JET	[VV96] J122906.7+020308	3C 273	R BAND F622W PC1-FIX	12 29 03	+02 03 05	W3287
WFPC2	U2NZ0202T	3C273-JET	[VV96] J122906.7+020308	3C 273	U BAND F300W PC1-FIX	12 29 03	+02 03 04	W3287
WFPC2	U2SU0902T	PG1226+023	[VV96] J122906.7+020308	3C 273	V BAND F606W WF3	12 29 03	+02 03 29	W3287
WFPC2	U26L0401T	PG1226+023	[VV96] J122906.7+020308	3C 273	V BAND F606W WF3	12 29 06	+02 03 07	W3288
WFPC2	U26L0405P	PG1226+023	[VV96] J122906.7+020308	3C 273	B BAND F450W WF3	12 29 06	+02 03 07	W3288
WFPC2	U2NZ0203T	3C273-JET	[VV96] J122906.7+020308	3C 273	U BAND F300W PC1-FIX	12 29 04	+02 03 04	W3288

Search Procedure

The scrapbook allows searches by target name or coordinates and was designed with three search options: search on coordinates, search on SIMBAD or NED "preferred" target names, and search on target names specified by the mission or observer. The use of these options is explained further in the help page. In the first ("Coordinates") option, coordinates are determined for input target names using SIMBAD or NED, and the search proceeds by selecting observations within the specified search radius (the name resolve step is skipped if the user enters coordinates directly). For the second option ("Resolved Target Name"), a string search is performed comparing the user-specified target name with the SIMBAD/NED target names stored in the TORS/TORI tables. This option is useful for searches in a crowded field, when coordinate resolution could lead to confusion. The third option ("Input Target Name") allows a user to compare the input target name to the mission/observer target name and also permits utilization of a wildcard symbol %. (The last two modes only work if the user enters a target name rather than coordinates.)

Creation of Thumbnails and Display

The final step in creating the spectral scrapbook was the design of the search results page. The page begins with a short description of the users input parameters, followed by a table describing the MAST data sets matching the users input parameters, with entries in the mission/instruments field linked to the appropriate MAST mission home page. The displayed fields correspond to the data in the TORS/TORI tables with the addition of the angular separation field (for coordinate searches) which describes the separation between the found entries and the users specified (or the name-resolver derived) coordinates.

Following the table are thumbnail plots or images, grouped by mission and/or instrument. The mission/instrument name heading each section is a link to a MAST search form which allows more detailed searches for objects within a specific MAST mission. The displayed thumbnails represent the first "n" entries found for each mission, where "n" is the optional "max thumbnails per mission" parameter from the scrapbook form, and is set to 10 by default. The thumbnails serve as "icons" for further investigation. Links under each thumbnail can be used to display "preview" plots, exposure information, downloadable data files, and literature links. For most missions the thumbnails are miniaturized versions of the preview plots. For HST missions (temporarily at least), the preview contains only a full-sized plot which is created on the fly from the HST preview database. Neither the thumbnails nor the preview plots are meant to convey quantitative information; for some spectral missions (e.g. TUES) they are equivalent to the downloadable data, but for most they are not.

Following the thumbnails is a link to the MAST cross correlation search tool. Clicking this link will display a table of the first "n" entries found in each MAST mission table for the user-specified target, where, again, "n" is the "max thumbnails per mission" parameter specified on the scrapbook search form.

MAST Spectral/Image Scrapbook Help

Help Index:

Please see also:

How we made the scrapbook

Introduction

The MAST Spectral/Image Scrapbook is designed to allow users to take a quick look at sample data in the MAST archive of a particular astronomical object of interest. It is particularly useful if the user is not already familiar with the datasets involved.

The tool utilizes a pair catalogs of representative spectra and images compiled from the MAST archive. Each of the tables lists unique datasets representing either each object or unique pointing observed by each MAST mission/instrument. These datasets contain either a calibrated spectrum or image, as the case may be. More than one dataset may be listed for an assortment of bandpasses, depending on the instrument. For instance, two GHRS spectra are included in the catalog for the star T Tauri, one for the long-wavelength and one for the short-wavelength ultraviolet ranges, among the 13 GHRS spectra in the archive. For IUE, representative images of an object are included for both low and high dispersion if they exist. For WFPC2 images only, one 2.5 x 2.5 arcmin U, B, V, R, and I image is included per pointing when available; a band centered on an emission line is also included when available. In addition, the table lists the names of the object returned by SIMBAD and NED, if available, and the name and coordinates of the object as given in the original observing catalog.

The user may query the table in one of several ways (see Search Criteria listed below):

- Enter an object name to be resolved by SIMBAD or NED, and use the SIMBAD/NED coordinates to search the catalog for any entries within a specified radius of that position.
- Enter a set of coordinates to search the catalog by position.
- Enter an object name to be resolved by SIMBAD or NED, and search the catalog for entries with that resolved name.
- Enter the mission target name to search by object name as catalogued by that mission (may include "%" as a wildcard).

Note that the individual spectra or images in the catalog are typical, not always the best quality available, and are intended to convey the general attributes and quality of the data. To explore further the data available, the user should proceed to the catalog search page for the relevant mission.

For extended objects, some missions obtained data from multiple pointings around the object. In this case for spectra, data from only a single pointing may be displayed (example: the Orion nebula). No attempt has been made to provide a listing of the various pointings for such objects.

Solar system objects are not included in this tool. A special solar system scrapbook tool is under consideration.

Input Parameters

This section describes the options available on the scrapbook search form. Only the target name or position is required; the remaining fields will default to the values shown.

Target
: Enter the name or the coordinates of the astronomical object of interest.
  - If you specify the name to be resolved for the "Coordinates" or "Resolved Target Name" search, use standard nomenclature as utilized by SIMBAD or NED for best results.
  - For the "Mission Target Name" search mode only, a "%" can be used as a wildcard and all names are converted to upper-case; e.g., entering "r136%" will return all entries in which the mission object name begins with R136.
  - To specify coordinates, enter J2000 RA and DEC as decimal degrees or as hours, minutes, and seconds. Several formats will be recognized as coordinates:
    - decimal degrees e.g. 65.4975 19.535 or 65.4975, +19.535
    - hours minutes seconds e.g. 4 21 59.4, 19 32 6 or 4 21 59.4 19 32 6
    - hours minutes, deg minutes e.g. 4 21 19 32 or 4 21, 19 32

Data Type
: The user specifiies a request for spectral or image data (but not both). By default, spectral data will be displayed.

Search Criteria
: Determines how the query of the catalog of representative spectra or images is performed. Three search options are currently available:
  - **Coordinates** - Searching the TORS/TORI tables by coordinates within the defined search radius is the default search option. Users may enter their own coordinates (consult examples under "Target"), or use the SIMBAD/NED name resolvers to obtain coordinates. The software uses the resolvers automatically when characters are entered as part of the target name. SIMBAD is the default resolver. As an example, if one enters "NGC4151" for the target, then selects "coordinates" for the search criteria and "SIMBAD" for the name resolver, the scrapbook program uses SIMBAD to determine the coordinates for NGC4151, calculates a circular search area of specified radius centered on the returned coordinates, returns all entries from either Table of Representative Spectra or Images (depending which Data Type is selected) which fall within this area, and displays the spectra or images.
  - **Resolved Target Name** - This mode compares the target name returned by SIMBAD or NED to the resolved names stored in the Table of Representative Spectra or Images. This mode is useful when looking for specific targets in crowded fields or for large extended objects, but may also miss some relevant entries. As an example of usage, if one enters "NGC 224", SIMBAD resolves the target as "M 31", and the tool returns entries from the table with the SIMBAD Name "M 31".
  - **Mission Target Name** - In this mode the user's input object name is compared directly to the mission object names without using a name resolver. The mission object names are those assigned by the mission and listed in its observing catalog. The names may or may not be consistent with those of other missions. This mode can be useful for targets with unusual designations or to find certain types of objects such as "jets". All input target names are converted to upper-case and a "%" may be used as a wildcard. If one enters "NGC%4151" for example, then entries matching "NGC4151" and "NGC 4151" will be returned. If one enters, "%JET", the entries ending in "JET" such as "HH46-JET" will be returned. This mode is the fastest to execute, but may return only a subset of the desired entries due to differences in the assigned mission object names. Warning: using wildcards can result in extremely large search results.

Search Radius
: Enter the coordinate search radius in arcminutes. The default of 3 arcmin will work for many objects, but a smaller radius may be needed in crowded fields. A larger radius may be needed to locate a large extended object. This parameter is not used when searching by name only (see above).

Maximum thumbnails per mission
: By default, a maximum of 10 thumbnails will be displayed for each mission. This value may be changed to any number greater than zero. This option affects only the display of the thumbnails. The search results table will always list all the found entries.

Name Resolver
: Select either SIMBAD (the default) or NED for name resolution. If the name is not found within either database, try entering coordinates (J2000) instead of a target name. This entry applies only to "Coordinates" and "Resolved Target Name" searches with an input name.

Submit Query
: Click on this button to begin the query. The Table of Representative Spectra or Representative Images will be searched for entries which meet the specified search criteria. The result may be none, one, or many objects. You may wish to redo the search with a smaller search radius in a crowded field, or using different search criteria.

Reset
: Clicking reset will return the form to its default values.

Help
: Clicking help will display this help file. If you still have trouble, please e-mail your question to archive@stsci.edu.

Spectrum Output

The output of your query will include a list of representative data sets for the specified object or coordinates, thumbnails of the spectra or images, and links to browse files, data, and catalog search pages. You may also select spectra to be coplotted using the Customized Plot tool.

Table Headings

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page.

Plot
Click on the appropriate buttons to select the spectra that you would like to display together on one graph (see Customized Plot).

Dataset Name
The name of the dataset in the MAST archive. This may be a single observation or a combination of integrations, depending on the particular mission and instrument involved.

Mission Object Name
The name of the astronomical object as given in the mission catalog. Various designations were used by the different missions. Since all stored object names are upper case, all input names are converted to upper case when using the "Mission Target Name" mode.

Comments
Explanatory comments regarding the data sets. The contents will vary with mission. Currently the field describes the gratings used by GHRS spectra.

Simbad/NED Name
The name of the astronomical object as returned by SIMBAD (or NED if selected). SIMBAD (NED) is used to resolve multiple designations and to help the user determine if the MAST datasets are of the same target or of multiple targets falling within the search radius. Since some SIMBAD names contain lower case characters, input names are not converted to upper case in "Coordinates" or "Resolved Target Name" modes.

RA (2000), Dec (2000)
The right ascension and declination in J2000 epoch as listed in the Table of Representative Spectra, taken from the mission observing catalog.

Angular Separation
When performing coordinate searches, the angular separation (radius), given in arcminutes, between the SIMBAD (or NED) coordinates and the mission object coordinates listed in the Table of Representative Spectra catalog. The output entries are sorted by mission and angular separation.

Customized Plot

The spectra that you selected will be automatically scaled to the full range of wavelengths and nearly the full range of fluxes (i.e., y axis plot scale runs from 0 (or .25 * the minimum flux for spectra with negative fluxes) to the 10th highest flux). Each spectrum is automatically assigned a color, up to a maximum of 15. The spectra are labelled by their dataset names, with a summary of the datasets plotted given below the plot. After inspecting the plot, you may wish to change the selection of datasets which are displayed. Use your browser "Back" button to do this.

Plot range
Adjust the minimum and maximum wavelengths (in Ångstroms) and minimum and maximum fluxes (in erg/cm^2/sec/Å) to select the spectral region of interest and to exclude noisy data.

Plot dimensions
Adjust the X size and Y size in pixels to create the size of plot desired. The maximum dimensions are 850 by 640 pixels.

Redraw plot
Use this button to replot the spectra when you have changed the plot range or plot dimensions.

Image Output

The output of your query will include a list of representative images for the specified object or coordinates, previews of the images, and links to browse files, data, and catalog search pages.

Table Headings

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page.

Dataset Name
The name of the dataset in the MAST archive. This may be a single observation or a combination of integrations, depending on the particular mission and instrument involved.

Mission Object Name
The name of the astronomical object as given in the mission catalog. Various designations were used by the different missions. Since all stored object names are upper case, all input names are converted to upper case when using the "Mission Target Name" mode.

Comments
Explanatory comments regarding the data sets. The contents will vary with mission. Currently the field describes the filters and apertures used for WFPC2 image data.

Simbad/NED Name
The name of the astronomical object as returned by SIMBAD (or NED if selected). SIMBAD (NED) is used to resolve multiple designations and to help the user determine if the MAST datasets are of the same target or of multiple targets falling within the search radius. Since some SIMBAD names contain lower case characters, input names are not converted to upper case in "Coordinates" or "Resolved Target Name" mode.

RA (2000), Dec (2000)
The right ascension and declination in J2000 epoch as listed in the Table of Representative Images, taken from the mission observing catalog. For WFPC2 images these refer to the position of the V1 axis, i.e., the center of the WFPC2 field of view.

Angular Separation
When performing coordinate searches, the angular separation (radius), given in arcminutes, between the SIMBAD (or NED) coordinates and the mission coordinates listed in the Table of Representative Images catalog. The output entries are sorted by mission and pointing.

Thumbnails and Links

The thumbnails displayed are small but readable quick-look versions of the calibrated data. Descriptions of how these thumbnails were created will be included in the planned mission help pages for the scrapbook.

Click on the mission/instrument name to go to the mission search page to query data from the full mission catalog. The search form will be loaded with the user-specified coordinates (or those derived from NED or SIMBAD) and the user-specified search radius, but the user may modify these or any other search parameter before searching the mission catalog.

For spectra, click on the data_id entry below each thumbnail to view the standard preview page. The preview pages contain a full-sized image of the spectrum and other associated information. Clicking on the mission name above the thumbnail will take the user to a query page filled out with the target name or coordinates and ready to be submitted. This is an alternative way of accessing mission-specific data products for the object. click on the data_id entry or the thumbnail to display a full-size image.

For non-HST missions, click on the object name listed below each thumbnail to download the data (fits files bundled in tar) to your disk. For HST data, click on the object name to display exposure informatiom.

Click on "Cross Correlation Search" to search the entire MAST archive for a listing of the MAST data sets for a particular target. This will submit the user specified target name to the "xcorr" cross correlation search form. The resolver name, number of entries displayed per mission, and the search radius specified in the scrapbook search form will also be passed to xcorr.

MAST Mission Search Help Page

Overview

This form allows one to

1. perform a quick search by target name or coordinates for a specified set of data types (default is all), or
2. list and briefly describe the available MAST missions for a specified set of data types (default is all).

Clicking the "search" button without any selection criteria will return a list of all the existing MAST data sets. The information below describes the various search options.

Note: if you already know which data set(s) you are interested in, (i.e., which mission or survey), you may instead

- click the "Data Search" link to display a list of links to mission-specific search scripts, or
- click on the mission names shown on the top MAST page to go to the mission home pages (a similiar list is displayed by clicking the "Missions" link at the top of the page).

For further assistance, contact a MAST staff member by clicking the "Contacts" link at the top of the page.

Target Name (or coordinates)
: Entering either a target name to be resolved by SIMBAD (by default) or NED, or J2000 coordinates (RA and DEC separated by a comma) will start a cross-correlation search for appropriate data sets within MAST. If data types are also selected, the search will be restricted to the selected missions.

Data Type(s)
: Archived data sets have been classified according to the type of data (i.e., spectral, image or other) and wavelength coverage. Selecting various data types and wavelength ranges and then clicking "Search", will return a list containing both a summary of each missions data holdings and a link to the mission home pages. If a particular target is also specified, the results page will list the actual data sets available from each of the selected missions.

  The wavelength ranges and data types used in the table are as defined below.

X-ray
: That portion of the electromagnetic spectrum having wavelengths from ~0.1 to ~124 Å (i.e., ~124 kev to ~100 eV).

Extreme UV
: The extreme ultraviolet wavelength range is defined as ~70 to 912 Å.

Far-UV
: The spectral region from 912 to 2000 Å.

Near-UV
: The spectral region from 2000 to 3400 Å.

Optical
: The spectral region from 3400 to ~7500 Å.

Near-IR
: The spectral region from ~7500 Å to ~30 µ.

Radio
: That portion of the electromagnetic spectrum having wavelengths greater than ~10 cm.

Images
: Image data refers to digital images obtained within various bandpasses and with various spatial resolutions. (Note: images of spectra are not included in this category.)

Spectra
: This category refers to spectroscopic data containing calibrated or uncalibrated fluxes as a function of wavelength.

Other
: Data sets listed in the "Other" category include polarimetric, photometric, and astrometric data.

MAST Cross Correlation Help

This page explains how to use the non-catalog-specific features of the MAST cross-correlation pages.

Missions
: Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)
: The radius in arcminutes on which to cross-correlate the mission with the object catalog catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions
: When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission
: Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

MAST/HIPPARCOS Cross Correlation Help

This page explains how to use the MAST/HIPPARCOS cross-correlator.

You can use this page to cross-correlate subsets of the HIPPARCOS catalog with the HST, IUE, and EUVE archives. To use the form, simply indicate the V magnitude, B-V color, Parallax (mas), and/or Spectral Type that define the subset of the catalog that you're interested in, and which missions you want to cross correlate this subset with. You can optionally specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will then extract the subset of the HIPPARCOS catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed these stars . The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

V Magnitude
Apparent magnitude in the Johnson V band.

```
Qualification  Meaning
-------------- --------------------------------------
   > 18        V greater (dimmer) than 18
   < 22        V less (brighter) than 22
 18.5 .. 22.5  V between 18.5 and 22.5
   18.0        V of exactly 18
```

The range of values of this field in the HIPPARCOS catalog is -1.44 to 14.08. (This does not mean that the HIPPARCOS catalog is complete to 14.08.)

B-V Color
Johnson B-V color, expressed as a magnitude difference.

Parallax
Trigonometric parallax, in milliarcseconds (mas).

Spectral Type
The spectral type. This field is case-sensitive, so that searches using it will go faster. (The database engine wouldn't be able to use the index otherwise.)

Right ascension range
Right ascension range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of right ascensions. While a single RA would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the RA *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of right ascensions.

```
12 00 00 .. 14 00 00
12 00 .. 14 00
12h00m00s .. 14h00m00s
12h 00m 00s .. 14h 00m 00s
12h 00' 00" .. 14h 00' 00"
180 .. 210
```

Note that if the right ascension is given as a single floating-point number, as in the last line in the above set of examples, it will be interpreted as degrees, not hours.

You can also use < and >:

```
< 5 00 00
> 14 00 00
< 2, > 20
```

The last line means "less than 2 OR greater than 20". A comma may be to OR two RA qualifications.

Declination range
Declination range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of declinations. While a single Dec would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the Dec *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of declinations:

```
20 30 00 .. 21 00 00
20 30 .. 21 00
20h30m00s .. 21h00m00s
20h 30m 00s .. 21h 00m 00s
20h 30' 00" .. 21h 00' 00"
20.5 .. 21.0
```

You can also use < and >:

```
< 20
> -20
< -20, > 20
```

The last line means "south of -20 OR north of +20".

Missions
Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)
The radius in arcminutes on which to cross-correlate the mission with the object catalog catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions
When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission
Use this selector to determine how many rows from each mission will be displayed. When ALL is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

MAST/SKYMAP SKY2000 Version 3 Correlation Help

This page explains how to use the MAST/SKY2000 cross-correlator.

Version 3 of the SKY2000 master catalog contains nearly 300,000 star entries with visual magnitudes between -1.4 and 12.92, all of which have coordinates accurate to less than or equal to 1.5 arcsec. More than 99% of the entries have Johnson V magnitudes, however note that not all the included fields have values for every star entry.

To use the SKY2000 form, simply indicate the V or B magnitude, B-V color, coordinates, Parallax (mas), and/or Spectral Type that define the subset of the catalog that you're interested in, and which missions you want to cross correlate this subset with. The page is initially displayed to search all MAST missions except FGS and HSP. To search on individual missions, first click the "unmark all" button and then select the specific missions desired. (Selecting fewer missions will speed up the search.) You can also specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will extract the subset of the SKY2000 catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed these stars. (Note that queries returning a large subset of the SKY2000 catalog can take a long time to complete.) The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

The MAST project wishes to thank Wayne H. Warren Jr. (Raytheon Technical Services Company) and Christopher B. Sande (Computer Sciences Corporation) for their assistance in obtaining the SKY2000 master catalog and documentation.

V Magnitude

Apparent magnitude in the Johnson V band.

```
Qualification  Meaning
-------------- ---------------------------------------
   > 18        V greater (dimmer) than 18
   < 22        V less (brighter) than 22
 18.5 .. 22.5  V between 18.5 and 22.5
   18.0        V of exactly 18
```

The range of values of this field in the SKY2000 version 3 catalog is -1.44 to 12.92. (This does not mean that the SKY2000 catalog is complete to 12.92.)

B Magnitude

Apparent magnitude in the Johnson B band. The range of values for this field is -1.43 to 16.66.

B-V Color

Johnson B-V color, expressed as a magnitude difference. Values range from -0.6 to 5.9.

Parallax

Trigonometric parallax, in milliarcseconds (mas). Values range from 742 to -343 although negative values have no physical meaning.

Spectral Type

A 30 character field containing spectral class, luminosity class, and peculiarity type. This field is case-sensitive, so that searches using it will go faster. (The database engine wouldn't be able to use the index otherwise.)

Right ascension range

Right ascension range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of right ascensions. While a single RA would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the RA *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of right ascensions.

```
12 00 00 .. 14 00 00
12 00 .. 14 00
12h00m00s .. 14h00m00s
12h 00m 00s .. 14h 00m 00s
12h 00' 00" .. 14h 00' 00"
180 .. 210
```

Note that if the right ascension is given as a single floating-point number, as in the last line in the above set of examples, it will be interpreted as degrees, not hours.

You can also use < and >:

```
< 5 00 00
> 14 00 00
< 2, > 20
```

The last line means "less than 2 OR greater than 20". A comma may be to OR two RA qualifications.

Declination range

Declination range (J2000). Use this to limit the catalog extraction to a specific area of the sky. This field should be used to specify a *range* of declinations. While a single Dec would be recognized, in general such a specification would not be useful, since the cross-correlator will try to match the Dec *exactly*- an operation that would be subject to the whims of floating-point computer arithmetic.

Here's how to specify a range of declinations:

```
20 30 00 .. 21 00 00
20 30 .. 21 00
20h30m00s .. 21h00m00s
20h 30m 00s .. 21h 00m 00s
20h 30' 00" .. 21h 00' 00"
20.5 .. 21.0
```

You can also use < and >:

```
< 20
> -20
< -20, > 20
```

The last line means "south of -20 OR north of +20".

Missions

Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)

The radius in arcminutes on which to cross-correlate the mission with the object catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions

When you select multiple missions, you can use this selector to control how a catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission

Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

MAST/AGN Cross Correlation Help

This page explains how to use the MAST/AGN cross-correlator. For information on how the AGN catalog was constructed, see the page describing the contents of the AGN catalog.

You can use this page to cross-correlate subsets of our AGN catalog with the HST, IUE, and EUVE archives. To use the form, simply indicate the classes, redshift range, visual magnitude range, and/or 6cm flux range that define the subset of the AGN that you're interested in, and which missions you want to cross correlate this subset with. You can optionally specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will then extract the subset of the AGN catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed the AGN. The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

Object Class

The classification of the AGN. For information on how the AGN were classified, see the section The Classification in the page describing the contents of the AGN catalog.

You may select one or more of these classifications. If you select more than one, then the cut will find AGN that fall into any one of the selected classes. (Each AGN has only one class associated with it.)

Redshift

The redshift of the AGN, expressed as *z*. You can enter a range of floating point numbers here in any of the following ways:

Qualification	Meaning
> 4	*z* greater than 4
< 2	*z* less than 2
2.5 .. 3.5	*z* between 2.5 and 3.5
2.0	*z* of exactly 2

Visual Magnitude

The visual magnitude (*V*) of the AGN. For information on how the visual magnitude was derived, see the page describing the contents of the AGN catalog.

This field can accept a range of floating point numbers:

Qualification	Meaning
> 18	*V* greater (dimmer) than 18
< 22	*V* less (brighter) than 22
18.5 .. 22.5	*V* between 18.5 and 22.5
18.0	*V* of exactly 18

6cm Flux

The radio flux at 6cm, in mJy. For information on how the 6cm flux was derived, see the page describing the contents of the AGN catalog.

This field can accept a range of floating point numbers:

Qualification	Meaning
> 18	flux greater than 18 mJy
< 22	flux less than 22 mJy
18.5 .. 22.5	flux between 18.5 mJy and 22.5 mJy
18.0	flux of exactly 18 mJy

Missions

Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)

The radius in arcminutes on which to cross-correlate the mission with the object catalog catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions

When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission

Use this selector to determine how many rows from each mission will be displayed. When ALL is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

The AGN Catalog

- The Catalog
- The Classification
- Useful Hints
- Disclaimer

The Catalog

The Active Galactic Nuclei (AGN) catalog is heavily based on A Catalogue of Quasars and Active Nuclei (7th Edition), ESO Scientific Report No. 17, by Véron-Cetty & Véron (1996) [VV96]. That includes 11,442 quasars and active galaxies, and gives optical magnitudes, redshift, and some radio information. To this we have added: 1. the BL Lac catalog of Padovani & Giommi (1995), updated with BL Lacs discovered in 1996 (for a total of 265 sources); 2. the radio galaxies in the 1 Jy, S4, and S5 radio catalogs, mostly not included in VV96. The resulting database, which totals 12,021 AGN, was also cross-correlated with various radio catalogs providing 6 cm data, namely the PKS database, the PMN survey , the GB6 catalog, the 1 Jy, S4, and S5 radio catalogues. Individual radio fluxes for radio-quiet AGN not included in radio catalogs (radio fluxes < 1 - 30 mJy), taken from the literature, were also added. The V magnitudes in VV96 are actually mostly B or photographic magnitudes when no (B-V) value is available. Therefore, for objects without (B-V) colors, V magnitudes have been derived from the given values by subtracting (B-V) values typical of the class to which an object belongs to, unless the reference was to a paper which gave V magnitudes directly. One should remember that most AGN are variable so the reported V magnitudes should be taken only as indicative. (See Padovani (1997) and Padovani et al. (1997) for some astrophysical applications of an extended version of the catalog.)

The Classification

The classification is based mostly on the one given by VV6, to which the user is referred to, with some differences and additions. Namely:

- AGN UNCLASSIFIED: unclassified sources in Table 3 of VV96 (which includes "active galaxies").
- BL LAC: sources appearing in the BL Lac catalogue of Padovani & Giommi (1995), updated with BL Lacs discovered in 1996.
- LINER: classified as S3 (or Seyfert 3) in VV96.
- QSO: this includes all quasars appearing in Table 1 of VV96, defined by a value of the blue absolute magnitude brighter than -23; for these objects a sub-classification as radio-loud or radio-quiet has been done, based on the two point spectral index alpha_ro (defined here between 5000 Angstroms and 6 cm [5 GHz]). Objects with (K-corrected) alpha_ro > 0.19 (corresponding to the "standard" dividing value of radio flux to optical flux > 10) have been called radio-loud. For the purpose of calculating alpha_ro, V magnitudes have been corrected for extinction following Wilkes et al. (1994) and for the presence of emission lines according to Natali et al. (1998). Radio-loud Seyfert 1 galaxies have been included with the radio-loud QSO, where they belong according to unified schemes for AGN (see, e.g., Urry & Padovani 1995). Note that sometimes radio fluxes are available only at wavelengths other than 6 cm (e.g., from the FIRST or NVSS surveys). In these cases the radio flux at 6 cm used to calculate alpha_ro has been derived by extrapolating the flux assuming a radio spectral index typical of the class to which an object belongs to.
  - QSO (NO V-MAG): 196 QSO without (believe it or not) V magnitude;
  - QSO RADIO-LOUD; QSO (and Seyfert 1 galaxies) with alpha_ro > 0.19 (includes a few QSO without V magnitude but radio flux > 0.5 Jy);
  - QSO RADIO-QUIET; QSO with alpha_ro <= 0.19.
- RADIO GALAXY; from the 1 Jy, S4, and S5; also, radio-loud Seyfert 2 galaxies were checked individually and classified as radio-galaxies if appropriate (radio galaxies are classified as Seyfert 2 galaxies in VV96).
- SEYFERT TYPE 1; sources in Table 3 of VV96 classified as S1 (excluding objects with broad lines in polarized light only); radio-loud Seyfert 1 galaxies are included with the radio-loud QSO (see above).
- SEYFERT TYPE 2; sources in Table 3 of VV96 classified as S2, plus S1 in VV96 with broad lines in polarized light only (classified as S1 in VV96).
- SEYFERT?; sources in Table 3 of VV96 classified as S or S?.
- STARBURST GALAXY; sources in Table 3 of VV96 classified as H2.

Useful Hints

(work in progress)

Disclaimer

Classification of astronomical objects is a complex subject and in many cases the assignement of an object to a given class can be a matter of dispute. We have done our best to be as objective as possible but are obviously open to comments and suggestions about the catalog. These should be sent, along with any questions, to Archive hotseat.

MAST/Abell Clusters Cross Correlation Help

This page explains how to use the MAST/Abell Clusters cross-correlator.

You can use this page to cross-correlate subsets of the Abell Clusters catalog with the currently archived MAST missions. To use the form, simply indicate the redshift range, visual magnitude range (see below), richness class(es), and/or a range of galactic coordinates that define the subset of the clusters that you're interested in, and which missions you want to cross correlate this subset with. You can optionally specify a search radius for each mission different from the default given in the page.

The MAST cross-correlator will then extract the subset of the Abell Clusters catalog that meets your qualifications, and will begin polling the selected mission databases to see which missions have observed the clusters. The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions:

- The name of the catalog or mission will be linked to that mission's search form, with the RA and Dec for the catalog target as defaults.
- The target name will be linked to a preview image or spectrum, if one is available.
- The name of the exposure (the Dataset Name for HST data, the Entry ID for IUE data, etc) will be linked to a page of information about that specific observation. (This is still under development for non-HST data.)

A note about the search radius: Abell clusters can be large, so a search radius on the order of the instrument aperture may be too small. We have therefore defined radii for all of the clusters for which we have a valid redshift. The search radius will be the cluster radius (in arcminutes) *plus* the aperture radius for the instrument. (Clusters for which a radius has not been defined- because a redshift was not available- will be searched on the aperture radius alone.)

Richness Class

The richness class of the cluster.

You may select one or more richness class. If you select more than one, then the cross-correlator will find clusters that fall into any one of the selected classes.

Redshift

The redshift of the cluster, expressed as z. You can enter a range of floating point numbers here in any of the following ways:

```
Qualification  Meaning
-------------- ---------------------------------------
    > .75      z greater than .75
    < .3       z less than .3
 .3 .. .75     z between .3 and .75
    .3         z of exactly .3
```

Mag 10

The visual magnitude (*V*) of the 10th-brightest galaxy in the cluster. This field can accept a range of floating point numbers:

```
Qualification  Meaning
-------------- ---------------------------------------
   > 18        V greater (dimmer) than 18
   < 22        V less (brighter) than 22
 18.5 .. 22.5  V between 18.5 and 22.5
   18.0        V of exactly 18
```

Galactic Longitude Range

Galactic longitude range (*lii*). Use this field to restrict the catalog to a range of galactic longitudes.

This field can accept a range of floating point numbers:

```
Qualification  Meaning
-------------- ---------------------------------------
   > 270       lii greater than 270 degrees
   < 30        lii less than 30 degrees
 160 .. 200    lii between 160 and 200 degrees
 < 30, > 270   lii between 270 and 30 degrees (including 0 degrees)
```

If you enter a single floating-point number, the cross-correlator will try to match that number exactly, so this probably isn't a useful way to qualify this field.

Galactic Latitude Range

Galactic latitude range (*bii*). Use this field to restrict the catalog to a range of galactic latitudes.

This field can accept a range of floating point numbers:

```
Qualification  Meaning
-------------- ---------------------------------------
   > 60        bii greater than 60 degrees
   < -60       bii less than -60 degrees
 -30 .. 30     bii between -30 and +30 degrees
< -60, > 60    bii less than -60 or greater than +60 degrees
```

If you enter a single floating-point number, the cross-correlator will try to match that number exactly, so this probably isn't a useful way to qualify this field.

Missions

Select one or more missions with which to cross-correlate the selected catalog. (For HST, each instrument is treated as a separate mission.) You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match a catalog entry in order for that catalog entry's results to be displayed.

Radius (arcmin)

The radius in arcminutes on which to cross-correlate the mission with the object catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission.

Show catalog entries that match any/all of the selected missions

When you select multiple missions, you can use this selector to control how an catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those catalog entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find catalog entries observed with *either* HST *or* IUE.

Display *n* rows per mission

Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

MAST Cross Correlation Help

This page explains how to use the MAST cross-correlator.

You can use this page to cross-correlate a list of sky positions with the HST, IUE, and EUVE archives. To use the form, you will need a file containing the list of sky positions you want to use as an input catalog. The format of this file is discussed below. Also, select which missions you want to cross correlate this input catalog with. You can optionally specify a search radius for each mission different form the default given in the page.

The MAST cross-correlator will then parse your input catalog and begin polling the selected mission databases to see which missions have observations at your catalog potisions. The results will be presented in a simple tabular form, with links to the MAST search pages for individual missions.

Format of the Input File

The input file should have one entry per row; blank lines and lines beginning with a # character will be ignored. Each row should contain columns delimited by one of the column-delimiting characters shown in the Column Delimiter popup menu in the form. (currently, these are tab, comma, pipe, semicolon, and colon). The RA and Dec can appear in any column. (Currently, the coordinates will be assumed to be equatorial with an equinox of J2000.)

Here are some examples of input-file formats:

- Comma-delimited file, RA in column 1, Dec in column 2:

```
240.083157,-22.621305,HD143275
261.347982,-56.377399,HD157246
67.278648,-13.048497,HD28497
24.426019,-57.236367,HD10144
```

- Pipe-delimited file, RA in column 2, Dec in column 3:

```
HD143275 | 16:00:19 | -22:37:16
HD157246 | 17:25:23 | -56:22:38
HD28497  | 04:29:06 | -13:02:54
HD10144  | 01:37:42 | -57:14:10
```

- Tab-delimited file, RA in column 1, Dec in column 2, with a comment line (which will be skipped):

```
# RA              Dec
16 00 19        -22 37 16
17 25 23        -56 22 38
04 29 06        -13 02 54
01 37 42        -57 14 10
```

Make sure that each column is separated by only one delimiter.

Once you have your input file, in the cross-correlation form, indicate the name of the file on your system, the character which delimits the columns (see below), and the column numbers of the RA and Dec (see below). Then hit the **Submit Query** button. Your browser will then send the contents of your input file to our server, which will search the Archive at the positions given in your input file. (Your file will not be saved on the server; it will be deleted as soon as the cross-correlation ends or the CGI script dies.)

Path to Your Local File

The pathname to the catalog file on your disk. Your browser will send the contents of this file to the cross-correlator to use as an input catalog. Depending on your browser and your platform, you may need to give the full path to this file (e.g., `/home/kimball/xcorr.lis`).

Column Delimiter

This is the character that delimits the columns in your file. The choice is currently limited to tab, comma, pipe (or vertical bar), semicolons, and colons. Let us know if you think something else would be useful here.

The cross-correlator currently cannot handle input lists of fixed-length records. When we work out a reasonable interface for this, however, we'll implement it.

RA Column Number, Dec Column Number

These are the column numbers of the RA and Dec columns within your file. The first column is assumed to be column #1.

Sometimes a catalog will start with a column-delimiting character. For example, if your catalog looks like this:

```
| HD143275 | 16:00:19 | -22:37:16 |
| HD157246 | 17:25:23 | -56:22:38 |
| HD28497  | 04:29:06 | -13:02:54 |
| HD10144  | 01:37:42 | -57:14:10 |
```

then the cross-correlator will think that column 1 is always empty, so you should start counting columns at column #2. Therefore, in this example, the RA will be in column #3 and the Dec in column #4.

Missions

Select one or more missions with which to cross-correlate your input catalog. You can use the **Show catalog entries that match any/all of the selected missions** selector (see below) to control whether any or all missions have to match and catalog row in order for that row's results to be displayed.

Radius (arcmin)

The radius in arcminutes on which to cross-correlate the mission with the input catalog. Each mission has its own independent radius. For each mission, a default radius has been chosen that is more or less appropriate for that mission. (Later on, we may break HST up into its individual instruments, treating each one like a separate mission. In that case, these fields will have default values appropriate for that instrument.)

Show catalog entries that match any/all of the selected missions

When you select multiple missions, you can use this selector to control how a catalog row's results will be displayed: Set it to `any` to show results if the catalog entry cross-correlates with at least one of the selected missions, or set it to `all` to show only those entries that cross-correlate with *every* selected mission. For example, you might set this selector to `all` if you are looking for catalog entries that have been observed with *both* HST *and* IUE, or to `any` to find entries observed with *either* HST *or* IUE.

Display *n* rows per mission

Use this selector to determine how many rows from each mission will be displayed. When `ALL` is selected, every row found for the mission will be displayed. Optionally, you may use this selector to reduce the number of rows from each mission reported, reducing the length of the results page. The *total number* of rows for each mission will always be reported.

What's New Help

Overview

In order to allow more specific listings of changes within MAST, the user may now select both the mission and time period for which to view changes. Once these options are choosen, clicking **GO** will generate and display the requested list of changes.

The **What's New** links available from the individual mission pages access the same master list of changes, but the link is hardcoded with the mission name and a time period of 1 year. In other words, clicking the Whats New link from the mission pages will display changes for that particular mission made during the past year.

Mission
: This entry specifies the mission for which to view changes. Besides the current MAST-supported missions (i.e., BEFS, COPERNICUS, DSS, EUVE, FIRST, FUSE, HST, HUT, IUE, IMAPS, ROSAT, UIT, and WUPPE), one may also select ALL (the default selection) or OTHER, which describes general changes not related to a particular mission (note ALL includes OTHER).

Time Period
: The period of time over which to view MAST-related changes, starting from the day the list is generated. The current options include: last month, last 3 months (the default), last 6 months, last year, and all.

SDSS Unusual BAL Quasars

A sample of 23 unusual Broad Absorption Line Quasars has been assembled from both the SDSS EDR and some post-EDR data, totalling approximately 8000 quasar spectra. No further examples of the five categories of unusual BAL quasars discussed in the paper could be found among the data inspected, at least for spectra with SNR at least 6 per pixel in at least one of the g, r, or i bands (see section 4 of the paper). The paper also presents a revised balnicity index for deciding whether a quasar is a BAL quasar or not.

Calibrated SDSS and followup spectra of all 23 objects, plus IRAF and SM code for calculating the traditional and revised balnicity indices, are available in a gzipped tar file.

Questions regarding the BAL quasar work can be addressed to the lead author, Pat Hall (pathall@astro.princeton.edu), of Princeton University.

- gzip-compressed PostScript file of the paper as accepted by the Astrophysical Journal Supplement on 2002 March 1. (2.3 Mbytes)
- gzip-compressed tar file sb1data.tar.gz (1.1 Mbytes) containing spectra of all unusual BAL quasars in the paper along with the IRAF and SM code for calculating traditional and revised balnicities.

Getting Started

Early Data Release

User's Guide

Contributed Data

BAL Quasars
Quasar Target Selection
Quasar Catalog
Composite Quasar Spectra
USNO 40 Catalogued stars
Galaxy Luminosity Function

Credits

What's New

SDSS Links

The Sloan Digital Sky Survey Quasar Target Selection Algorithm

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Paper abstract:
We describe the algorithm for selecting quasar candidates for optical spectroscopy in the Sloan Digital Sky Survey. Quasar candidates are selected via their non-stellar colors in *ugriz* broad-band photometry, and by matching unresolved sources to the FIRST radio catalogs. The automated algorithm is sensitive to quasars at all redshifts lower than z~5.8. Extended sources are also targeted as low-redshift quasar candidates in order to investigate the evolution of Active Galactic Nuclei (AGN) at the faint end of the luminosity function. Nearly 95% of previously known quasars are recovered (based on 1540 quasars in 446 square degrees). The overall completeness, estimated from simulated quasars, is expected to be over 90%, whereas the overall efficiency (quasars:quasar candidates) is better than 65%. The selection algorithm targets ultraviolet excess quasars to i^*=19.1 and higher-redshift (z>3) quasars to i^*=20.2, yielding approximately 18 candidates per square degree. In addition to selecting ``normal'' quasars, the design of the algorithm makes it sensitive to atypical AGN such as Broad Absorption Line quasars and heavily reddened quasars.

The algorithm was approved for normal SDSS operations on 2001 August 24; spectra of quasar candidates that were identified from imaging data processed after that date will thus constitute a uniformly selected sample of SDSS quasars. Note that the quasars from the EDR quasar catalog were *not* selected with this verion of the algorithm and are thus not a uniform sample. An updated quasar catalog that is uniformly selected according to this algorithm will be released concurrent with the next SDSS data release, currently scheduled for January 2003.

Questions regarding the quasar selection algorithm can be addressed to the lead author, Gordon Richards (gtr@astro.psu.edu), of the Department of Astronomy and Astrophysics at The Pennsylvania State University.

- PostScript file of the paper as accepted by the Astronomical Journal on 2002 February 11. (5.3 Mbytes)

```
Sloan Digital Sky Survey Quasar Catalog I.  Early Data Release       Creation Date: 
20 Aug 2001

Column Format         Description
   1     A18    Object Name   hhmmss.ss+ddmmss.s  (J2000)
   2     I10    10000000 x R.A.(J2000) in radians
   3     I10    1000000 x Dec.(J2000) in radians
   4     I5     1000 x redshift
   5     I2     Source of object  0 = EDR quasar   1 = Extreme BAL Search   2 = 
Visual search of EDR spectra
   6     I5     100 x u* magnitude
   7     I4     100 x error in u* magnitude
   8     I5     100 x g* magnitude
   9     I4     100 x error in g* magnitude
  10     I5     100 x r* magnitude
  11     I4     100 x error in r* magnitude
  12     I5     100 x i* magnitude
  13     I4     100 x error in i* magnitude
  14     I5     100 x z* magnitude
  15     I4     100 x error in z* magnitude
  16     I5     100 x Galactic absorption in u band
  17     I7     100 x FIRST Peak flux density at 20 cm (mJy)
  18     I5    -1000 x log ROSAT full band count rate
  19     I5    -100 x Absolute i* magnitude  (Ho: 50     Omega_M: 1.00     Omega_L: 
0.00    alpha_Q: -0.50)
  20     I5     Morphology flag    0 = point source  1 = extended
  21     I3     Target selection version     1 = 2.2a    2 = 2.5    3 = 2.7
  22     I3     Quasar target flag          0 = not targetted as quasar       1 = 
targetted as quasar
  23     I3     FIRST target flag           0 = not targetted as FIRST        1 = 
targetted as FIRST
  24     I3     ROSAT target flag           0 = not targetted as ROSAT        1 = 
targetted as ROSAT
  25     I3     Serendipity target flag     0 = not targetted as serendipity  1 = 
targetted as serendipity
  26     I3     Star target flag            0 = not targetted as star         1 = 
targetted as star
  27     I3     Galaxy target flag          0 = not targetted as galaxy       1 = 
targetted as galaxy
  28     I6     SDSS Imaging Run Number for photometric measurements
  29     I6     Modified Julian Date of spectroscopic observation
  30     I5     Spectroscopic Plate Number
  31     I5     Spectroscopic Fiber Number
  32     A20    Object Name if not discovered by SDSS

         1              2          3       4  5   6    7   8    9  10   11  12   13  14
15   16      17   18  19  20 21 22 23 24 25 26 27    28   29     30   31      32
000011.96+000225.1      8703      7037  479 0 1787   1 1759   1 1769   1 1764   1 1757
3   16       0 1661 2471  0  0  1  0  1  0  0  0   125 51791  387 200 LBQS 2357-0014
000039.00-001804.0     28366    -52554 2114 0 1947   3 1927   2 1909   3 1900   2 1883
6   17       0    0 2650  0  0  1  0  0  1  1  0   125 51791  387 167
000042.89+005539.4     31197    161903  951 0 1835   2 1821   2 1796   1 1791   1 1777
3   15       0    0 2590  0  0  1  0  0  1  1  0   125 51791  387 531 LBQS 2358+0038
000053.09-003712.8     38614   -108250 1323 0 1872   2 1857   3 1845   2 1845   2 1861
5   22       0    0 2609  0  0  1  0  0  0  0  0   125 51791  387 169
000056.89-010409.8     41377   -186645 2111 0 2051   8 2005   3 1959   3 1917   3 1879
5   21       0    0 2634  0  0  1  0  0  0  0  0   125 51791  387  98
000058.23-004646.5     42348   -136065 1895 0 1863   2 1871   3 1873   2 1837   2 1831
4   22       0    0 2692  0  0  1  0  0  0  0  0   125 51791  387  93 ZC 2358-010B
000058.77+003510.6     42741    102327 1659 0 2037   8 1992   2 1949   2 1897   2 1890
6   13       0    0 2601  0  0  1  0  0  0  0  0   125 51791  387 517
000109.13-004121.7     50273   -120321  417 0 1904   3 1880   3 1866   2 1853   2 1826
3   21       0    0 2353  0  0  1  0  0  1  1  0   125 51791  387  57
000111.19-002011.4     51776    -58734  518 0 1972   4 1909   2 1897   2 1856   1 1849
4   19    2328    0 2397  0  0  1  1  0  1  0  0   125 51791  387 161
000118.40-010221.9     57017   -181413 1969 0 1964   4 1942   2 1941   3 1912   3 1902
6   21       0    0 2624  0  0  1  0  0  1  0  0   125 51791  387  42
000141.43+002356.2     73766     69632  937 0 1941   3 1919   1 1897   2 1900   2 1898
7   17       0    0 2479  0  0  1  0  0  1  0  0    94 51791  387 514
000208.83-001742.7     93692    -51521  652 0 1920   3 1882   1 1873   2 1858   2 1860
5   16       0    0 2443  0  0  1  0  0  0  0  0   125 51791  387 109
000221.11+002149.4    102621     63482 3071 0 2014   6 1895   1 1868   1 1860   2 1868
6   16    1286    0 2766  0  0  0  1  0  1  1  0    94 51791  387 556
000222.47-000443.4    103612    -13744  811 0 1883   2 1837   3 1818   2 1815   2 1784
3   17     423    0 2533  0  0  1  1  0  1  0  0    94 51791  387 116 LBQS 2359-0021
000226.09+000549.0    106244     16923 1654 0 1864   4 1850   1 1855   2 1833   1 1833
5   16       0    0 2665  0  0  1  0  0  0  0  0   125 51791  387 111
000230.71+004959.1    109600    145404 1355 0 1902   2 1864   2 1817   1 1803   1 1797
4   13       0    0 2652  0  0  1  0  0  1  1  0    94 51791  387 575 [HB89] 2359+005
000421.02-003403.1    189823    -99056 1461 0 1907   2 1898   1 1884   2 1863   2 1873
5   16       0    0 2609  0  0  1  0  0  1  1  0    94 51791  387  28 LBQS 0001-0050
000433.93-004844.8    199208   -141799 1297 0 2042   8 1973   2 1915   3 1894   2 1889
6   18       0    0 2554  0  0  1  0  0  0  0  0   125 51793  388 289
000435.75-011318.6    200534   -213253  507 0 1919   3 1890   2 1897   2 1871   2 1862
5   15       0    0 2375  0  0  1  0  0  0  0  0   125 51793  388 296
000442.18+000023.3    205212      1133 1008 0 1940   3 1921   1 1895   1 1896   2 1906
6   19     410    0 2499  0  0  1  1  0  1  0  0    94 51791  387  35
000445.72+002244.9    207783     66177  497 0 1965   4 1917   2 1924   2 1895   2 1870
6   26       0    0 2352  1  0  1  0  0  0  0  0    94 51791  387 632
000500.42-003348.4    218472    -98341 2177 0 1891   2 1874   2 1862   2 1849   2 1823
5   18       0    0 2707  0  0  1  0  0  0  0  0    94 51793  388 303 UM 197
000527.53-000556.3    238189    -17275  613 0 1951   3 1917   1 1918   2 1901   3 1887
5   18       0    0 2387  0  0  1  0  0  1  1  0    94 51793  388 313
000531.07+000950.9    240765     28648  944 0 1948   4 1901   1 1874   1 1863   2 1845
5   16       0    0 2517  0  0  1  0  0  0  0  0   125 51793  388 396
000546.49-002414.0    251977    -70493 1728 0 1957   4 1946   2 1951   2 1914   2 1915
7   18       0    0 2594  0  0  1  0  0  1  1  0   125 51793  388 268 [HB89] 0003-006
000549.05-003435.5    253841   -100626 1624 0 1930   4 1916   2 1908   2 1883   2 1881
5   19       0    0 2612  0  0  1  0  0  1  1  0    94 51793  388 267 [HB89] 0003-008
000602.17-005358.1    263381   -156988 1862 0 1931   3 1931   2 1925   2 1886   2 1890
6   16       0    0 2637  0  0  1  0  0  1  1  0    94 51793  388 250 [HB89] 0003-011
000608.05-010700.7    267654   -194932  948 0 1893   2 1867   2 1850   2 1850   1 1862
5   19     291 1616 2532  0  0  1  1  1  1  0  0   125 51793  388 247
000654.11-001533.4    301150    -45253 1727 0 1829   2 1814   1 1805   2 1776   2 1768
2   17       0    0 2732  0  0  1  0  0  1  0  0   125 51793  388 234 LBQS 0004-0032
000701.32+002242.3    306397     66051  886 0 1784   1 1754   2 1734   3 1732   2 1719
2   37       0    0 2643  0  0  1  0  0  1  1  0    94 51793  388 430 LBQS 0004+0005
000709.92+001854.2    312648     54991 1434 0 1912   2 1880   2 1855   3 1835   2 1839
4   46       0    0 2646  0  0  1  0  0  1  1  0    94 51793  388 436
000710.01+005329.0    312716    155578  316 0 1722   2 1690   2 1667   2 1676   3 1611
3   17     155  980 2469  0  0  1  1  1  0  0  0   125 51793  388 445 LBQS 0004+0036
000725.19+003645.0    323752    106902 2031 0 1952   4 1933   2 1908   2 1903   3 1873
5   22       0    0 2641  0  0  1  0  0  0  0  0   125 51793  388 463
000737.14+002003.1    332443     58332 1102 0 2006   5 1960   4 1914   2 1905   2 1897
8   34       0    0 2515  0  0  1  0  0  1  0  0    94 51793  388 478
000743.79-002432.5    337278    -71391 1538 0 1865   2 1840   1 1829   1 1811   2 1815
3   21       0    0 2674  0  0  1  0  0  1  1  0    94 51793  388 181
000752.55+002110.2    343654     61584 1273 0 1895   3 1878   4 1843   2 1840   1 1840
6   29       0    0 2608  0  0  1  0  0  1  1  0    94 51793  388 474
000807.53+001619.0    354545     47464 1480 0 1934   2 1917   2 1891   1 1869   1 1875
6   31       0    0 2612  0  0  1  0  0  0  0  0    94 51793  388 499 UM 203
000834.71+003156.1    374313     92900  263 0 1784   2 1773   1 1754   1 1753   1 1730
2   21       0 1421 2354  0  0  1  0  1  1  1  0   125 51793  388 487 LBQS 0006+0015
000838.30-005156.8    376924   -151109 2889 0 2147  13 1984   3 1970   2 1964   3 1959
10   15       0    0 2649  0  0  1  0  0  0  0  0    94 51793  388  83
000859.19+011351.1    392112    214830  287 0 1912   3 1877   2 1831   2 1820   3 1762
3   11       0    0 2302  1  0  1  0  0  0  0  0    94 51793  388 562
000904.42-004332.8    395919   -126676 1830 0 1865   2 1879   2 1878   2 1845   1 1846
4   19       0    0 2675  0  0  1  0  0  1  1  0   125 51793  388  98
000927.61+011055.6    412782    206321 1673 0 1931   3 1919   2 1915   2 1901   2 1902
6   12       0    0 2598  0  0  1  0  0  0  0  0    94 51793  388 570
000945.46+001336.9    425759     39609  697 0 1886   2 1847   1 1844   1 1838   1 1836
4   16       0    0 2477  0  0  1  0  0  1  1  0    94 51795  389 355 LBQS 0007-0003
001002.04+004224.5    437819    123361 1211 0 1973   3 1937   2 1893   3 1884   2 1890
6   12       0    0 2547  0  0  1  0  0  0  0  0    94 51793  388 505
001002.96-010107.2    438490   -177795  555 0 1962   3 1901   1 1884   1 1855   2 1864
5   15     129    0 2411  0  0  1  1  0  0  0  0    94 51793  388   2
001010.03+005126.6    443632    149643  387 0 1935   4 1915   2 1870   2 1846   2 1818
3   12       0    0 2341  1  0  1  0  0  0  0  0   125 51795  389 338
001017.80+010450.7    449284    188627 1825 0 1952   3 1909   1 1877   2 1832   2 1830
3   12       0    0 2685  0  0  1  0  0  1  0  0    94 51793  388 607
001018.57-005810.4    449839   -169223  627 0 1976   3 1924   1 1927   2 1907   2 1909
7   17       0    0 2386  0  0  1  0  0  0  0  0    94 51793  388   8
001022.15-003701.2    452444   -107689 3156 0 2235  44 1856   2 1824   1 1822   1 1820
3   27       0    0 2814  0  0  1  0  0  0  0  0   125 51793  388 114
001025.90+005447.6    455174    159388 2845 0 2114  15 1913   2 1902   2 1883   3 1869
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3   14       0    0 2754  0  0  1  0  0  0  0  0   125 51795  389 339
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6   15       0    0 2362  0  0  1  0  0  1  1  0    94 51795  389 323
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7   16       0    0 2651  0  0  1  0  0  1  1  0   125 51795  389 387
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5   16       0    0 2557  0  0  1  0  0  1  1  0    94 51795  389 272
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2   14       0    0 2782  0  0  1  0  0  1  1  0   125 51795  389 178 LBQS 0013-0029
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8   13       0    0 2590  0  0  1  0  0  1  1  0   125 51795  389 514
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4   12       0    0 2646  0  0  1  0  0  1  1  0   125 51795  389 506
001641.17+010045.2    728076    176726 3037 0 2179  28 1945   2 1931   2 1916   3 1925
8   14       0    0 2707  0  0  1  0  0  0  0  0   125 51795  389 567
001647.83+011220.2    732916    210422 1490 0 2058   8 1976   2 1932   2 1896   3 1890
7   14       0    0 2580  0  0  1  0  0  0  0  0    94 51795  389 563
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4   14       0    0 2564  0  0  1  0  0  0  0  0    94 51795  389 111
001754.17+011123.3    781163    207660 1465 0 1952   4 1949   2 1915   2 1893   2 1889
6   15       0    0 2580  0  0  1  0  0  1  1  0    94 51900  390 328
001800.21+004602.8    785553    133945 1907 0 1901   2 1893   1 1884   2 1860   1 1859
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4   14       0    0 2703  0  0  1  0  0  1  0  0   125 51900  390 365 LBQS 0016+0045
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5   15       0    0 2628  0  0  1  0  0  1  1  0    94 51795  389  31
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6   14       0    0 2548  0  0  1  0  0  1  1  0   125 51795  389 622
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001950.05-004040.8    865434   -118334 4320 0 2474 163 2144   7 1983   3 1947   2 1927
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002005.69-005016.3    876807   -146235  575 0 2117   9 2031   3 2015   3 1958   3 1953
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6   16       0    0 2623  1  0  1  0  0  1  1  0    94 51900  390 433
002028.34-002914.9    893279    -85082 1923 0 1931   4 1915   1 1910   2 1896   2 1880
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4   15       0    0 2593  0  0  1  0  0  1  0  0   125 51900  390 479 LBQS 0018-0004
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4   15       0    0 2466  0  0  1  0  0  1  1  0   125 51900  390 122
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5   12       0 1638 2438  0  0  1  0  1  0  0  0    94 51900  390 532 LBQS 0019+0022B
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3   13       0    0 2724  0  0  1  0  0  1  0  0   125 51900  390  92
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3   12       0 1427 2478  0  0  1  0  1  1  0  0   125 51900  390 531 LBQS 0019-0000
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4   13       0    0 2381  0  0  1  0  0  0  0  0    94 51900  390 157
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002342.37+002041.7   1034383    60202 1018 0 1935   4 1909   2 1883   2 1879   2 1886
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4   10       0    0 2633  0  0  1  0  0  1  0  0    94 51782  391 207
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3   12       0 1812 2388  0  0  1  0  1  1  0  0   125 51782  391 271
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3   12       0    0 2704  0  0  1  0  0  1  0  0    94 51782  391 102
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003153.84+005916.1   1391786   172408 1365 0 1914   3 1918   1 1888   2 1881   2 1875
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5   10       0    0 2615  0  0  1  0  0  0  0  0   125 51793  392 321
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2   10       0 1274 2342  0  0  1  0  1  1  0  0   125 51782  391 624
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3   13       0    0 2707  0  0  1  0  0  1  1  0   125 51793  392 208 UM 259
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3   11       0    0 2815  0  0  1  0  0  1  0  0    94 51793  392 440
003506.76-010851.5   1532080  -200302 1474 0 1984   4 1946   2 1922   2 1881   2 1871
4   13       0    0 2592  0  0  1  0  0  0  0  0   125 51793  392 219
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6   10       0    0 2622  0  0  1  0  0  0  0  0    94 51793  392 181
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003550.67-004301.7   1564013  -125165 1680 0 1929   3 1908   1 1916   2 1892   2 1886
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5   11       0    0 2600  0  0  1  0  0  0  0  0    94 51793  392 127
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2   10       0    0 2598  0  0  1  0  0  1  0  0   125 51793  392  95
003722.17-001140.6   1630557   -33969 1369 0 1906   2 1899   2 1875   1 1867   2 1868
5   10       0    0 2589  0  0  1  0  0  1  1  0    94 51793  392 164
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4   10       0    0 2528  0  0  1  0  0  1  1  0    94 51793  392  93
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003943.61-003002.3   1733413   -87380 1552 0 1942   3 1910   1 1896   1 1869   2 1865
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004000.99+003330.6   1746054    97481 1669 0 2111  12 2013   3 1970   2 1923   2 1918
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4   11       0    0 2647  0  0  1  0  0  0  0  0   125 51794  393 338
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3   10       0 1546 2601  0  0  1  0  1  0  0  0    94 51793  392  69
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2   11       0    0 2750  0  0  1  0  0  0  0  0    94 51794  393 298 UM 265
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3   15       0 1636 2396  0  0  1  0  1  1  1  0   125 51793  392  35
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3   11       0    0 2681  0  0  1  0  0  1  1  0   125 51794  393 261
004118.58+001742.5   1802481    51512 1764 0 1899   3 1887   1 1879   2 1845   1 1847
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004143.16-005855.0   1820353  -171386 2555 0 1931   3 1887   1 1891   1 1898   2 1884
5   11       0    0 2688  0  0  1  0  0  1  0  0    94 51794  393 250
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3   11       0 1602 2324  1  0  1  0  1  0  0  0   125 51794  393 369
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4   10       0    0 2572  0  0  1  0  0  0  0  0   125 51794  393 228
004253.58-005506.5   1871562  -160306 1885 0 1910   2 1913   1 1893   1 1856   2 1847
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004308.93+011218.7   1882725   210350 1191 0 1923   3 1932   2 1910   2 1912   3 1936
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2   11       0    0 2728  0  0  1  0  0  1  1  0    94 51794  393 419
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4   11       0    0 2625  0  0  1  0  0  0  0  0   125 51794  393 422
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4    9     693    0 2611  0  0  1  1  0  0  0  0   125 51794  393 199
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2    9       0    0 2805  0  0  1  0  0  0  0  0   125 51794  393 181
004338.29+000523.7   1904076    15695  821 0 1938   3 1908   2 1904   3 1906   5 1893
7    9       0    0 2441  0  0  1  0  0  0  0  0   125 51794  393 479
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5   10       0    0 2392  0  0  1  0  0  0  0  0    94 51794  393 201
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3   11       0    0 2628  0  0  1  0  0  1  1  0    94 51794  393 455
004413.72+005141.0   1929847   150341  937 0 1885   2 1859   1 1841   3 1834   2 1825
3   11       0 1943 2542  0  0  1  0  0  0  0  0   125 51794  393 446
004414.03-004222.3   1930072  -123257 1700 0 2274  55 2129   6 2072   4 1992   3 1967
9   10       0    0 2509  0  0  1  0  0  0  0  0   125 51794  393 169
004434.08+001903.4   1944649    55434 1877 0 1907   2 1902   1 1905   2 1870   1 1873
6    9       0    0 2652  0  0  1  0  0  0  0  0    94 51794  393 497
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4    8       0    0 2716  0  0  1  0  0  0  0  0    94 51794  393 495
004458.67+004319.9   1962534   126049  350 0 1892   2 1879   2 1847   2 1830   1 1782
2   10       0    0 2334  1  0  1  0  0  0  0  0    94 51794  393 488
004502.64+004403.3   1965419   128153  621 0 1942   3 1900   2 1915   2 1896   2 1894
5   10       0    0 2392  0  0  1  0  0  0  0  0    94 51794  393 489
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8   10       0    0 2593  1  0  1  0  0  0  0  0   125 51794  393 122
004516.00+000042.3   1975132     2051 1548 0 1990   3 1921   1 1888   2 1852   1 1844
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004546.62+001759.0   1997404    52312 1136 0 2030   5 2046   3 2014   2 2014   4 2016
19    9       0 1524 2402  0  0  0  0  1  1  0  0    94 51794  393 515
004613.48+002358.1   2016935    69722 2116 0 1897   2 1871   1 1861   1 1851   1 1835
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5   12       0    0 2572  0  0  1  0  0  1  1  0    94 51794  393 541
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7   11       0    0 2578  0  0  1  0  0  1  1  0   125 51794  393 551
004639.85+000732.1   2036116    21922 2121 0 1914   3 1892   1 1879   2 1866   2 1847
4   10       0    0 2682  0  0  1  0  0  0  0  0   125 51876  394 353
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004705.83-004819.5   2055006  -140574  546 0 1897   3 1896   2 1923   2 1942   2 1968
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4   11       0    0 2706  0  0  1  0  0  1  1  0    94 51794  393 589
004719.17+002807.6   2064705    81822  515 0 1915   3 1877   1 1886   1 1863   2 1848
4   11       0    0 2385  1  0  1  0  0  1  0  0   125 51794  393 585
004732.72+002111.4   2074563    61640 2879 0 2017   5 1868   2 1862   2 1864   2 1849
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3   14     161    0 2783  0  0  1  1  0  1  0  0   125 51876  394 288 UM 278
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5   13      0    0 2726  0  0  1  0  0  0  0  0    94 51794  393  29
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3   12      0    0 2728  0  0  1  0  0  0  0  0   125 51876  394 336
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6   11      0    0 2413  0  0  1  0  0  0  0  0   125 51876  394 397
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3   12      0    0 2688  0  0  1  0  0  1  1  0   125 51876  394 399
004941.12+005623.4   2167933    164032  724 0 1946   3 1914   2 1900   2 1884   2 1862
4   12      0    0 2438  0  0  1  0  0  0  0  0   125 51876  394 367
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5   11      0    0 2481  0  0  1  0  0  1  1  0   125 51876  394 381
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005006.35-005319.3   2186280   -155107 4320 0 2371  73 2198   9 2023   3 1955   3 1950
8   21      0    0 2742  0  0  1  0  0  0  0  0    94 51876  394 256
005008.47+011330.3   2187826    213822 1138 0 1889   2 1893   2 1880   1 1880   2 1886
5   12      0    0 2538  0  0  1  0  0  1  1  0    94 51876  394 408
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4   21      0    0 2640  0  0  1  0  0  1  1  0    94 51876  394 271
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2   13      0    0 2800  0  0  1  0  0  0  0  0   125 51876  394 403
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5   21      0    0 2653  0  0  1  0  0  1  1  0    94 51876  394 236
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3   13   1370    0 2609  0  0  1  1  0  0  0  0    94 51876  394 460 LBQS 0048+0025
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2   12      0    0 2761  0  0  1  0  0  1  1  0   125 51876  394 475 LBQS 0049-0012
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2   14      0    0 2847  0  0  1  0  0  1  0  0   125 51876  394 533 LBQS 0049+0045
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2   20      0    0 2659  0  0  1  0  0  1  1  0   125 51876  394 167 LBQS 0049-0053
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5   17      0    0 2513  0  0  1  0  0  0  0  0   125 51876  394 168
005235.25+010227.9   2294566    181708 1390 0 1869   2 1848   2 1833   2 1821   1 1819
3   13      0    0 2639  0  0  1  0  0  0  0  0   125 51876  394 522
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4   21      0    0 2506  0  0  1  0  0  0  0  0    94 51876  394 134
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2   22      0    0 2625  0  0  1  0  0  0  0  0    94 51876  394  99
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3   13      0    0 2707  0  0  1  0  0  1  1  0    94 51783  395 352 LBQS 0051-0019
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5   13      0    0 2440  0  0  1  0  0  1  1  0    94 51876  394 120
005419.99+002727.9   2370733     79896 2522 0 1959   4 1879   1 1835   1 1818   1 1792
3   13      0    0 2766  0  0  1  0  0  0  0  0   125 51876  394 514
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3   14    308 1258 2522  0  0  1  1  1  0  0  0   125 51876  394 502 LBQS 0052-0015
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005548.84+002939.2   2435348     86261  448 0 1877   2 1865   2 1862   2 1854   2 1835
4   13      0    0 2365  1  0  1  0  0  1  1  0   125 51783  395 347
005629.32+000109.3   2464784      3362 1176 0 1866   2 1865   1 1856   1 1854   2 1861
4   12      0    0 2571  0  0  1  0  0  1  1  0   125 51876  394 628 LBQS 0053-0015
005639.85+005820.3   2472442    169704 1168 0 1974   4 1932   2 1892   2 1886   3 1874
5   14      0    0 2538  0  0  1  0  0  1  1  0   125 51783  395 375
005645.68+004154.2   2476686    121894  818 0 1974   4 1928   3 1910   1 1904   2 1878
4   15      0    0 2445  0  0  1  0  0  1  0  0    94 51783  395 379
005646.81+010452.5   2477508    188719 1990 0 1903   2 1889   2 1880   3 1866   5 1852
4   13      0    0 2669  0  0  1  0  0  1  1  0    94 51783  395 366
005703.39+001408.1   2489561     41122 3036 0 2202  18 2018   2 1982   2 1948   2 1942
10   12      0    0 2674  0  0  1  0  0  0  0  0    94 51783  395 394
005709.49-005450.9   2494001   -159549 1892 0 1909   2 1882   2 1880   2 1862   2 1860
4   16      0    0 2664  0  0  1  0  0  1  0  0    94 51783  395 121
005717.36-000113.3   2499722     -3555 2162 0 1940   2 1909   2 1897   3 1889   2 1873
5   13      0    0 2664  0  0  1  0  0  0  0  0    94 51783  395 432
005717.89+003242.9   2500106     95167  492 0 1862   2 1841   1 1848   2 1820   2 1817
3   14      0    0 2420  0  0  1  0  0  1  1  0   125 51783  395 377
005722.49+010101.8   2503453    177529 1145 0 1972   4 1921   1 1872   1 1858   2 1858
4   13      0    0 2562  0  0  1  0  0  0  0  0   125 51783  395 417
005729.41+011435.3   2508487    216972  693 0 1900   2 1868   2 1869   2 1881   2 1869
5   14      0    0 2432  0  0  1  0  0  1  1  0    94 51783  395 402
005744.19+010929.2   2519231    202132 1213 0 1899   2 1899   2 1866   2 1860   2 1874
5   14      0    0 2572  0  0  1  0  0  0  0  0    94 51783  395 401
005807.90+010551.4   2536479    191573 1062 0 1880   2 1851   3 1818   3 1813   3 1817
3   14      0    0 2591  0  0  1  0  0  1  1  0    94 51783  395 454
005808.09+011215.8   2536613    210210 1001 0 1909   2 1902   3 1882   3 1891   3 1883
5   15      0    0 2501  0  0  1  0  0  1  1  0    94 51783  395 457
005814.31+011530.2   2541137    219631 2497 0 1866   2 1788   3 1773   3 1777   3 1762
2   14      0    0 2806  0  0  1  0  0  1  0  0    94 51783  395 445
005823.86-000415.0   2548080    -12367  934 0 1907   2 1900   2 1889   2 1895   2 1887
5   13      0    0 2481  0  0  1  0  0  1  0  0    94 51783  395 498
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1   15      0    0 2857  0  0  1  0  0  1  1  0    94 51783  395 452 LBQS 0055+0025
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5   14      0    0 2616  0  0  1  0  0  0  0  0   125 51783  395 446
005837.30-003553.7   2557859   -104417 1810 0 1949   3 1944   2 1927   3 1905   2 1893
5   20      0    0 2614  0  0  1  0  0  1  0  0    94 51783  395 148
005855.75+011128.5   2571271    207916 1225 0 1890   2 1877   2 1839   2 1838   1 1850
4   13      0    0 2596  0  0  1  0  0  1  0  0    94 51783  395 443
005905.51+000651.6   2578371     19956  719 0 1781   1 1759   1 1753   1 1755   1 1741
2   14 232498 1345 2566  0  0  1  1  1  1  1  0   125 51783  395 510 LBQS 0056-0009
005921.36+004108.7   2589900    119690  423 0 1941   3 1920   2 1910   2 1893   2 1868
4   13      0    0 2313  1  0  1  0  0  0  0  0    94 51783  395 538
005922.65+000301.4   2590835      8796 4160 0 2377 105 2251  16 1926   2 1918   2 1909
7   13      0    0 2768  0  0  1  0  0  1  0  0   125 51783  395 512 PSS J0059+0003
005930.04+011124.4   2596213    207717 1031 0 1903   3 1876   1 1848   1 1846   1 1833
5   14      0    0 2552  0  0  1  0  0  1  1  0    94 51783  395 529
005947.42-011010.9   2608847   -204154 1126 0 1923   3 1897   1 1866   1 1854   1 1851
4   18      0    0 2564  0  0  1  0  0  1  1  0   125 51783  395  44
010002.31+001642.5   2619676     48606  778 0 1764   1 1734   2 1726   1 1732   2 1715
3   17      0    0 2607  0  0  1  0  0  0  0  0    94 51816  396 359 LBQS 0057+0000
010033.49+002200.2   2642353     64007  753 0 1822   2 1787   1 1791   2 1802   1 1779
3   15   1867    0 2529  0  0  1  1  0  1  1  0    94 51816  396 342
010047.68-003752.2   2652674   -110161  733 0 1968   5 1905   2 1895   2 1863   2 1851
4   17      0    0 2463  0  0  1  0  0  0  0  0   125 51816  396 318
010135.84-005009.1   2687694   -145888 1013 0 1946   2 1921   1 1900   2 1904   2 1884
4   20      0    0 2492  0  0  1  0  0  0  0  0    94 51783  395  62
010203.90-000421.9   2708099    -12699 1105 0 1934   3 1933   2 1906   2 1903   3 1906
6   15      0    0 2510  0  0  1  0  0  1  1  0    94 51816  396 425
010209.03+001822.6   2711830     53460 2290 0 1933   3 1890   1 1879   2 1878   1 1866
6   17      0    0 2688  0  0  1  0  0  1  0  0    94 51816  396 424
010226.32-003904.5   2724403   -113668  294 0 1635   1 1630   2 1622   1 1638   2 1594
1   19      0 1118 2492  0  0  1  0  1  0  0  0   125 51816  396 276 DMS 0059-0055
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2   14      0    0 2757  0  0  1  0  0  0  0  0   125 51783  395 612 LBQS 0059+0035
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4   18      0    0 2629  0  0  1  0  0  1  1  0   125 51816  396 261 DMS 0100.1-0058
010321.76-002401.0   2764720    -69862 1327 0 1922   3 1945   2 1894   1 1895   2 1893
5   19    367    0 2558  0  0  1  1  0  0  0  0   125 51816  396 236
010329.44+004054.9   2770303    119020 1435 0 1892   3 1892   2 1861   2 1848   2 1849
4   19      0    0 2622  0  0  1  0  0  1  0  0    94 51816  396 378
010336.40-005508.7   2775371   -160413 2442 0 2124  10 2017   3 1995   3 1974   3 1922
7   15      0    0 2639  0  0  1  0  0  0  0  0    94 51816  396 297
010342.73+002537.2   2779969     74530  394 0 1774   3 1746   2 1746   1 1735   1 1699
3   12      0    0 2458  0  0  1  0  0  1  1  0   125 51783  395 583 LBQS 0101+0009
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1   18    239    0 2575  0  0  1  1  0  0  0  0   125 51816  396 471
010406.99+011412.9   2797615    215887  312 0 1870   2 1867   1 1841   1 1828   2 1783
2   11      0    0 2312  1  0  1  0  0  0  0  0   125 51816  396 364
010418.72-002517.9   2806141    -73593  808 0 2175  18 2067   3 1994   2 1947   2 1866
2   12      0    0 2402  0  0  1  0  0  0  0  0    94 51816  396 176
010430.58-011430.3   2814766   -216730 1156 0 1846   2 1838   1 1813   2 1820   1 1830
3   25      0    0 2606  0  0  1  0  0  0  0  0   125 51816  396 207 LBQS 0101-0130
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5   17      0    0 2722  0  0  1  0  0  0  0  0   125 51816  396 139 LBQS 0102-0106
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3   13      0    0 2487  0  0  1  0  0  1  0  0   125 51816  396 405 LBQS 0102+0036
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7   19      0    0 2350  0  0  1  0  0  1  1  0   125 51816  396 122
010540.75-003314.0   2865799    -96672 1179 0 2042   6 1929   2 1801   2 1769   1 1741
3   18    459    0 2659  0  0  1  1  0  1  1  0    94 51816  396 130
010603.86+010506.2   2882601    189378 1611 0 1941   4 1903   3 1888   2 1868   1 1874
5   12      0    0 2623  0  0  1  0  0  1  1  0   125 51816  396 452
010612.21+001920.1   2888676     56245 3110 0 2344  63 1924   3 1859   1 1822   2 1822
4   15      0    0 2806  0  0  1  0  0  0  0  0   125 51816  396 553
010614.39+011409.3   2890263    215712 1356 0 1957   5 1946   3 1919   2 1912   2 1918
7   13      0 2494 2543  0  0  1  0  1  0  0  0    94 51816  396 445
010616.05+001523.9   2891472     44793 3050 0 2204  20 2036   3 2008   2 1979   3 1992
15   15      0    0 2645  0  0  1  0  0  0  0  0    94 51816  396 552
010619.24+004823.3   2893792    140760 4430 0 2450  99 2117   4 1906   2 1869   2 1844
4   13      0    0 2729  0  0  1  0  0  0  0  0   125 51816  396 454 BRI 0103+0032
010623.97-010817.5   2897227   -198654 1330 0 1967   4 1950   2 1925   2 1918   2 1923
7   45      0    0 2546  0  1  0  0  0  0  0  0    94 51816  396  52
010629.59+000122.3   2901319      3993 1634 0 1871   3 1851   1 1840   1 1816   1 1812
3   13      0    0 2678  0  0  1  0  0  1  1  0   125 51816  396 543 LBQS 0103-0013
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3   15      0    0 2578  0  0  1  0  0  1  1  0   125 51816  396 506 LBQS 0104+0001
010638.22+004320.6   2907592    126082 1114 0 1887   2 1879   2 1868   2 1870   2 1868
4   15      0    0 2545  0  0  1  0  0  0  0  0    94 51816  396 526
010648.02+004627.8   2914721    135160 1883 0 1839   2 1846   1 1849   1 1823   2 1811
3   15      0    0 2702  0  0  1  0  0  1  1  0   125 51816  396 545 LBQS 0104+0030
010650.95-003611.6   2916852   -105285 1742 0 1951   3 1938   2 1932   2 1906   2 1904
6   25      0    0 2607  0  0  1  0  0  1  1  0    94 51816  396  78
010705.56+000608.8   2927472     17884 1652 0 1921   3 1908   2 1892   2 1889   2 1886
6   15      0    0 2568  0  0  1  0  0  0  0  0   125 51816  396 639
010737.01-001911.6   2950344    -55836  738 0 1875   2 1838   1 1825   1 1823   2 1815
3   19      0    0 2506  0  0  1  0  0  1  1  0   125 51794  397 262 LBQS 0105-0035
010739.80-011042.5   2952373   -205686 1597 0 1959   4 1919   1 1910   2 1891   2 1897
5   31      0    0 2606  0  0  1  0  0  1  0  0   125 51816  396  41
010815.26+000708.5   2978160     20779 2361 0 1941   3 1889   1 1895   2 1865   2 1855
4   15      0    0 2677  0  0  1  0  0  0  0  0   125 51816  396 640
010822.69+001147.9   2983566     34321 3716 0 2345  91 2073   3 1955   4 1949   4 1954
11   17      0    0 2715  0  0  1  0  0  0  0  0   125 51794  397 382
010826.84-003724.2   2986580   -108802 1373 0 1793   2 1766   1 1745   1 1729   2 1720
2   18  88360    0 2731  0  0  1  1  0  1  1  0   125 51794  397 267 UM 305
010828.19+000013.8   2987561       674 1197 0 1891   2 1864   2 1830   1 1822   2 1828
3   17      0    0 2609  0  0  1  0  0  1  1  0    94 51794  397 277
010841.39-001003.1   2997161    -29240 1243 0 1860   2 1858   2 1831   2 1825   2 1831
4   18      0    0 2614  0  0  1  0  0  1  1  0   125 51794  397 276 LBQS 0106-0026
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6   35      0    0 2615  0  0  1  0  0  1  0  0   125 51816  396  14
010855.02-005747.2   3007072   -168097 1673 0 1811   1 1793   2 1780   2 1752   2 1748
2   38      0    0 2738  0  0  1  0  0  1  1  0    94 51794  397 296 LBQS 0106-0113
010858.03+005114.5   3009263    149057 2967 0 2212  19 1995   2 1960   2 1959   3 1961
9   15      0    0 2659  0  0  1  0  0  0  0  0    94 51794  397 333
010915.98+003204.6   3022316    -93311 1773 0 1952   3 1930   4 1927   2 1904   2 1907
6   20      0    0 2630  0  0  1  0  0  0  0  0    94 51794  397 228
010947.42+010750.5   3045182    197344  966 0 1865   2 1852   2 1834   2 1832   3 1832
4   16      0    0 2645  0  0  1  0  0  1  1  0   125 51794  397 529 LBQS 0107+0051
010954.37+003812.9   3050236    111165 1980 0 1878   2 1864   1 1852   2 1844   2 1844
3   13      0    0 2697  0  0  1  1  0  1  1  0   125 51794  397 439 LBQS 0107+0022
010954.86-011246.8   3050590   -211760 1460 0 1883   2 1873   1 1854   1 1839   2 1840
3   30      0    0 2641  0  0  1  0  0  0  0  0    94 51794  397 210 LBQS 0107-0128
011000.65+005500.5   3051151    160017  499 0 1883   2 1844   1 1860   1 1847   1 1848
4   17      0    0 2516  0  0  1  0  0  0  0  0   125 51794  397 374
011024.51-001543.8   3072151    -45761 1750 0 1927   3 1908   2 1896   2 1861   2 1855
4   17      0    0 2658  0  0  1  0  0  1  1  0   125 51794  397 161 LBQS 0107-0031
011033.47+000830.9   3078667     24772  469 0 1926   3 1908   1 1917   2 1896   2 1890
6   12      0    0 2332  0  0  1  0  0  1  0  0   125 51794  397 479 NGC 0450:[GMS97]
068
011037.42-002742.1   3081546    -80581 1428 0 1954   3 1938   2 1885   2 1863   1 1885
5   13      0    0 2603  0  0  1  0  0  1  1  0    94 51816  396  22 NGC 0450:[GMS97]
101
011051.72-003929.0   3091943   -114857 1071 0 1900   2 1890   1 1872   1 1871   2 1878
4   16      0    0 2536  0  0  1  0  0  1  1  0   125 51794  397 248
011056.00+001912.0   3095707     55854  866 0 1877   2 1856   1 1842   1 1832   2 1823
3   13      0    0 2492  0  0  1  0  0  0  0  0    94 51794  397 467
011121.90+011351.3   3113892    214839  806 0 1934   2 1901   2 1897   2 1869   2 1881
5   19      0    0 2451  0  0  1  0  0  1  1  0    94 51794  397 403
011124.42+002647.0   3115725     77911 1004 0 1870   2 1853   1 1831   1 1829   2 1821
3   14      0    0 2563  0  0  1  0  0  1  1  0   125 51794  397 495 NGC 0450:[GMS97]
041
011129.94+003431.3   3119739    100423 1321 0 1904   2 1912   2 1871   2 1871   2 1869
4   15   2198    0 2580  0  0  1  1  0  1  1  0   125 51794  397 482
011200.57-002336.9   3142013    -68697  747 0 2141  14 2017   3 1977   2 1962   2 1927
7   16      0    0 2367  0  0  1  0  0  0  0  0   125 51794  397 141
011227.60-011221.7   3161670   -210495 1755 0 1844   3 1812   1 1798   1 1771   1 1766
2   35      0    0 2747  0  0  1  0  0  1  1  0   125 51794  397 122 LBQS 0109-0128
011237.35+001929.7   3168760     56710 2695 0 2174  15 2016   2 1994   2 1960   2 1933
10   17      0    0 2640  0  1  0  0  0  0  0  0    94 51794  397 513
011240.23-005203.5   3170856   -151436 1897 0 1930   3 1918   2 1915   2 1890   3 1884
5   18      0    0 2638  0  0  1  0  0  1  0  0    94 51794  397  52 LBQS 0110-0107
011251.12+000921.2   3178769     27212 2865 0 2238  36 2013   3 2007   3 1970   3 1945
9   16      0    0 2642  0  0  1  0  0  1  0  0   125 51794  397 510
011254.91+000313.0   3181529      9358  239 0 1761   1 1763   2 1757   1 1728   1 1735
2   16      0 1186 2356  0  1  0  1  0  1  0  0   125 51794  397 512 PB 06317
011301.83+000633.4   3186557     19075 1687 0 1809   1 1796   2 1796   1 1779   1 1782
3   15      0    0 2723  0  0  1  0  0  1  1  0   125 51794  397 514 LBQS 0110-0009
011304.39-003133.2   3192785    -91785  412 0 1933   2 1905   1 1879   2 1847
4   15      0    0 2323  1  0  1  0  0  0  0  0    94 51794  397  62 LBQS 0110-0047
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4  17       0    0 2545  0  0  1  0  0  1  0  0   125 51794  397  88
011339.39-003009.3   3213873    -87719 1004 0 1859   2 1857   2 1843   1 1856   2 1847
5  15       0    0 2537  0  0  1  0  0  1  1  0    94 51794  397  69 NGC 0450:[GMS97]
106
011357.93-011139.8   3227356   -208464  754 0 1916   3 1868   1 1850   1 1840   2 1809
3  38       0    0 2501  0  0  1  0  0  1  0  0   125 51794  397  89
011402.35-004750.9   3230572   -139189  350 0 1882   2 1879   2 1868   2 1861   1 1808
3  18       0    0 2307  1  0  1  0  0  0  0  0   125 51794  397  58 NGC 0450:[GMS97]
129
011411.77+001119.2   3237423     32933 1527 0 1905   2 1855   1 1833   2 1810   1 1815
3  15       0    0 2671  0  0  1  0  0  1  0  0   125 51789  398 303
011417.19-005518.8   3241360   -160904  853 0 1834   1 1817   2 1805   1 1811   1 1800
5  23       0    0 2616  0  0  1  0  0  1  1  0    94 51794  397  44
011418.27+002202.4   3242146     64116 1681 0 1901   2 1882   2 1878   1 1857   1 1858
5  15       0    0 2644  0  0  1  0  0  0  0  0    94 51789  398 353
011420.95-004049.3   3244100   -118746  439 0 1892   3 1861   2 1881   2 1858   1 1826
3  17       0    0 2358  0  0  1  0  0  0  0  0   125 51794  397  60
011522.03-004937.4   3288514   -144352 1276 0 1956   3 1952   2 1910   2 1897   2 1909
6  21       0    0 2549  0  0  1  0  0  1  1  0    94 51789  398 298
011537.72+002028.6   3299926     59566 1281 0 1920   3 1917   1 1893   2 1887   2 1898
7  16       0    0 2558  0  0  1  0  0  0  0  0    94 51789  398 474 NGC 0450:[GMS97]
058
011540.05-003328.7   3301621    -97389 1601 0 1825   2 1786   1 1803   2 1781   1 1784
2  15       0    0 2710  0  0  1  0  0  1  0  0    94 51789  398 270
011615.51-004334.8   3327409   -126770 1282 0 1912   3 1878   2 1855   2 1848   2 1843
4  18       0    0 2597  0  0  1  0  0  1  0  0   125 51794  397   5 NGC 0450:[GMS97]
119
011627.81-001304.3   3336351    -38029  469 0 1919   3 1892   1 1892   2 1876   2 1865
4  16       0 1614 2354  0  0  1  0  1  1  1  0   125 51789  398 233
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4  16       0    0 2604  0  0  1  0  0  0  0  0   125 51789  398 519 NGC 0450:[GMS97]
073
011712.81-005817.5   3369078   -169567  486 0 1878   3 1855   2 1869   1 1856   2 1842
4  18       0    0 2382  0  0  1  0  0  1  0  0    94 51789  398 255
011715.90+003957.4   3371324    116234 1759 0 1950   3 1925   2 1920   2 1893   2 1908
6  16       0    0 2618  0  0  1  0  0  0  0  0    94 51794  397 614
011757.79-010809.9   3401792   -198288  707 0 1918   3 1882   1 1888   1 1894   2 1866
5  23       0 1612 2427  0  0  1  0  1  0  0  0    94 51789  398 245
011758.83+002021.4   3402543     59220  613 0 1884   3 1861   2 1861   2 1844   1 1868
5  17       0 1308 2444  0  0  1  0  1  1  0  0    94 51789  398 548
011817.10-011421.9   3415835   -216321  668 0 1987   5 1952   2 1930   2 1909   2 1906
6  25       0    0 2401  0  0  1  0  0  0  0  0   125 51789  398 125
011824.29-010832.0   3421058   -199356  967 0 1925   3 1914   2 1901   1 1913   2 1902
6  21       0    0 2474  0  0  1  0  0  1  0  0    94 51789  398 220
011827.98-005239.8   3423742   -153194 2100 0 1857   2 1823   2 1814   2 1801   2 1774
3  19       0    0 2757  0  0  1  0  0  1  0  0    94 51789  398 211 UM 314
011847.35+004654.9   3437827    136472 2656 0 1937   2 1900   3 1891   2 1891   2 1887
5  16       0    0 2705  0  0  1  0  0  1  0  0    94 51789  398 555
011855.75-004032.4   3443935   -117926  745 0 1852   2 1836   1 1844   2 1854   2 1848
4  19       0    0 2477  0  0  1  0  0  0  0  0    94 51789  398 166
011906.79-002740.6   3451964    -80511  990 0 1879   3 1871   1 1855   2 1864   2 1849
4  17       0    0 2526  0  0  1  0  0  0  0  0    94 51789  398 149
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4  18       0    0 2618  0  0  1  0  0  1  0  0   125 51789  398 453
011922.85-004419.8   3463647   -128951 1054 0 1860   2 1838   1 1810   1 1798
2  20       0 1578 2595  0  0  1  0  0  0  0  0   125 51789  398  81 NGC 0450:[GMS97]
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2  17       0    0 2707  0  0  1  0  0  1  0  0    94 51789  398 531
011949.28-001542.0   3482864    -45673 1813 0 1950   3 1940   2 1928   1 1894   2 1891
5  17       0    0 2624  0  0  1  0  0  1  0  0    94 51789  398 108
011950.07-001138.9   3483443    -33887 1495 0 1999   4 1912   2 1884   1 1822   2 1819
3  17       0    0 2656  0  0  1  0  0  0  0  0    94 51789  398 110
011959.33+001358.1   3490177     40633 1047 0 1948   3 1925   3 1893   2 1890   2 1887
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3  16       0    0 2622  0  0  1  0  0  1  1  0   125 51789  398  42
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044
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012201.22-003940.5   3578818   -115410 1954 0 1908   3 1900   2 1898   1 1885   2 1870
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076
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012301.79+000323.3   3622862      9858 1365 0 1895   3 1892   2 1856   1 1856   2 1870
5  17       0    0 2603  0  0  1  0  0  0  0  0   125 51817  399 235 NGC 0450:[GMS97]
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020
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012517.14-001828.9   3721295    -53763 2278 0 1907   3 1828   2 1835   1 1823   2 1801
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3  14       0 2619 2692  0  0  1  0  0  1  1  0   125 51817  399 154 NGC 0450:[GMS97]
099
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013306.18-004523.7   4062387   -132053  733 0 2024   6 1944   2 1925   2 1898   2 1874
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NED0
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13   48       0    0 2534  0  0  0  0  0  1  0  0   125 51811  416  98
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6   59       0    0 2622  0  0  0  0  0  1  0  0    94 51811  416 498
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5   82       0    0 2571  0  0  1  0  1  1  0  0   125 51811  416  13
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2   33       0    0 2554  0  0  1  0  0  1  0  0   756 51630  266 294
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5   51       0    0 2588  0  0  1  0  0  1  0  0   756 51630  266 389
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4   30       0    0 2716  0  0  1  0  0  1  0  0   752 51630  266 280
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003803
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5   29      0    0 2509  0  0  1  0  0  1  0  0   752 51941  272 243
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102259.80+010123.5  27183359    178582 1563 0 1939   3 1910   2 1878   2 1835   2 1823
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3   31 102317    0 2769  0  0  1  1  0  1  0  0   756 51941  272  88 [HB89] 1021-006
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002225
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3   32      0    0 2734  0  0  1  0  0  1  0  0   756 51957  273 347 LBQS 1024+0030
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4   30      0    0 2528  0  0  1  0  0  1  0  0   752 51941  272 594 2QZ
J102644.1+000628
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2   28      0    0 2367  0  0  1  0  0  1  0  0   752 51941  272   1
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4   28      0    0 2522  0  0  1  0  0  1  0  0   752 51941  272  77 2QZ
J102720.0+000050
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4   32      0    0 2469  0  0  1  0  0  1  0  0   756 51957  273 335
102742.12+005504.0  27388672    160186 2127 0 1964   4 1923   3 1918   2 1904   2 1894
6   26      0    0 2651  0  0  1  0  0  1  0  0   752 51941  272 609 2QZ
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4   38      0    0 2605  0  0  1  0  0  1  0  0   752 51941  272 622 LBQS 1025+0046
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2   28      0    0 2832  0  0  1  0  0  0  0  0   752 51957  273 291 LBQS 1025-0030
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4   31      0    0 2635  0  0  1  0  0  0  0  0   752 51941  272  21
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2   29      0    0 2302  1  0  1  0  0  0  0  0   752 51957  273 255 LBQS 1026-0032
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3   28      0    0 2657  0  0  1  0  0  1  0  0   756 51957  273 212 2QZ J103013.6-
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2   33      0    0 2775  0  0  1  0  0  0  0  0   752 51957  273  86 LBQS 1030-0050
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4   28      0    0 2446  0  0  1  0  0  1  0  0   756 51913  274 513
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NED0
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3   25      0    0 2705  0  0  1  0  0  1  0  0   752 51910  275 321 [HB89] 1039+012
NED0
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NED0
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NED0
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6   25      0    0 2318  0  0  1  0  0  1  0  0   752 51910  275 236
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105443.14-010701.8  28567506   -194983  522 0 2160  15 2038   3 1988   3 1929   2 1895
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2  22      0    0 2699  0  0  1  0  0  1  0  0   756 51908  277 305
105803.16-005415.2  28712966   -157820 1956 0 1910   2 1898   1 1884   1 1870   2 1855
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1055.6+0055
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3  16      0    0 2685  0  0  1  0  0  1  0  0   752 51908  277 420 [CCH91]
1057.5+0110
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3  16      0    0 2705  0  0  1  0  0  1  0  0   752 51908  277 405 [CCH91]
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4  18      0    0 2671  0  0  1  0  0  1  0  0   752 51900  278 384
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3  24      0    0 2607  0  0  1  0  0  0  0  0   756 51900  278 214
110729.03+004811.1  29124480    140168 1392 0 1784   1 1766   2 1732   1 1719   1 1720
2  21      0    0 2745  0  0  1  0  0  0  0  0   756 51900  278 378
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3  26      0    0 2495  0  0  1  0  0  0  0  0   756 51900  278 270
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110914.13-003600.7  29200913   -104757 2282 0 1978   3 1919   2 1907   2 1901   1 1871
3  19      0    0 2665  0  0  1  0  0  1  0  0   756 51900  278 188
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8  12      0     0 2522  0  0  0  0  0  1  0  0   756 51658  282 609
113923.66+002301.5  30516838     66981  472 0 1749   1 1719   2 1728   1 1717   1 1702
1  10      0     0 2512  0  0  1  0  0  0  0  0   756 51959  283 350 HE 1136+0039
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4   9      0     0 2591  0  0  1  0  0  1  0  0   756 51959  283 286
113943.06+003521.2  30530949    102843  876 0 1825   2 1797   1 1803   1 1813   1 1800
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114001.49+010341.6  30544347    185280 1050 0 1950   2 1919   1 1896   2 1910   2 1924
5  11      0     0 2490  0  0  1  0  0  1  0  0   756 51959  283 330
114016.67+005351.2  30555388    156655 1138 0 1830   2 1799   3 1764   2 1772   3 1785
3  11  10394     0 2645  0  0  1  1  0  0  0  0   752 51959  283 335 LBQS 1137+0110
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4  13      0     0 2451  0  0  1  0  0  1  0  0   756 51658  282  31 2QZ J114023.0-
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114043.67-000126.3  30575025     -4188 1764 0 1867   2 1861   2 1860   1 1836   1 1834
2  14      0     0 2675  0  0  1  0  0  1  0  0   756 51658  282 637 LBQS 1138+0015
114056.80-002329.9  30584575    -68355 3605 0 2335  80 2143   6 1986   3 1958   4 1925
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114100.83-001856.7  30587503    -55110 1535 0 1966   4 1939   2 1905   3 1886   3 1865
5  11      0     0 2595  0  0  1  0  0  1  0  0   752 51959  283 316
114104.35+010526.1  30590059    190343 1689 0 1946   2 1920   2 1909   1 1885   3 1873
4  10      0     0 2615  0  0  1  0  0  1  0  0   756 51959  283 367
114112.29+004759.0  30595837    139579 2893 0 2051   4 1929   1 1914   2 1906   3 1887
4  12      0     0 2706  0  0  1  0  0  0  0  0   756 51959  283 377
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3  11      0     0 2505  0  0  1  0  0  1  0  0   756 51959  283 262
114158.52+004927.0  30629456    143846  463 0 1853   1 1819   2 1804   2 1793   2 1788
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114201.23-004442.1  30631424   -130034 1718 0 2015   6 1965   3 1945   2 1914   2 1895
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3  10      0     0 2735  0  0  1  0  0  1  0  0   756 51959  283 249 LBQS 1139-0037
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114259.30-000156.4  30673656     -5646 1980 0 2009   4 1959   1 1925   2 1898   2 1873
3  12      0     0 2636  0  0  1  0  0  1  0  0   756 51959  283 435
114311.24-002133.0  30682336    -62691 1921 0 1899   2 1900   2 1889   2 1877   3 1859
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J114313.4+002937
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9   10       0    0 2451  0  0  0  0  1  1  0  0   756 51959  283 221
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3   13       0    0 2657  0  0  1  0  0  1  0  0   756 51959  283 476 2QZ
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114534.51-004338.6  30786529   -126958 1748 0 1939   3 1914   3 1916   3 1897   2 1891
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4   14       0    0 2545  0  0  1  0  0  0  0  0   756 51959  283 594 2QZ J114757.7-
000536
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001552
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3   14       0    0 2658  0  0  1  0  0  1  0  0   756 51943  284 323 LBQS 1145+0120
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003929
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000716
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2   11       0    0 2764  0  0  1  0  0  0  0  0   756 51943  284 412 LBQS 1148+0055
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4   12       0    0 2419  0  0  1  0  0  1  0  0   756 51930  285 296
115404.13+001419.5  31157135     41673 1610 0 1903   2 1829   1 1796   2 1781   1 1777
2   11     146    0 2710  0  0  0  1  0  0  0  0   756 51943  284 516 2QZ
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4   19       0    0 2455  0  0  1  0  0  0  0  0   752 51986  294 616 2QZ
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3   19       0    0 2667  0  0  1  0  0  0  0  0   756 51985  295 325
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2   16       0    0 2420  0  0  1  0  0  0  0  0   752 51986  294 625 LBQS 1308+0047
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4   12       0    0 2577  0  0  1  0  0  0  0  0   752 51985  295 269 2QZ J131113.7-
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4   21       0    0 2551  0  0  1  0  0  0  0  0   756 51986  294  34
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5   17       0 2091 2435  0  0  1  0  0  1  0  0   752 51985  295 220
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4   17       0    0 2611  0  0  1  0  0  0  0  0   756 51985  295 570 LBQS 1311+0121
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4   15       0    0 2647  0  0  1  0  0  0  0  0   756 51985  295 577
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3   15       0    0 2642  0  0  1  0  0  1  0  0   756 51985  295 496
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7   14       0    0 2303  0  0  1  0  0  1  0  0   752 51985  295 163
131452.78+011120.2  34683172    207511 1367 0 1894   2 1893   1 1870   1 1870   2 1871
4   17       0    0 2589  0  0  1  0  0  0  0  0   756 51985  295 566
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3   13       0    0 2673  0  0  1  0  0  1  0  0   756 51985  295 506
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4   12       0    0 2636  0  0  1  0  0  0  0  0   752 51985  295 117
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3   16       0    0 2585  0  0  1  0  0  1  0  0   756 51985  295 511
131552.68+000454.3  34726735     14272  734 0 1841   2 1803   1 1820   2 1818   3 1811
3   13       0    0 2507  0  0  1  0  0  0  0  0   752 51985  295 504 LBQS 1313+0020
131558.97+005511.1  34731306    160531 1574 0 1929   3 1906   2 1895   1 1870   3 1866
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3   18       0    0 2619  0  0  1  0  0  1  0  0   752 51985  295 567 LBQS 1313+0111
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2   15     266    0 2767  0  0  1  1  0  1  0  0   752 51985  295 636 LBQS 1313+0107
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2   13     208    0 2569  0  0  0  1  0  1  0  0   752 51985  295  80
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3   13       0    0 2308  0  0  1  0  0  1  0  0   752 51985  295 632
131714.21+010013.0  34786024    175164 2691 0 1990   4 1846   2 1829   2 1812   3 1781
2   16       0    0 2787  0  0  1  0  0  0  1  0   756 51665  296 321 LBQS 1314+0116
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2   12       0    0 2585  0  0  1  0  0  1  0  0   752 51985  295  36 LBQS 1315+0002
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4   15       0    0 2607  0  0  1  0  0  1  0  0   752 51985  295 547
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2   16       0    0 2723  0  0  1  0  0  1  0  0   756 51665  296 401 LBQS 1315+0127
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131908.13+002843.7  34868870     83572 1128 0 1843   2 1844   1 1832   1 1837   3 1849
3   15       0    0 2580  0  0  1  0  0  1  0  0   752 51665  296 398 LBQS 1316+0044
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J131913.9+005252
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2   13 139605    0 2611  0  0  1  1  0  1  0  0   756 51665  296 185 LBQS 1317-0033
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4   17       0    0 2656  0  0  1  0  0  0  0  0   756 51665  296 464
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3   15       0    0 2609  0  0  1  0  0  0  0  0   756 51665  296 465
132018.12+011125.4  34919768    207764  919 0 1926   2 1910   1 1894   1 1909   2 1892
5   16       0    0 2465  0  0  1  0  0  1  0  0   756 51665  296 460 2QZ
J132018.1+011125
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2   11       0 1242 2323  0  0  1  0  1  0  0  0   756 51665  296 184 LBQS 1317-0018
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4   13       0    0 2626  0  0  1  0  0  1  0  0   756 51665  296 495 2QZ
J132033.8+001138
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5   17       0    0 2483  0  0  1  0  0  0  0  0   756 51665  296  98
132037.53+004439.3  34933883    129897 1102 0 1856   2 1846   2 1824   1 1818   1 1824
2   17       0    0 2595  0  0  1  0  0  1  0  0   756 51665  296 457 LBQS 1318+0100
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3   11       0    0 2648  0  0  1  0  0  1  0  0   752 51665  296 166 LBQS 1318-0006
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132138.85+010846.3  34978477    200051 1417 0 1924   2 1908   2 1886   1 1882   2 1877
4   13       0    0 2562  0  0  1  0  0  1  0  0   756 51665  296 527
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2   12       0 1593 2754  0  0  1  0  1  1  0  0   752 51959  297 345 LBQS 1319+0039
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4   11     407    0 2756  0  0  0  1  0  1  0  0   756 51665  296 147
132148.13-003516.9  34985219   -102631 1155 0 1872   2 1866   1 1849   2 1853   2 1868
3   12       0    0 2568  0  0  1  0  0  1  0  0   756 51665  296 110 LBQS 1319-0019
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4   12       0    0 2461  0  0  1  0  0  0  0  0   756 51665  296 511 LBQS 1319+0033
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4   12     104    0 2565  0  0  1  1  0  1  0  0   756 51665  296 524 2QZ
J132214.7+010801
132214.82+005419.0  35004636    158045 2152 0 1877   2 1845   2 1829   2 1823   2 1801
2   12       0    0 2729  0  0  1  0  0  1  0  0   752 51959  297 322 LBQS 1319+0110
132228.49+000235.4  35014571      7536 1599 0 1932   3 1912   2 1909   2 1890   2 1889
4   12       0    0 2600  0  0  1  0  0  1  0  0   752 51959  297 314
132236.00-004912.4  35020033   -143136 1130 0 1866   1 1836   2 1803   2 1792   1 1782
2   15       0    0 2627  0  0  1  0  0  0  0  0   756 51665  296 106 LBQS 1320-0033
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003949
132251.64+004654.7  35031411    136465  521 0 1877   8 1856  17 1875  37 1857  40 1869
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132256.51-005930.2  35034950   -173091 1152 0 1868   2 1863   1 1846   1 1847   1 1859
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2   15     894    0 2731  0  0  1  1  0  0  0  0   756 51665  296  67
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4   12       0    0 2635  0  0  1  0  0  1  0  0   752 51665  296 549 LBQS 1320+0040
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3   14       0    0 2526  0  0  1  0  0  0  0  0   752 51959  297 267 LBQS 1320-0006
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1   12       0    0 2773  0  0  1  0  0  1  0  0   756 51665  296 616 LBQS 1320+0103
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4   16       0    0 2627  0  0  1  0  0  0  0  0   752 51665  296  77
132409.01-004027.0  35087673   -117664 1455 0 1953   3 1934   1 1930   2 1909   2 1915
4   15       0    0 2562  0  0  1  0  0  1  0  0   752 51665  296  35
132417.44-001625.3  35093806    -47773 1329 0 1931   2 1932   2 1901   1 1901   2 1907
4   15       0    0 2551  0  0  1  0  0  0  0  0   752 51959  297 229
132418.76-003055.4  35094767    -89954 1317 0 1966   3 1931   3 1889   1 1887   2 1882
5   15       0    0 2563  0  0  1  0  0  0  0  0   756 51959  297 226
132515.99+003413.8  35136382     99575 1496 0 1955   3 1938   2 1922   2 1906   2 1905
4   13       0    0 2570  0  0  1  0  0  1  0  0   752 51959  297 390
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6   12       0    0 2648  0  0  1  0  0  0  0  0   756 51959  297 164
132706.25-004238.7  35216565   -124049 1702 0 2200  17 2080   3 2030   3 1977   2 1954
6   15       0    0 2527  0  0  1  0  0  0  0  0   752 51959  297  93
132711.13+011009.7  35220113    204094  971 0 1894   2 1885   2 1868   1 1876   2 1855
4   14       0    0 2509  0  0  1  0  0  0  0  0   756 51959  297 524 LBQS 1324+0125
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4   13       0 1645 2413  0  0  1  0  0  1  0  0   752 51959  297 537
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3   14       0    0 2551  0  0  1  0  0  1  0  0   756 51959  297 527 LBQS 1324+0126
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2   13       0    0 2689  0  0  1  0  0  0  0  0   752 51959  297 504
132748.08-001021.8  35246988    -30147  479 0 1934   2 1902   1 1898   1 1871   3 1867
4   12       0    0 2362  0  0  1  0  0  1  0  0   756 51959  297 154 2QZ J132748.1-
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3   14    2434    0 2769  0  0  0  1  0  0  0  0   752 51959  297 520 LBQS 1325+0027
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2   14       0    0 2719  0  0  1  0  0  1  0  0   752 51959  297 573
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3   17       0    0 2426  0  0  1  0  0  1  0  0   752 51959  297  44
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2   13       0    0 2671  0  0  1  0  0  0  0  0   752 51959  297 626 LBQS 1328+0047
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3   13       0    0 2613  0  0  1  0  0  0  0  0   756 51959  297 637 2QZ
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3   15       0    0 2626  0  0  1  0  0  1  0  0   756 51671  299 267 2QZ J133855.0-
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3   15       0    0 2664  0  0  1  0  0  1  0  0   752 51671  299 400 [HB89] 1336+007
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2   15       0    0 2648  0  0  1  0  0  1  0  0   756 51671  299 386 [HB89] 1336+006
NED0
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001452
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5   15       0    0 2531  0  0  1  0  0  1  0  0   752 51671  299 437
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3   13       0    0 2640  0  0  1  0  0  1  0  0   756 51671  299 248
134031.36+001507.6  35802061     44005 1904 0 1860   2 1870   2 1875   1 1850   1 1845
3   15    4659    0 2677  0  0  1  1  0  1  0  0   756 51671  299 427 [HB89] 1337+005
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134059.24-001944.9  35822335    -57447 1857 0 2035   4 2015   2 2004   2 1976   3 1967
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134113.93-005315.0  35833017   -154899  237 0 1764   1 1773   2 1752   1 1709   1 1726
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134154.22+005948.6  35862317    173981 1714 0 1881   2 1881   2 1883   1 1860   2 1856
3   17       0    0 2646  0  0  1  0  0  0  0  0   752 51671  299 446
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134233.70-001148.1  35891030    -34332  516 0 1939   2 1902   2 1914   2 1895   2 1882
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3   15       0    0 2445  0  0  1  0  0  1  0  0   756 51671  299  45 2QZ J134318.4-
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J134323.6+001222
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134427.35-004341.5  35973672   -127097 1454 0 1921   2 1893   1 1882   2 1870   2 1872
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134459.44-001559.5  35997014    -46520  245 0 1771   1 1770   2 1760   3 1745   2 1747
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134526.18+002857.3  36016460     84231  970 0 2057   5 2048   2 2038   2 2068   4 2036
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134655.94+005700.6  36081732    165838 1433 0 1952   2 1942   1 1917   2 1898   2 1891
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134723.09+002158.7  36101475     63934 4270 0 2356  63 2117   3 1934   2 1897   2 1884
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134751.71-001518.4  36122289    -44526  554 0 1815   1 1789   1 1807   1 1798   2 1802
2   14       0    0 2467  0  0  1  0  0  0  0  0   752 51666  300 195 LBQS 1345-0000
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134808.79+003723.2  36134710    108756 3620 0 2401  60 2058   2 1941   1 1934   2 1936
5   15       0    0 2725  0  0  1  0  0  0  1  0   752 51666  300 461
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134813.09-003045.7  36137841    -89485 1210 0 1989   4 1954   1 1908   2 1902   2 1895
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134814.88+010259.7  36139143    183246  471 0 1985   3 1952   1 1904   2 1870   2 1844
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134818.25-002441.9  36141592    -71848  738 0 1909   3 1877   1 1865   1 1854   3 1848
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002442
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001512
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3   16      0    0 2550  0  0  1  0  0  0  0  0   756 51666  300 491
134854.43+002953.4  36167898     86949 1082 0 1914   2 1903   2 1878   1 1881   1 1893
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2   16      0    0 2593  0  0  1  0  0  0  0  0   756 51666  300 173 LBQS 1346+0007
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135121.78+001649.1  36275061     48923 1558 0 1870   2 1850   2 1832   2 1814   1 1811
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3   21      0    0 2577  0  0  1  0  0  0  0  0   752 51666  300 165
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2   20   2610 1408 2830  0  0  0  1  1  0  0   752 51942  301 316 HE 1351+0000
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4   21       0    0 2563  0  0  1  0  0  0  0  0   756 51637  306 117
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143452.74-002828.1  38173800    -82814 2248 0 1924   2 1892   1 1886   2 1885   2 1868
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3   26       0    0 2646  0  0  1  0  0  1  0  0   756 51665  311  36
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4   27       0    0 2577  0  0  1  0  0  1  0  0   756 51665  311 634
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4   26       0    0 2623  0  0  1  0  0  1  0  0   756 51689  312 348
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5   29       0    0 2578  0  0  1  0  0  0  0  0   756 51689  312 307 [HGP92]
151245.6+000
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5   34       0    0 2640  0  0  1  0  0  0  0  0   756 51673  313 632
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4   28       0    0 2592  0  0  1  0  0  1  0  0   756 51641  314 419
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164612.61+641608.4  43904204  11217058 3134 0 2119  11 1924   2 1892   5 1891  10 1885
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4   16      0    0 2617  0  0  1  0  0  0  0  0  1339 51699  349 202
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3   15      0    0 2324  0  0  1  0  0  1  0  0  1336 51699  349 511
165933.75+605834.0  44486808  10642341 1216 0 1917   3 1915   2 1893   2 1891   2 1901
4   11      0    0 2540  0  0  1  0  0  1  0  0  1339 51780  351 274
165946.60+615947.5  44496155  10820438  667 0 1989   4 1937   1 1916   1 1894   2 1887
4   20      0    0 2413  0  0  1  0  0  0  0  0  1339 51780  351 426
165951.98+622758.6  44500066  10902425 1325 0 1936   3 1933   2 1909   2 1900   2 1896
6   20      0    0 2553  0  0  1  0  0  1  0  0  1336 51780  351 409
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170011.20+600341.6  44514044  10482721 2053 0 1972   3 1930   2 1867   2 1805   2 1768
2    9      0 1818 2736  0  0  1  0  0  0  0  0  1336 51703  353 346
170017.84+631923.1  44518877  11051964 1721 0 1821   2 1795   2 1784   6 1754   1 1762
2   23      0    0 2755  0  0  1  0  0  1  0  0  1336 51699  349 147
170023.00+611529.3  44522627  10691564 2727 0 2296  49 2081   3 2026   3 1975   3 1926
6   14      0    0 2626  0  0  1  0  0  0  0  0  1336 51780  351 238
170035.42+632522.7  44531660  11069397 1001 0 1836   2 1819   2 1811   6 1813   2 1815
3   22      0 2420 2582  0  0  1  0  0  0  0  0  1336 51699  349 157
170049.55+643159.3  44541936  11263161 1258 0 1869   2 1879   2 1858   4 1860   2 1869
4   13      0 2167 2579  0  0  1  0  0  1  0  0  1336 51699  349 534
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3    9      0    0 2693  0  0  1  0  0  1  0  0  1339 51703  353 336
170058.07+602135.4  44548127  10534783 3875 0 2464 107 2158   5 1987   2 1969   3 1934
6   10      0    0 2701  0  0  1  0  0  0  0  0  1339 51703  353 330
170058.87+620137.6  44548713  10825774 1197 0 1917   3 1914   1 1888   2 1884   2 1899
5   14      0    0 2545  0  0  1  0  0  1  0  0  1336 51780  351 480
170100.62+641209.0  44549982  11205452 2736 0 1685   2 1610   2 1603   2 1588   1 1577
1   13      0 1931 3013  0  0  0  0  1  1  0  0  1336 51699  349 542 HS 1700+6416
170102.18+612300.8  44551119  10713454 2293 0 1896   2 1835   2 1800   1 1786   2 1772
4   14      0    0 2779  0  0  1  0  0  0  0  0  1339 51780  351 232
170113.94+635243.0  44559672  11148921 1762 0 1796   2 1794   2 1799   2 1777   3 1780
3   12      0 2508 2733  0  0  1  0  0  1  0  0  1339 51699  349 548
170144.61+603300.7  44581970  10568003 1821 0 1861   2 1863   2 1864   1 1835   1 1825
3   10      0    0 2681  0  0  1  0  0  0  0  0  1336 51780  351 203
170151.73+592221.8  44587151  10362495 1174 0 1901   3 1884   1 1868   2 1870   2 1874
4   12      0    0 2554  0  0  1  0  0  1  0  0  1339 51703  353 308
170216.04+592655.7  44604829  10375775 1171 0 1950   3 1942   2 1908   1 1903   2 1898
5   15      0    0 2522  0  0  1  0  0  1  0  0  1336 51703  353 306
170216.09+611232.2  44604865  10682979  582 0 2053   5 1964   2 1933   1 1893   2 1873
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170301.34+610712.7  44637776  10667490  960 0 1814   2 1775   1 1750   1 1749   1 1724
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170306.10+615244.4  44641232  10799926 1912 0 1779   1 1767   1 1763   2 1741   2 1742
2   12      0 2022 2786  0  0  1  0  0  0  0  0  1339 51780  351 489
170335.34+612607.4  44662502  10722501 3575 0 2553  71 2085   3 1985   3 1977   3 1984
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170405.39+590113.5  44684355  10301009 1609 0 1934   2 1922   3 1919   2 1889   2 1885
4   12      0    0 2602  0  0  1  0  0  1  0  0  1336 51703  353 272
170406.14+604753.7  44684896  10611298 1364 0 1855   2 1865   2 1830   1 1820   1 1820
3   12      0 1958 2636  0  0  1  0  0  1  0  0  1339 51703  353 372 CRSS J1704.1+6047
170421.85+624741.5  44696324  10959775 2950 2 2289  35 2074   3 2043   3 1998   4 1969
8   13      0    0 2618  0  0  1  0  0  0  0  0  1339 51699  349   1
170434.02+591203.6  44705172  10332524 1359 0 1936   3 1927   2 1905   2 1897   2 1909
5   17      0    0 2561  0  0  1  0  0  0  0  0  1339 51703  353 273
170438.97+585748.7  44708770  10291080  918 0 1906   2 1866   2 1843   2 1844   1 1838
3   13      0 1653 2529  0  0  1  0  1  0  0  0  1336 51703  353 262
170441.37+604430.4  44710519  10601442  372 0 1566   1 1543   1 1522   1 1516   2 1479
2   12      0  989 2662  0  0  1  0  1  0  0  0  1339 51703  353 377 [HB89] 1704+608
170445.65+634144.2  44713629  11116984 1161 0 1963   3 1923   1 1878   2 1860   2 1854
4   17      0    0 2564  0  0  1  0  0  0  0  0  1339 51699  349 592
170524.09+613246.6  44741587  10741855 2311 0 1926   2 1869   1 1863   1 1860   2 1849
5   16      0    0 2708  0  0  1  0  0  0  0  0  1339 51780  351 518
170533.68+644004.7  44748562  11286692  535 0 1862   2 1824   2 1818   1 1796   1 1803
3   13      0    0 2461  0  0  1  0  0  1  0  0  1356 51699  349 613
170540.87+651211.8  44753785  11380122  889 0 1895   3 1882   2 1870   2 1873   2 1866
4   17      0    0 2494  0  0  1  0  0  1  0  0  1359 51691  350 400
170544.46+580609.4  44756396  10140821 1314 0 1941   3 1935   2 1906   2 1893   3 1885
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4   11      0    0 2591  0  0  1  0  0  0  0  0  1339 51788  355 322
170548.19+601908.3  44759110  10527649  955 0 1885   2 1865   2 1841   1 1842   2 1827
3   11      0 1835 2538  0  0  1  0  0  0  0  0  1339 51780  351  83
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170611.40+610052.9  44775990  10649075 2030 0 1924   1 1905   2 1892   2 1871   2 1871
5   12      0 2588 2650  0  0  1  0  0  0  0  0  1339 51780  351 186
170629.45+602005.7  44789118  10530431 1199 0 1914   2 1917   1 1895   1 1899   2 1917
6   10      0 1903 2529  0  0  1  0  0  0  0  0  1336 51703  353 411
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4   14      0    0 2676  0  0  1  0  0  0  0  0  1339 51780  351 555
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3   13      0    0 2592  0  0  1  0  0  0  0  0  1336 51699  349 603
170700.46+591041.4  44811669  10328534 1833 0 1895   2 1877   2 1875   2 1848   2 1844
3   16      0    0 2672  0  0  1  0  0  1  0  0  1339 51703  353 237
170704.88+644303.2  44814878  11295347 3168 0 2126  17 1852   2 1845   1 1842   1 1828
3   15      0    0 2790  0  0  1  0  0  0  0  0  1359 51691  350 266
170714.49+651059.4  44821870  11376632 2104 0 1893   2 1876   2 1878   2 1867   2 1844
3   17      0 2443 2682  0  0  1  0  0  1  0  0  1359 51691  350 387
170716.59+602431.9  44823394  10543337 1807 0 1960   3 1923   1 1927   2 1901   2 1910
6   11      0    0 2614  0  0  1  0  0  0  0  0  1336 51780  351  96
170720.18+613025.5  44826010  10735015 1744 0 1976   4 1927   2 1935   2 1880   2 1850
4   16      0    0 2629  0  0  1  0  0  1  0  0  1339 51780  351 147
170804.25+595835.3  44858059  10467870 1702 0 1918   2 1904   2 1910   2 1890   2 1898
5   11      0    0 2612  0  0  1  0  0  0  0  0  1336 51703  353 489
170804.90+602202.2  44858532  10536060 4350 0 2343 106 2254  11 2026   3 1977   3 1960
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170819.79+614207.1  44869355  10769029 1354 0 1748   1 1722   1 1686   2 1675   2 1677
2   14      0    0 2780  0  0  1  0  0  1  0  0  1339 51780  351 543 HS 1707+6145
170830.25+610517.6  44876961  10661911 1050 0 1884   2 1861   2 1839   2 1839   2 1828
3   12      0    0 2562  0  0  1  0  0  0  0  0  1336 51780  351 126
170832.20+624205.4  44878382  10943498 1028 0 1925   2 1886   1 1862   3 1862   2 1869
4   13      0 2045 2535  0  0  1  0  0  0  0  0  1336 51694  352 303
170839.83+652137.7  44883930  11407558 1397 0 1851   2 1848   1 1830   1 1825   1 1826
3   14      0 2130 2637  0  0  1  0  0  1  0  0  1359 51691  350 429
170901.04+621227.0  44899353  10857258 1197 0 1946   3 1926   2 1890   2 1886   2 1888
4   12      0    0 2543  0  0  1  0  0  1  0  0  1336 51780  351 569
170903.06+594530.7  44900823  10429832 1708 0 1946   3 1923   3 1900   2 1869   2 1857
4   12      0    0 2634  0  0  1  0  0  0  0  0  1339 51703  353 517
170905.58+581417.8  44902659  10164500  626 0 1914   4 1877   2 1889   2 1858   2 1857
4   12      0    0 2433  0  0  1  0  0  1  0  0  1336 51703  353 207
170911.12+642209.6  44906688  11234572 2038 0 1960   3 1951   2 1915   2 1898   2 1873
5   15      0    0 2643  0  0  1  0  0  0  0  0  1359 51691  350 268
170918.26+622516.1  44911877  10894547 1406 0 1904   2 1898   2 1853   2 1850   3 1860
4   12      0    0 2600  0  0  1  0  0  0  0  0  1339 51780  351 507
170930.80+641002.9  44920998  11199337 1592 0 1857   2 1852   1 1837   2 1806   1 1802
3   13      0 2036 2683  0  0  1  0  0  0  0  0  1359 51691  350 283
170931.00+630357.1  44921143  11007072 2402 0 2023   5 1838   1 1782   1 1731   2 1688
2   14      0    0 2844  0  0  1  0  0  0  0  0  1339 51694  352 311
170933.01+634127.7  44922602  11116186 1270 0 1924   3 1925   2 1898   2 1893   2 1900
5   13      0 2187 2549  0  0  1  0  0  0  0  0  1336 51694  352 249
170937.63+640615.0  44925966  11188291 1119 0 1870   3 1879   1 1860   1 1857   2 1868
4   12      0 2455 2557  0  0  1  0  0  1  0  0  1359 51691  350 447
170951.03+570313.7  44935708  9955177 2547 0 2272  28 2094   4 2035   3 1992   3 1925
6   12      0  221    0 2594  0  0  1  0  0  0  0  0  1336 51788  355 310
170954.33+615817.5  44938112  10816075 1853 0 1968   3 1945   2 1923   2 1896   2 1899
5   12      0    0 2624  0  0  1  0  0  0  0  0  1339 51780  351 582
170956.01+573225.4  44939331  10042695  522 0 1874   2 1835   1 1827   1 1814   2 1814
4   11      0 1549 2437  0  0  1  0  1  0  0  0  1336 51788  355 390
171005.49+644842.9  44946224  11311818 1008 0 1818   1 1802   3 1787   1 1789   1 1779
2   15      0    0 2604  0  0  1  0  0  1  0  0  1359 51691  350 477
171007.50+641240.9  44947688  11206998 1376 0 1816   2 1817   1 1794   2 1780   1 1781
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171007.77+570705.1  44947882  9968989 1034 0 1905   2 1897   1 1878   1 1880   2 1883
4   10      0    0 2517  0  0  1  0  0  1  0  0  1336 51788  355 264
171009.85+642256.7  44949397  11236852  256 0 1946   3 1892   2 1817   1 1781   1 1753
2   16      0 2124 2318  1  0  1  0  0  0  0  1  1359 51691  350 278
171014.53+592326.5  44952795  10365632 4470 0 2327  51 2253  11 2046   3 1964   3 1934
7   11      0    0 2736  0  0  1  0  0  1  0  0  1336 51703  353 177
171015.72+634806.1  44953662  11135501 1786 0 1920   4 1914   1 1916   1 1887   2 1887
5   13      0 2075 2626  0  0  1  0  0  0  0  0  1359 51694  352 385
171017.55+583204.5  44954993  10216212 2344 0 1969   3 1922   2 1908   2 1902   2 1884
5   17      0    0 2669  0  0  1  0  0  1  0  0  1339 51703  353 126
171022.61+640602.9  44958672  11187705 1248 0 1873   3 1856   1 1833   1 1826   1 1827
3   12      0 2721 2612  0  0  1  0  0  1  0  0  1359 51691  350 287
171029.48+590834.8  44963668  10322402  864 0 1862   3 1846   2 1820   1 1827   2 1814
3   11      0    0 2532  0  0  1  0  0  0  0  0  1336 51703  353 178
171030.20+602347.5  44964191  10541186 1553 0 1814   2 1786   2 1761   1 1736   2 1742
2   13      0 1913 2748  0  0  1  0  0  1  0  0  1336 51780  351   4 HS 1709+6027
171041.36+642216.1  44972310  11234887 1282 0 1911   3 1922   2 1907   2 1903   2 1907
5   16      0 2481 2542  0  0  1  0  0  0  0  0  1356 51691  350 225
171048.44+652944.3  44977461  11431147  603 0 1964   3 1913   1 1926   2 1899   2 1884
5   15      0    0 2385  0  0  1  0  0  0  0  0  1359 51691  350 466
171049.89+652102.9  44978511  11405827  385 0 1826   2 1809   2 1797   1 1790   1 1755
2   18      0 2214 2398  1  0  1  0  0  1  0  0  1359 51691  350 467
171054.87+654808.0  44982131  11461388 3746 0 2520 107 2147   6 2006   3 2000   3 1977
10   14      0    0 2665  0  0  1  0  0  0  0  0  1356 51691  350 371
171056.81+622445.4  44983543  10893059 1517 0 1906   4 1950   2 1923   2 1894   2 1915
6   12      0    0 2585  0  0  1  0  0  1  0  0  1336 51694  352 291
171100.93+563336.2  44992358  9871594 1200 0 1938   2 1894   2 1845   1 1831   2 1833
3   13      0    0 2599  0  0  1  0  0  0  0  0  1336 51788  355 279
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3   23      0 1991 2448  0  0  1  0  0  1  0  0  1336 51703  353  88
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171118.80+653011.8  44999539  11432482 1092 0 1911   2 1900   1 1872   2 1873   2 1862
5   13      0 2376 2538  0  0  1  0  0  0  0  0  1356 51691  350 461
171124.23+593121.4  45003482  10388657 1491 0 1971   3 1924   2 1911   2 1876   2 1868
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171126.94+585544.2  45005456  10285044  537 0 1927   4 1894   2 1899   2 1882   3 1881
6   12      0 1939 2370  0  0  1  0  1  0  0  0  1336 51703  353 146
171127.49+641722.4  45005860  11220645  798 0 1919   3 1890   2 1896   2 1902   2 1880
5   15      0 2055 2442  0  0  1  0  0  1  0  0  1359 51691  350 222
171133.48+633602.0  45008027  11100395 1461 0 1946   4 1932   2 1909   2 1893   3 1894
5   15      0 2167 2579  0  0  1  0  0  1  0  0  1359 51694  352 391
171134.41+605240.4  45010888  10625198 3835 0 2172  13 2033   2 1938   1 1932   3 1922
6   12      0    0 2738  0  0  1  0  0  0  0  0  1339 51780  351  12
171143.95+603634.6  45017826  10578374 2121 0 1918   2 1904   1 1903   2 1897   1 1877
4   15      0    0 2651  0  0  1  0  0  0  0  0  1339 51780  351  32
171144.82+584919.6  45018458  10266397 1532 0 1921   2 1915   1 1909   1 1883   2 1868
6   16      0    0 2599  0  0  1  0  0  0  0  0  1336 51703  353 163
171152.55+601318.5  45018990  10510690  981 0 1868   2 1857   1 1840   2 1843   2 1843
4   12      0    0 2544  0  0  1  0  0  1  0  0  1336 51703  353 531
171152.09+571643.4  45023743  9997046 1786 0 1927   3 1930   3 1927   2 1899   2 1891
5   11      0    0 2619  0  0  1  0  0  1  0  0  1336 51788  355 298
171207.44+584754.5  45034910  10262270  269 0 1808   1 1807   2 1799   3 1799   2 1751
2   16      0 1812 2313  0  0  1  0  0  1  0  0  1336 51703  353 408
171212.38+605328.9  45038502  10627549 1689 0 1966   3 1941   2 1917   2 1867   2 1856
3   13      0    0 2634  0  0  1  0  0  0  0  0  1339 51780  351   2
171216.26+660211.7  45041338  11525558  873 0 1903   3 1875   2 1863   2 1877   2 1883
5   17      0 2259 2488  0  0  1  0  0  0  0  0  1359 51691  350 374
171224.92+560624.9  45047621  9792508 4200 0 2412  88 2303  21 2055   3 2002   4 2008
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171227.74+575506.9  45049673  10108701 1597 0 1968   3 1932   2 1916   2 1740   1 1723
4   13      0    0 2880  0  0  1  0  0  1  0  0  1336 51703  355 415 SBS 1711+579
171231.37+562137.5  45052315  9836752 2049 0 1963   3 1947   2 1932   2 1895   2 1866
3   12      0    0 2645  0  0  1  0  0  1  0  0  1336 51788  355 209
171244.12+555949.7  45061584  9773346 1358 0 1888   2 1874   1 1858   2 1853   2 1866
3   11      0    0 2602  0  0  1  0  0  0  0  0  1336 51997  367 345
171249.15+614135.1  45065243  10767477 1713 0 1918   3 1899   2 1897   1 1876   2 1877
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171300.21+612354.4  45073281  10716605 1848 0 1930   2 1918   2 1884   2 1887   2 1889
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171304.63+611945.3  45076497  10703976 1783 0 1930   3 1928   2 1931   3 1901   2 1893
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171304.86+612249.4  45076664  10712900 3154 0 2176  16 1990   2 1965   2 1953   2 1963
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6   19      0    0 2620  0  0  1  0  0  1  0  0  1336 51703  353  44
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233239.27-010726.0  61638681   -196156 1876 0 1967   3 1936   2 1893   2 1857   2 1850
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233438.54+002341.8  61725419     68932 1388 0 1905   2 1904   1 1864   3 1857   2 1866
6   16       0    0 2605  0  0  1  0  0  0  0  0    94 51821  384 503
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233736.43+000950.7  61854785     28642 1136 0 1910   3 1898   2 1883   1 1875   2 1896
7   21       0    0 2546  0  0  1  0  0  0  0  0   125 51877  385 395
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234002.76-005242.0  61961200   -153300 2257 0 1911   2 1869   1 1863   1 1857   2 1836
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234147.27+001551.9  62037199     46150 3950 0 2447 112 2163   6 1998   3 2003   4 1974
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4   13       0    0 2691  0  0  1  0  0  0  0  0   125 51877  385 502
234212.83+011001.7  62055791    203709 1073 0 1944   3 1917   1 1879   2 1880   2 1887
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234242.40+002556.0  62077292     75439 1251 0 1923   2 1916   1 1893   2 1888   2 1888
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0032
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234445.14+002655.6  62166555     78330  524 0 1918   3 1882   1 1890   2 1871   2 1883
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234506.32+010135.5  62181951    179166 1794 0 1939   4 1915   1 1902   2 1870   2 1860
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6   25       0    0 2600  0  0  1  0  0  1  1  0    94 51877  385  32
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3   18       0    0 2715  0  0  1  0  0  0  0  0    94 51788  386 274
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NED0
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235006.26-000933.6  62400077    -27812 1195 0 1867   2 1827   1 1793   2 1789   1 1805
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NED0
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SDSS EDR QUASARS

Simple | Advanced

Get coordinates for: **using resolver:**

(•) SIMBAD ( ) NED

RA (J2000)	**Dec (J2000)**	**Radius (arcmin)**
		10.0

Redshift	**u Mag**	**g Mag**	**r Mag**	**i Mag**	**z Mag**

SEARCH Reset [ ] **Show Query** *Help...*

Output Columns

Mark
Object Name
RA rad
Dec rad
RA (J2000)
Dec (J2000)
Redshift
Source
u Mag
u Mag err

Sort by:

RA (J2000) [ ] **Descending Sort**

Sloan Digital Sky Survey Quasar Catalog

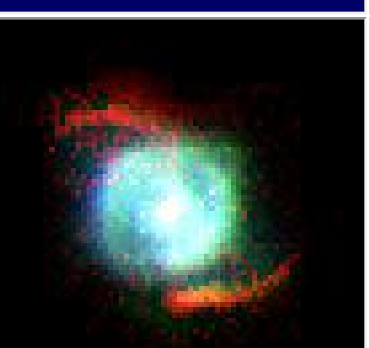
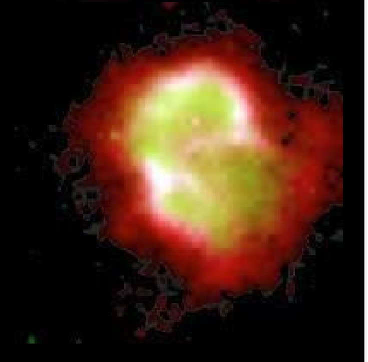
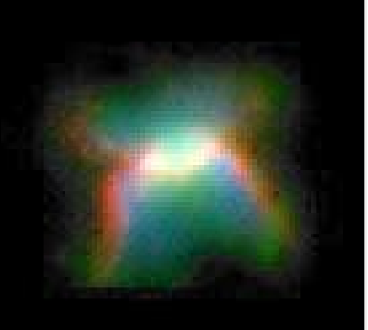
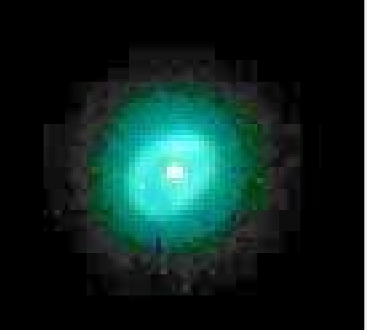
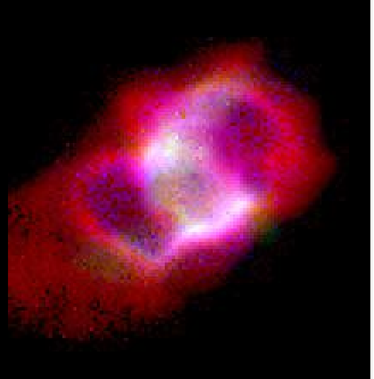
The Sloan Digital Sky Survey Quasar Catalog consists of 3814 objects (3000 discovered by the SDSS) contained in the initial public release. Each object has at least 1 emission line with a full width at half maximum larger than 1000 km/s, luminosities brighter than M(i*)=-23 and highly reliable redshifts. The area covered by the catalog is 494 square degrees; most of the objects were found in SDSS commissioning data using a multicolor selection technique. The quasar redshifts range from 0.15-5.03.

Calibrated spectra of all objects in the catalog, from 3800-9200 Angstroms, are also available in a gzipped tar file.

Notes: the sample is not homogeneous and is not intended for statistical analysis. The lead author is Donald Schneider from the Dept. of Astronomy and Astrophysics at Penn State University (dps@astro.psu.edu). This sample is the preferred quasar catalog for Sloan analysis, and should supercede the quasar catalog in the EDR.

- PostScript file of the paper as submitted to the Astronomical Journal in October 2001. (1.3 Mbytes)
- ASCII Catalog (0.7 Mbytes)
- A gzipped (compressed) tarfile containing a FITS spectrum for each of the 3814 quasars: edrqsosp.tar.gz (WARNING: very large filesize of 245 MBytes, 623 MBytes uncompressed)
- A web-based EDR QUASAR search interface, developed by MAST, allows you to search the EDR Quasar catalog and retrieve individual spectra. A "simple" and an "advanced" interface are both available. This interface is a generic MAST data retrieval interface, under development by MAST. Comments to archive@stsci.edu are welcome.

Magellanic Cloud Planetary Nebulae

Latest observations, results, and highlights

- Scheduling status of Cycle 10 HST programs 9077 and 9120
- Morphology and Evolution of the Large Magellanic Cloud Planetary Nebulae, The Astrophysical Journal, Volume 548, Issue 2, pp. 727-748
- Conference posters: IAU Nov 01, IAP Jun 01, AAS Jan 01 (PDF files)
- Press release on 9 March 2000: CNN, BBC, Spaceflight Now, Science Daily, Space.com

Web site contents

- Observations: our observing programs, and access to calibrated FITS data
- Images: collections of GIF images for easy viewing and comparison
- Analysis: object coordinates, dimensions, fluxes, classifications, and notes
- Papers: published journal articles, conference proceedings and posters
- Links to related web sites: background/educational information, galactic planetary nebulae galleries

The MCPN project team

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Magellanic Cloud Planetary Nebulae

HST observing programs

Click on the program "ID" to see the scheduling status. Click on the observation "Log" for a listing of exposures. See the downloading instructions for access to the corresponding FITS data. This information is from the HST observing programs and data archive webpages.

Type	ID	Log	PI	Title (click to see complete proposal)
GO	9120	Log	Stanghellini	Planetary Nebulae in the LMC: A Study on Stellar Evolution and Populations
SNAP	9077	Log	Shaw	Survey of the LMC Planetary Nebulae
SNAP	8663	Log	Stanghellini	Survey of SMC Planetary Nebulae: Nebular and Stellar Evolution in a Low-Metallicity Environment
SNAP	8702	Log	Shaw	The Most Elusive Nuclei of LMC Planetary Nebulae
SNAP	8271	Log	Stanghellini	A Snapshot Survey of LMC Planetary Nebulae: A Study of Nebular and Late Stellar Evolution
GO	6407	Log	Dopita	Post Asymptotic Giant Branch Evolution in the Magellanic Clouds
GTO	5185	Log	Blades	MAGELLANIC CLOUD PLANETARY NEBULAE: CYCLE 4 (post-COSTAR)
GTO	4821	Log	Blades	MAGELLANIC CLOUD PLANETARY NEBULAE: CYCLE 3 (pre-COSTAR)
GTO	4075	Log	Blades	MAGELLANIC CLOUD PLANETARY NEBULAE: CYCLE 2 (pre-COSTAR)
GTO	1266	Log	Blades	MAGELLANIC CLOUD PLANETARY NEBULAE (pre-COSTAR)

Ground-based observations

- Observing log summary
- ELCAT: Catalog of Relative Emission Line Intensities Observed in Planetary Nebulae

Magellanic Cloud Planetary Nebulae

Image collections

These image collections contain GIF thumbnail representations of the data. Some of these pages may load slowly because they contain many images. The actual FITS data can be accessed via the observations page.

- Large Magellanic Cloud (LMC) gallery
  Thumbnail images of key emission features from STIS slitless spectra for LMC objects from programs 8271, 8702, and 6407: broadband, [O III], H-alpha and [N II]. Also some Stroemgren y images from WFPC2 observations.
- Large Magellanic Cloud (LMC) gallery - latest images*
  Thumbnail images of key emission features from STIS slitless spectra for LMC objects from program 9077: broadband, [O III], H-alpha and [N II].
- LMC morphology sequence
  The Large Magellanic Cloud (LMC) planetary nebulae organized by morphological type.
- LMC color composites
  Color composite images of selected Large Magellanic Cloud (LMC) planetary nebulae, created for press release.
- Small Magellanic Cloud (SMC) gallery*
  Thumbnail images of key emission features from STIS slitless spectra for all of our SMC objects: broadband, [O III], H-alpha and [N II].
- Blades FOC images
  Mostly deconvolved pre-COSTAR images of LMC and SMC planetary nebulae made with the Faint Object Camera (FOC) by Chris Blades. See ApJ 510:687 10 Jan 99.

Magellanic Cloud Planetary Nebulae

Data reduction and analysis

Details on data calibration and the measurements below can be found in ApJ, 548, 727 (Shaw et al., 2001).

- LMC and SMC* notebooks
  Detailed notes for each object.
- LMC and SMC* measurements and classifications
  Basic measurements such as dimensions, coordinates, central star photometry, morphological classifications, and contour plots.
- LMC* and SMC* flux measurements
  Emission line fluxes and ratios for each object, and spectral plots.

Magellanic Cloud Planetary Nebulae

Refereed papers

LMC Planetary Nebula Morphology: Probing Stellar Populations and Evolution
Stanghellini, L., Shaw, R. A., Balick, B., & Blades, J. C. 2000, ApJL, 534, L167

Morphology and Evolution of the LMC Planetary Nebulae
Shaw, R. A., Stanghellini, L., Mutchler, M., Balick, B. & Blades, J. C., 2001, ApJ, 548, 727

Papers in production

The Ionization Structure of LMC Planetary Nebulae (title TBD)

Stanghellini, L., et al. 2001, ApJ, in preparation

Ultra-Compact H II Regions in the SMC Planetary Nebulae

(Target for submission is early summer 2001.)

Morphology and Evolution of the SMC Planetary Nebulae

This will be a basic presentation of the imaging data. (Target for submission is late summer 2001.)

Abundances of LMC Planetary Nebulae (ESO Data, title TBD)

(Target for submission is late summer 2001.)

Conference posters and proceedings

IAP conference poster

Morphology and Evolution of the SMC Planetary Nebulae
Shaw, R. A., Stanghellini, L., Mutchler, M., Blades, J. C., Balick, B., Jacoby, G., DeMarco, O., 2001, BAAS

Morphology and Evolution of the LMC Planetary Nebulae
Shaw, R. A., Stanghellini, L., Mutchler, M., Blades, J. C., & Balick, B. 2000, BAAS, 31, 1538

Planetary Nebulae as Probes of Stellar Evolution and Populations
Stanghellini, L. 2000, in Chemical Evolution of the Milky Way: Stars versus Clusters, eds. F. Giovannelli & F. Matteucci (New York: Kluwer), in press

Magellanic Cloud Planetary Nebulae: A Fresh Look at the Relationship Between Nebular and Stellar Evolution
Stanghellini, L., Shaw, R. A., Blades, J. C., & Balick, B. 2000, in *Asymmetrical Planetary Nebulae II: From Origins to Microstructures*, ASP Conf. Ser., eds. J. H. Kastner, N. Soker & S. Rappaport (San Francisco: ASP) p. 441

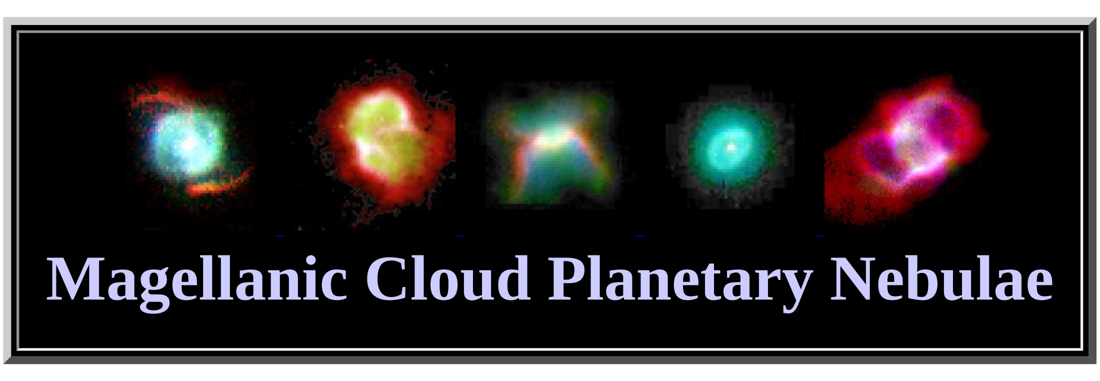
Morphology and Evolution of the SMC Planetary Nebulae
Shaw, R. A., Stanghellini, L., Mutchler, M., Balick, B., Blades, J. C., Jacoby, G.~H., & DeMarco, O.~2000, BAAS, 34, 1400

Magellanic Clouds Planetary Nebulae: an updated view on stellar evolution and populations
Stanghellini, L., Shaw, R. A., & Mutchler, M., 2001, invited review, to be published on the proceedings of the conference "Ionized Gaseous Nebulae", Mexico City, November 21-24, 2000; RMAA, in press.

Magellanic Cloud Planetary Nebulae

Links to related resources

- Galactic PNe images by Hajian & Terzian, and Balick
- About planetary nebulae: SEDS
- About the Magellanic Clouds: LMC & SMC facts, LMC & SMC images; LMC & SMC image by CTIO
- Amazing Space activity for students
- Max's 3-D virtual PN



Planetary nebulae (PNs) are the gaseous relics of the outermost red giant layers, ejected as a superwind after the Asymptotic Giant Branch (AGB) phase. They carry a wealth of information on the evolution of their progenitor stars, and they retain information on the galaxian environment at the time of the formation of their progenitors. In short, they are the ideal probes of stellar evolution and formation of those stars that undergo the AGB phase.

The importance of studying Magellanic Cloud Planetary Nebulae (MCPN) is twofold: it allows the determination of physical parameters of PNs and their central stars, since their distances are known (as opposed to Galactic PN distances, that suffer large uncertainties); and they are the ideal probes of stellar evolution in low-metallicity galaxies. Small Magellanic Cloud PNs are probably the only direct way to study evolved stellar populations in a very low metallicity environment.

Our project is based on Hubble Space Telescope (HST) imaging with STIS and WFPC2, and optical and ultraviolet slitless spectroscopy. Only with HST can Magellanic Cloud PNs be resolved in their sizes and shapes, and their central stars can be detected. Ground based spectroscopic studies have been used to determine the plasma abundance of the nebulae.

Web site contents

- Home: project highlights and current events
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WFPC2 Pointings

Coordinates: Choose either a more traditional search by Target Name/Coordinate, or the serendipitous approach, to search by RA/Dec/Galatic Latitude and/or Ecliptic Latitude ranges. You do not have to search by coordinates at all.

Target Name/Coordinates | Resolver: SIMBAD | Radius (arcmin): 3.0

RA Range ____ degrees **Dec Range** ____ degrees

Galactic Latitude Above & Below Plane > ± ____ degrees

Ecliptic Latitude Above & Below Plane > ± ____ degrees

Band: To search for specific bands, enter the number of exposures required per band (e.g. 4, >1, or <10). Specify if the search is to be for all specified bands (and) or any of the specified bands (or).

(•) And ( ) Or

U	B	V	R	I	Narrow Line

Exposure Times: To query on exposure times, enter exposure limits (in seconds) for the total exposure time in each band (e.g. >1000, or <10). Specify if the search is to be for all specified bands (and) or any of the specified bands (or).

(•) And ( ) Or

U	B	V	R	I	Narrow Line

# of Unique Bands	Total # of Exposures	# of Days between first & last exp.	Min. Total Exposure Time

Submit Query | Reset | Max Number of Pointings displayed: 100 | Help

MAST Pointings Help

Help Index:

Introduction

The MAST "Pointings" interface allows a user to search for WFPC2 exposures in a new powerful way. We have assembled a searchable data table that allows users to look for sky regions (or pointings) which have been observed more than N times, observed with 2 or more filters, or has been observed more than twice with a time separation of more than (or less than) N days. An exposure is defined to be the file created after the shutter closes. (So a CR-SPLIT results in at least 2 exposures.) All exposures within a 40 arcsecond radius are considered one "pointing". The total number of exposures within the U, B, V, R, I and for Narrow Line filters were tallied for each pointing. Included in the table are the total number of exposures for a pointing and the number of unique bands. Each band is defined by 3-4 WFPC2 filters (see Table). Filters not in this table, or exposures made with more than one filter were classified as "other" and were included in the total number of exposures. Note that an individual dataset might cover one or more pointings. The table also lists the date/time of first and last exposure for every pointing.

Because the definition of a "pointing" is a little arbitrary, results from this table should be regarded as a starting point for a continued search and subsequent retrieval request.

An example of the kind of query this table will allow is: How many high galactic latitude observations exist [for RA between 9 - 18 hours in the northern hemisphere (dec > -20) observable from the northern hemisphere in the early spring] where there has been at least two observations, and where at least one of those observations was in the I-band, and at least one of those observations was in any other filter?

Galactic Latitude Above & below plane +/- > 20.0 degrees
Band I >0
Number of Unique Bands >1
Total Number of Exposures >1
RA 09..18
Dec >-20.0

Filter choice for all bands					
U	**B**	**V**	**R**	**I**	**Line**
F300W	F450W	F606W	F702W	F814W	F656N
F336W	F439W	F555W	F675W	F791W	F673N
F255W	F467M	F569W	F622W	F785LP	F502N
F380W	F410M	F547M			F658N

Input Parameters

This section describes the options available

Coordinate Query Options
The first section of the search form contains the various coordinate search options that may be included in the query. Note that the RA/Dec range options may be combined with either the galactic or ecliptic latitude options. Entering a target name or specific coordinates for Target Name/Equatorial Coordinates however, may not be combined with the other coordinate search options.

Target Name/Equatorial Coordinates
Enter the name or the coordinates of the astronomical object of interest.
- If you specify the name to be resolved for the "Coordinates" or "Resolved Target Name" search, use standard nomenclature as utilized by SIMBAD or NED for best results.
- For the "Mission Target Name" search mode only, a "%" can be used as a wildcard and all names are converted to upper-case; e.g., entering "r136%" will return all entries in which the mission object name begins with R136.
- To specify coordinates, enter J2000 RA and DEC as decimal degrees or as hours, minutes, and seconds. Several formats will be recognized as coordinates:
  - decimal degrees e.g. 65.4975 19.535 or 65.4975, +19.535
  - hours minutes seconds e.g. 4 21 59.4, 19 32 6 or 4 21 59.4 19 32 6
  - hours minutes, deg minutes e.g. 4 21 19 32 or 4 21, 19 32

Name Resolver
Select either SIMBAD (the default) or NED for name resolution. If the name is not found within either database, try entering coordinates (J2000) instead of a target name. This parameter applies only to the "Target Name/Coordinates" search option.

Search Radius
Enter the coordinate search radius in arcminutes. The default of 3 arcmin will work for many objects, but a smaller radius may be needed in crowded fields. A larger radius may be needed to locate a large extended object. This parameter applies only to the "Target Name/Coordinates" search option.

RA/DEC Range
Specify a start & end RA and/or DEC in decimal degrees (J2000) using the "x .. y" syntax. For example, to search for all pointings between 10 and 30 degrees, enter: **10 .. 30** . Other possible conditions include: **<, >, <=,** or **>=** .

Galactic Latitude
Search on galactic latitude.
- **Above & Below Plane >:** ± Search above or below the galactic plane using designated latitude. e.g. entering 20 in > box will result in search where galactic latitude > +20 and < -20.
- **Within Plane <** ± Search within the galactic plane the galactic plane using designated latitude. e.g. entering 20 in the box will result in search where galactic latitude < +20 and > -20.
- **>** Search where galactic latitude is greater than number entered: e.g. entering 20 in the box will result in search where galactic latitude > 20
- **<** Search where galactic latitude is less than number entered: e.g. entering 20 in the box will result in search where galactic latitude < 20.

Ecliptic Latitude
Search on ecliptic latitude.
- **Above & Below Plane >** ± Search above or below the ecliptic plane using designated latitude. e.g. entering 20 in > box will result in search where ecliptic latitude > +20 and < -20.
- **Within Plane <** ± Search within the ecliptic plane the ecliptic plane using designated latitude. e.g. entering 20 in the box will result in search where ecliptic latitude < +20 and > -20.
- **>** Search where ecliptic latitude is greater than number entered: e.g. entering 20 in the box will result in search where ecliptic latitude > 20
- **<** Search where ecliptic latitude is less than number entered: e.g. entering 20 in the box will result in search where ecliptic latitude < 20

Band
Specify specific bands for the search. If nothing is entered into any bands, bands are not used for search criteria.

Specify if selection is to be on all bands chosen (and) or on any of the bands chosen.
- **And** Select on all bands designated
- **Or** select on any bands chosen
- **U** Enter the number of U band exposures required (e.g. 2, >=2, <10)
- **B** Enter the number of B band exposures required (e.g. 2, >=2, <10)
- **V** Enter the number of V band exposures required (e.g. 2, >=2, <10)
- **R** Enter the number of R band exposures required (e.g. 2, >=2, <10)
- **I** Enter the number of I band exposures required (e.g. 2, >=2, <10)
- **Line** Enter the number of Narrow band exposures required (e.g. 2, >=2, <10)

The filter numbers in the table refer to wavelength in nanometers.

Filter choice for all bands					
U	**B**	**V**	**R**	**I**	**Line**
F300W	F450W	F606W	F702W	F814W	F656N
F336W	F439W	F555W	F675W	F791W	F673N
F255W	F467M	F569W	F622W	F785LP	F502N
F380W	F410M	F547M			F658N

Exposure Times
Enter exposure limits (in seconds) for the total exposure time in each desired band (e.g. >1000, or <10). You may also specify if the search is to be for all specified bands (and) or any of the specified bands (or). For example, specifying "And" and entering >100 for "U" and >100 for "B" will return pointings for which the total exposure times are > 100 seconds in the U filter and > 100 seconds in the B filter. Specifying "Or" would return all pointings for which the total exposure times are > 100 seconds in the U filter or > 100 seconds in the B filter.

Number of Unique Bands
Enter a restriction for the number of unique filters.

Number of Exposures
Enter the number of for the total number of exposures e.g. <30

Number of Days between first and last exposure
Enter the number of days required between the first and last exposure. Entering >365 will look for pointings with exposures taken at least a year apart.

Submit Query
Click on this button to begin the query. The Pointings Tables will be searched for entries which meet the specified search criteria. The result may be none, one, or

many objects. You may wish to redo the search with a smaller search radius in a crowded field, or using different search criteria.

Reset
Clicking reset will return the form to its default values.

Maximum Number of Pointings Displayed
The maximum number of rows (i.e., pointings) to be displayed on the search results page. Allowed values are 10, 100, 500, 1000, and 5000. The default is 100. Note displaying more rows will increase execution time.

Help
Clicking help will display this help file. If you still have trouble, please e-mail your question to archive@stsci.edu.

Output

The output of your query will include three parts:

- A summary section including a definition of the query used to interrogate the database, and a summary table containing the total number of pointings found, the total number of unique exposures found, etc. (See summary table heading descriptions below.)
- A table of pointing entrees in which each row represents one pointing matching the users search criteria. See descritpion of pointings table below.
- Links in the above two tables allow a third table to be displayed which describes information about the individual exposures contained in the selected pointing or pointings. (See exposures table description below.)

Summary Table

This table summarizes the search results. Note that clicking on the filter entrees in either the Summary table or the Pointings table will display the individual exposures described by the table entry. The summary table column headings are described below.

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page. Currently only information concerning HST/WFPC2 pointings are avaiable in the pointings table.

# of Pointings
Total number of pointings found for a given query, where a pointing is defined as a group of exposures falling within a 40 arcsecond radius.

Exposures
Total number of **unique** exposures for the specified search criteria (i.e., exposures contained in 2 or more pointings are only counted once).

U
Total number of **unique** exposures taken with a U band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "U" column of the pointings search results table).

B
Total number of **unique** exposures taken with a B band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "B" column of the pointings search results table).

V
Total number of **unique** exposures taken with a V band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "V" column of the pointings search results table).

R
Total number of **unique** exposures taken with a R band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "R" column of the pointings search results table).

I
Total number of **unique** exposures taken with a I band filter. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "I" column of the pointings search results table).

Line
Total number of **unique** exposures taken with a Narrow band filter (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "Line" column of the pointings search results table).

Other
Total number of **unique** exposures taken with any filter or filter combination not explicity assigned to a band. (note: since pointings may overlap, this number may be less than the sum of the entrees listed in the "Other" column of the pointings search results table).

Exposure Display Format
Clicking on the filter totals in the summary table will run a script to display the unique exposures for that particular filter and selected search criteria. The default **"retrieval list"** format will display data set names in an html table with options for downloading files. The **"print list"** option displays a comma-separated list of data set names which can be cut and pasted into other data retrieval tools. The **"file list"** option writes the list of data set names (one per line) to a file (dsn.txt) which can be downloaded to the users computer.

Maximum Number of Exposures Displayed
The maximum number of rows (i.e., exposures) to be displayed on the exposure search results page. Allowed values are 50, 100, 500, 1000, and 5000. The default is 100. Note displaying a large number of rows will increase execution time and displaying a large number of buttons may cause some browsers problems.

Found Pointings Table

Each row of the pointings table contains information on the exposures within one pointing. The non-zero "U", "B", "V", "R", "I", "LINE", or "OTHER" filter entries contain two numbers: the total number of exposures taken with a given filter (upper number), and the sum of the exposure times for those exposures in seconds (lower number). Clicking on the upper number will display the exposures table (see below). The pointings table column headings are described below.

Mission/Instrument
The mission and/or instrument from which the data are derived. The table entries will be linked to the appropriate MAST mission home page. Currently only information concerning HST/WFPC2 pointings are avaiable in the pointings table.

RA (2000), Dec (2000)
The right ascension and declination in J2000 epoch as defined for a particular pointing.

Galatic Latitude and Longitude
The galactic latitude and longitude as listed in the pointings table, as calculated from the J2000 ra and dec in the mission catalog.

Ecliptic Latitude and Longitude
The ecliptic latitude and longitude as listed in the pointings table, as calculated from the J2000 ra and dec in the mission catalog.

Angular Separation
When performing equatorial coordinate searches, the angular separation (radius), given in arcminutes, between the SIMBAD (or NED) coordinates and the coordinates listed in the pointings table.

Total
Total number of exposures counted for the pointing.

U
Total number of exposures taken with "U band filters" counted for the pointing.
B
Total number of exposures taken with "B band filters" counted for the pointing.
V
Total number of exposures taken with "V band filters" counted for the pointing.
R
Total number of exposures taken with "R band filters" counted for the pointing.
I
Total number of exposures taken with "I band filters" counted for the pointing.
Other
Total number of exposures taken with any other filter or filter combination for this pointing.
Line
Total number of exposures taken with "Narrow band filters" counted for the pointing.
Unique
Total number of unique bands within this pointing.
First Date
The date of observation the earliest exposure for this pointing was acquired.
Last Date
The date of observation the latest exposure for this pointing was acquired.

Exposures Table

This table lists the individual exposures and data set names associated with the pointings selected from the pointings search results page. Options on the search results page control both the page format (i.e., html table or comma-separated list), and the maximum number of entries displayed. The html table format allows the display of preview images and data retrieval. Column headings are described below.

Row
The row number in the results.

Mark
Mark this dataset for retrieval by pressing this checkbox. After you have marked for retrieval all the datasets that you're interested in, hit the **Retrieve Marked Datasets for Retrieval** button to initiate the retrieval.

Dataset Name
The unique identifier for an HST observation. This value is hyperlinked. By clicking on it, you can display a preview image of the observation.

Target
The name of the target of the observation, as given by the proposer.

PEP ID
The ID number of the observing program. Clicking on an entry in this field will display the HST proposal search page containing the proposal title, PI's name, abstract, ads links to published papers, and a table of all known observations.

Occasionally, you will see target names like `PAR`, `UNKNOWN-TARGET`, and so on; these are (most likely) parallel observations, which are observations done by one instrument while another is making the primary observing of the telescope's visit.

RA
The equatorial right ascension of the instrument aperture, in equinox J2000.

(For the WFPC2, the aperture right ascension coincides with the V1 right ascension, which is the middle of the field of view.)

Dec
The equatorial declination of the instrument aperture, in equinox J2000.

(For the WFPC2, the aperture declination coincides with the V1 declination, which is the middle of the field of view.)

V3 Position Angle
The V3 position angle (PA_V3) is the direction in degrees east from north that the tip of the L shape formed by the 3 WF chips would point, if the L shape is imagined to form the tip of an arrow. (see WFPC2 Position & Orientation). The V3 position angle is 180 degrees different (exactly opposite in direction) rom the U3 position angle, which is specified by the observer during the Phase 2 proposal process as the "ORIENT".

Exposure Time
The exposure time of the observation, in seconds.

Filter
The HST filter used for the observation.

Observation Date
The starting date and time of the observation (GMT).

Release Date
HST data has a nominal proprietary period of one year (though in special cases, this may be shortened or extended). The Release Date field gives the end of the dataset's proprietary period.

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Overview of On-the-Fly Reprocessing

Introduction

The On-The-Fly Reprocessing (OTFR) system reconstructs FITS data files from original telemetry and calibrates data at the time that a user's request for the data is processed. Through this system, users obtain data calibrated with up-to-date reference files, parameters, and software. Only the telemetry files (called POD files) need to be stored for instruments supported by OTFR, although we will still store the initial versions of the raw data files. Since the summer of 2000, the only calibrated STIS and WFPC2 data available has been OTFC STIS and WFPC2 data. The On-The-Fly Reprocessing system, released March, 2001 for STIS and WFPC2 and September 26, 2001 for NICMOS, will eventually provide the calibrated data for all future instruments, including ACS and COS.

An OTFC system was developed for HST data by the CADC/ST-ECF (Crabtree et al 1996).

Advantages of OTFC / OFTR

By deploying OTFC and later OFTR, we only need to store the uncalibrated data (or in the case of OTFR, the original telemetry) in the HST archive. Doing so significantly reduced the volume of data stored in the archive (Hanisch et al 1997). For WFPC2, we achieved a savings in storage space by more than a factor of ten. The raw data occupies less storage and compresses much better than the calibrated data. The storage requirements for the HST archive have rapidly increased with STIS and NICMOS and will become even greater with the Advanced Camera (ACS). The large advantages of OTFC/OTFR for WFPC2 will likely be realized for ACS. We no longer store the original calibrated data for WFPC2 and STIS as of summer 2000.

Another motivation comes from the scientific need to recalibrate data to take advantage of various improvements. A large fraction (over 90%) of the calibrated data in the HST archive could be improved by recalibration, although the improvements are not always significant. In the past, instruments that undergo evolution of calibration files or calibration software often required that users carry out their own recalibrations at their home sites. With OTFR, the STScI carries out the recalibration.

The elements for improved calibrations are listed below.

- Improved calibration files. For example, the ideal dark current reference files for correcting WFPC2 observations are those that are obtained at nearly the same time as the science data. Therefore, the original calibration, using nominal dark reference files, is not optimal. The OTFR system helps solve this problem by permitting users to obtain the calibrated data with the appropriate dark file as soon as it is available. In addition, other types of improved calibration files are sometimes generated that supersede previous calibration files. Such files are used by OTFR soon after they are created.
- Improved parameter values. Improvements to the data can come about as better values for header keyword parameters are determined by the instrument teams. The OTFR system incorporates the improved header structure in a clean way.
- Improved software. Improvements are made to the calibration software (e.g., calwp2 and calstis) to correct problems, improve algorithms, or add new capabilities.
- Handling associations. OTFC had no clean method to handel associations of data files such as those generated for NICMOS or ACS. OTFR will generate associated data products in the indentical process as the OPUS pipeline with no need to invent new tools.

Dataflow

In broad outline, the following steps are carried out.

- A user specifies the desired calibrated datasets through the usual retrieval mechanisms in Starview or the archive Web interface. The user is informed of the initial status by email.
- The relevant POD files are retrieved from the HST archive and passed to the OTFR system.
- The raw FITS files are constructed from the telemetry (POD files).
- The headers are updated with the best values of calibration files, calibration switches, and other parameters.
- The data are calibrated.
- The data are sent back to the HST archive system.
- The HST archive system returns the data to the user.
- The HST archive system sends a final email message about the completion status to the user.

Elements of the OTFR System

- **User interfaces**

  Starview, the user interface to the STScI archive, provides capabilities for requesting OTFR processing (Travisano and Richon 1997). The STScI archive Web interface to the archive may also be used to retrieve OTFR data. StarView currently is the only archive interface which allows the user to review the details of the OTFR changes and reference file updates, by employing the WFPC2 OTFR or STIS OTFR screens.

- **Data Archiving and Distribution System (DADS)**

  DADS, the STScI data archive system, provides raw data to the OTFC pipeline (Travisano and Richon 1997). DADS also sends the newly calibrated and raw data to users. Future versions of DADS will allow users to specify either calibrated or updated raw data alone.

- **Calibration Database System (CDBS)**

  The calibration database system tracks all calibration files used for calibrating HST data (Lubow et al 1997). The system contains a tool called bestref that recommends the calibration files for each existing dataset. These recommendations are updated as new calibration files become available.

- **Calibration Software**

  The calxxx software is used to calibrate the data. It is provided through STSDAS.

- **OPUS**

  To coordinate the processing activities, the OTFC system employs OPUS blackboards (Rose 1998). They allow for parallel processing of tasks distributed over multiple CPUs. The OPUS system operates by means of scripts that transfer the data from the archive system, perform the getref/upref processing, the actual calibration processing, and the return of the data to the HST archive system.

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Instructions for Using On-the-Fly Reprocessing (OTFR)

- OTFR is currently available for WFPC2, NICMOS, and STIS data. In fact, the ***only*** source of calibrated data for these instruments is OTFR.
- Both the Web interface and Starview provide access to OTFR.
  - On the Web interface, you will find the Science Files Requested box on the Retrieval Options screen. To retrieve OTFR calibrated data check Raw and Calibrated data.
  - On Starview, make the request as you normally would. On the Retrieval Request - File Options screen, you will find a check box for Raw and Calibrated data.

    More detailed information about each dataset is found by going to the HST Instrument Searches screen from the Starview Search Menu. From there, select on the OTFR menu option for the appropriate instrument search. The OTFR screen contains some new fields. The date of last software change is the most recent date of installation of new calibration software which will likely have a significant impact on the results of calibration. The date of last action update is the date of the last change of parameters for the dataset that could affect the results of calibration. You can use this information to determine whether there is any benefit in re-requesting a dataset from OTFR. If the dataset you have already obtained from OTFR was processed after both dates, then there is likely to be no significant advantage in requesting the dataset again.

- If your calibrated data request includes instruments which are not supported by OTFR, the system will automatically split your request into two requests - one for OTFR supported instruments (WFPC2, NICMOS, and STIS) and the other for nonOTFR supported instruments. You will receive separate email messages about the status of each request. The OTFR request number is terminated by the character z.

  For mixed OTFR and nonOTFR data in the same calibrated data request,

- All requests for calibrated data currently return both uncalibrated and calibrated data. In a future release, we intend to allow users the option of selecting the type of data that they receive.
- If a requested dataset cannot be calibrated by OTFR, the system attempts to return the uncalibrated data (with any modifications) back to the user.
- If you receive an email response message that says "File not processed", there was likely a temporary hardware problem during the request processing. Please resubmit the request.
- If you encounter a problem, please check the OTFR Web page to see if it has been reported.
- New problems should be reported to archive@stsci.edu

On-the-Fly Reprocessing of HST Data

Welcome to the STScI OTFR WWW site.

Through OTFR, Hubble archive users can obtain data that are processed with the latest calibration files, software, and data parameters. The OTFR system reconstructs the data files with update headers and calibrates data when processing a user's request for the data from the archive. WFPC2, NICMOS, and STIS data can now be retrieved with OTFR system.

The raw data returned to users through OTFR is reconstructed from telemetry files to include updates to data parameters.

The following links provide information for users:

- Description
- Instructions

FAQ Help

Overview

Welcome to the MAST Frequently Asked Question (FAQ) help page. If you don't see an answer to your question, or have suggestions for adding new FAQs, please contact the archive help desk at the e-mail address shown at the bottom right of this page.

The FAQ links on the various mission pages will display all the FAQs specific to that mission. A form shown at the top of the FAQ page however will allow FAQs from other missions and/or specific categories to be displayed. To use the form, simply select the mission and/or category from the menu list and click "GO".

Mission/Category

This entry specifies the mission for which to view FAQs. Note that for some missions, the MAST pages simply link to FAQ pages maintained at remote sites and will therefore have a different appearance and format. This currently applies to FUSE, VLA-FIRST, and ROSAT. MAST FAQs currently exist for the remaining MAST-supported missions. A general FAQ page also exists for MAST itself.

If a category follows the mission name separated by a "/", only the FAQ's for that particular category will be displayed. If only the mission name is selected, all the missions FAQs will be displayed.

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archive@stsci.edu

IUEDAC IDL-Based FITS Routines

This document is intended to provide a description of the options available for reading/writing IUE data with IDL-based IUEDAC (formally IUERDAF) software. This document includes the following sections:

(For a list of acronym definitions click here.)

I. Introduction

A. History

The IUE mission had a long life time, starting from a era before the exchange of astronomical data in FITS format became a standard and extending to times of rapid development of computer power and numerical analysis techniques. Such factors required the development of two data processing packages, the first, IUESIPS, for data reduction following the observations, and NEWSIPS, for final archiving of the data at the close of the mission. The NEWSIPS-generated data products are to be preferred, but MAST will continue also to support analysis of the corresponding IUESIPS data.

The initial writing of IUE data in IUESIPS were done in "GO format," a protocol based on the VICAR file format system (see "Original IUE VICAR Label") used by the instrument development team at RAL and adopted for the IUE project. VICAR data consists of headers written in EBCDIC and binary and data in binary and required VICAR-specific software to read them. IUEDAC programs were written in IDL for convenient reading of archived VICAR files and for manipulating the IUE data arrays in the IDL environment.

Historically, most astronomers used IUEDAC software to read IUESIPS data; a very few users developed their own software). The use of FITS formats in NEWSIPS permitted a wider range of options. For example, several IUE data- reading tasks became available in the European package MIDAS. More recently, the IRAF/STSDAS group has written generalized FITS table-reading tasks which can be used for reading of IUE data as well as a 'iuetools' package which permits the selection of specific extracted arrays from MXLO/MXLO FITS files. The output files can then be read by standard IRAF and STSDAS tasks; see the companion document "reading IUE data files in IRAF/STSDAS."

B. Conversion from GO to RDAF format

One may convert IUESIPS GO files to "RDAF" format (*.lab and *.dat file pairs) by invoking iue IUEDAC routine,'gotordaf'. (Then one can read them by invoking 'iuespec'.)

C. Types of Data Format

The following FITS file types are used for IUE data files: p>

- a Primary Array format for IUE *raw* and *science image* files,
- Image Extension for *error flag* and *cosmic ray* images associated with the image files.
- the Binary Table Extension FITS format for *extracted spectral files* (these files contain a primary header but no primary data array; each table extension contains both a header and data array),

FITS table and image formats have been the basis for developing various programs listed below. Note also that the same file format is assumed for both tape and disk files. Thus, disk files are not separated into separate header and data files.

D. Other Documentation

The reader may wish to consult the following documentation:

- HST Data Handbook, Vol. 1., Chapter 2.2: "FITS File Format". Description of FITS primary, image and table extension arrays, and syntax for use in STSDAS/TABLES tasks.
- IUEDAC User's Guide: Chapter 3
- NEWSIPS Image Processing Manual, Chapter 12: "Final Data Products". Complete description of data file structures and contents.
- Primer on IDL structures.
- Prolog (description, caveats, and detailed examples for IUEDAC programs.
- HEASARC web page pointing to various FITS i/o libraries. This contains many IDL FITS-readers not included in the IUEDAC library.
- Evaluation of various FITS i/o tools in the IDL Astronomy Library. This source lists strengths and drawbacks of each tool considered for specific situations.

II. Caveats

A. Use of IDL for running IUEDAC routines

Because IUEDAC routines are written in IDL, the user must have IDL (licensed by RSI) on his/her computer. IUEDAC routines generally run on IDL versions 3-5 and have been modified to comply with Y2K dates. IUEDAC was written in a Unix environment, but it is also supported in VMS, MS windows, and MacOs.

B. Running the routines in the VMS Operating System

A few comments should be made regarding the use of FITS disk files on VMS computers. First, VMS does not support IEEE floating point format. Although routines are available for converting IEEE format to VMS format, some IEEE special values exist which have no counterpart under VMS. (The typical solution is to run a routine to find the special characters and then prompt the user for a replacement value.) IUEDAC software calls a routine which converts the IEEE special characters to -999.9 (although it may not flag all the allowed special characters). Second, when files are transferred from Unix to vms systems using FTP (using binary mode), the result is usually a 512-byte fixed-length record file. These files must then be either converted to 2880-byte fixed-length record files, or read using RMS block mode which ignores all file attributes. The IUEDAC FITS routines typically use the RMS-block mode for reading FITS files, while the writing routines generate 2880-byte fixed length records.

III. Examples

Examples of how to use the existing IDL routines are included below. With the exception of the IUESIPS-specific reader "extfits.pro" noted below, IDL FITS-reading routines convert the FITS headers into IDL string arrays, and the data into IDL variables. When reading FITS files containing one or more extensions, the user must specify which data is to be extracted. *Be sure that FITS files have been transferred properly! (e.g. by first typing "binary" in the ftp process.)*

A. Reading and Interpreting FITS Files:

1. Displaying contents of FITS files, IUEFHRD.pro To display the format of an unknown FITS file called guess.fit: Write the primary header as "mhead", the first extension header (if it exists) as "exthead", and the starting record number of each header and data section found in a vector called "params":

   ```
   iuefhrd,'guess.fit',params,mhead,exthead
   ```

2. A generalized FITS reader, IFITSRD.pro (see also Section IV)

   a. To read headers and primary array file arr.fit: Store main header in string array "mheader", extension header in "exheader" and primary data array as "arr":

   ```
   IDL>  ifitsrd,'arr.fit',-1,mheader,exheader,arr       ; read primary array
   ```

   b. To read headers and image extension data as eps from same file:

   ```
   IDL>  ifitsrd,'arr.fit',0,mheader,exheader,eps       ; read image extension
   ```

   In general, 'ifitsrd' calls 'iuefhrd', which lists all the parameter fields in the binary table (this may be as many as 20, but is usually less than this). Including even one of the p-fields (e.g. "p1") in the command will resulting in a listing of all these fields. Thus the action of reading the file will give the user the correspondence between the p-fields and the arrays or scalar values they represent.

   c. Reading of data arrays.

   Assume "guess.fit" has a primary array, an image extension and a binary table extension. Write the headers and the first 5 columns from the first 2 rows of the binary table, assuming the binary extension data starts in record 12:

   ```
   IDL>  ifitsrd,'guess.fit',[1,2],mhead,exhead,p1,p2,p3,p4,p5,erec=12
   ```

   Note that one uses "ifitsrd" for either for image (SILO/SIHI) or extracted data files. Because "ifitsrd" is a generalized reader, it addresses arrays by their running row numbers.

3. FITS-reader for NEWSIPS extracted spectral data arrays, READMX.pro "readmx" reads IUE merged extracted spectra (MXLO, MXHI) and returns the primary FITS header, wavelengths and absolute fluxes. The nu flags, net, background, and ripple-corrected fluxes may be optionally returned.

   a. To read a low-dispersion image:

   ```
   IDL> readmx,'swp32525.mxlo',main,wave,flux,flags,sigma,bkgrd,net
   ```

   b. To read the region of a high dispersion spectrum contiaining MgII:

   ```
   IDL> readmx,'lwp12345.mxhi',head,wave,flux,quality,sigma,wrange=[2790,2810]
   ```

   c. To read echelle orders 100--103 of this image:

   ```
   IDL> readmx,'lwp12345.mxhi',h,wave,flux,quality,sigma,orange=[100,103]
   ```

   Notice that because "readmx" is written for IUE data, it recognizes echelle orders or wavelengths rather than row numbers.

B. Writing FITS Files

These routines write FITS files from string arrays (headers) and variables (data arrays) brought into the user's IDL memory buffer by previous read commands. Both IUESIPS= and NEWSIPS-generated data may be written.

1. To generate a FITS primary array file called arr.fit from an IDL variable ARR:

   ```
   IDL>  arr = indgen(3,4,5)         ; IDL variable
   IDL>  keygen,arr,header,in='data'         ; generate FITS keywords
   IDL>  hdugen,header,arr,fname='arr.fit'         ; create primary array file
   ```

2. To append a variable "eps" as an image extension to the above file:

   ```
   IDL>  keygen,eps,epshd,in='data'         ; create header for eps array
   IDL>  imxgen,'arr.fit',epshd,eps         ; append to arr.fit
   ```

3. Writing IDL variables to a binary table extension file with IFITSWRT,pro.

   a. To write W,F,NU, and SIGMA vectors to a FITS binary table file called 'data.fits' (default name) using the string array HDR as the primary array, and defining TTYPE and TUNIT keywords:

   ```
   IDL>  ifitswrt,hdr,w,f,nu,sigma,p1t='wavelength',p1u='angstrom', $

             p2t='flux',p2u='ergs/cm2/sec/A',p3t='quality',p4t='sigmas'
   ```

   b. Write X and Y vectors to a FITS (binary table) file called "gauss.fits" (no header array exists):

   ```
   IDL>  ifitswrt,0,x,y,ofn='gauss.fits'
   ```

   c. Write header, wavelength, flux, and nu vectors as a binary table extension to a FITS file called "data.fits" (default name).

   ```
   IDL>  ifitswrt,hdr,w,f,nu
   ```

4. Writing IUESIPS files in GO format to FITS files

   IDL> gotordaf,`swp12345.mehi1'   ; first convert GO to rdaf-format files
   IDL> extfits,'imaget',1,3   ; here "imaget" is a root name like swp12345hlg.

   The output file will be "swp12345hlg.fits"

IV. Summary of FITS Reading and Writing Routines

A. General FITS Readers:

IFITSRD
- general FITS reader, but written with IUE data in mind. IFITSRD can read primary arrays, binary table extensions, image extensions, and ascii table extension FITS formats. The various data fields are given by a series of "p-arguments" (see Example 2c above), all of which are printed to the screen when the IFITSRD command is given. In general, one may not know what data fields these p-arguments correspond to until they are printed out. Since IFITSRD is a generalized FITS reader, these p's will differ for different types of files and, obviously, for different satellite missions. IFITSRD uses the following routines, which are also general FITS readers designed with IUE files in mind:

IUEFHRD
- reads a FITS primary and extension header. If file format unknown, run this before IFITSRD

IUEARRD
- reads FITS primary array or image extension

IUE3DRD
- reads one row of a FITS table Output is 1-20 fields (IDL variables).

IUE3DROW
- reads 1 row of a FITS table into an IDL structure

IUEATRD
- reads one row of a FITS ASCII table Output is 1-20 fields (IDL variables)

B. FITS Writers

1. General Writers:

   IFITSWRT
   - writes 1 row to a binary table extension using up to 15 input parameters. An input string array header can be specified for creating the primary FITS header. Parameters may be strings, scalars, or vectors or arrays (but currently not variable-length arrays.) Additional rows can be appended to existing binary tables.

3. Writers for IUE data:

   SAVFITS
   - writes IUE data from IDLSAV files to fits files
   IMXGEN
   - Appends input header and data to input FITS file as image extn
   HDUGEN
   - creates FITS primary array file from input IDL data and header
   MXCON
   - converts NEWSIPS MXLOs to IRAF-compatible primary FITS files. (The output file is compatible with IRAF fits readers.)

8. IUESIPS-specific FITS writers:

   IMFITS
   - specific to IUESIPS image files (RI, PI, LBL, FES) Converts images to primary array FITS images. FITS files. Using IMXGEN (see below), epsilon arrays can (optionally) be appended to PI or ELBL files as an image extension.
   EXTFITS
   - specific to IUESIPS extracted files (MELO, MEHI) Converts "lab, dat" files generated by GOTORDAF to FITS files. Output is FITS primary array or binary table extensions. Each row of the binary table denotes data for a spectral order.

9. Miscellaneous Low Level Routines:

   Routines designated with a "*" were originally borrowed from the ASTRON library and were developed by UIT, HRS and others. Most are modified forms of borrowed versions suitable for IUE data.

   ***STPAR**
   - returns the value of a FITS keyword.
   ***ADDPAR**
   - adds or modifies a FITS keyword in an IDL string array.
   ***DELPAR**
   - deletes a keyword from an IDL string array.
   ***FLAGNAN**
   - flags IEEE NaN (not a number) values
   PSTRA
   - write an IDL string array (e.g., a FITS header) into an ASCII disk file for storage or printing.
   IUEFHMOD
   - modifies a keyword in an existing FITS file.
   FITSCON
   - converts FITS binary table data types (i.e. IEEE big-indian format) to formats compatible with the current cpu.
   TRANS_BYTES
   - translates internal data formats between different machine architectures.
   SWAP_BYTES
   - low level routine for swapping bytes.
   FITSLAB
   - converts an IUE VICAR label to FITS keywords as currently planned for the IUE final archive.
   KEYGEN
   - converts the IUE scale factor record to FITS keywords, or generates the required FITS keywords necessary to describe the input data set.
   FDATE
   - converts year and cumulative day to FITS date format.
   ***DATECONV**
   - allows conversion between various date formats, including both old and new FITS date-format conventions.

10. Miscellaneous Text Files:

   The files below are FITS header files which are used by some of the FITS writing routines to create FITS headers: 3DHD1.TXT; 3DHD2.TXT; MAIN_HD.TXT; IMAGE_HD.TXT; 3DMELO.TXT; 3DMELO2.TXT; 3DMEHI.TXT; 3DMEHI2.TXT; BINHD.TXT; GENHD.TXT.

Reading/Writing IUE FITS Data in IRAF/STSDAS

I. Introduction

The original IUESIPS-generated data were archived in the Guest Observer ("GO") format, based on an obsolete version of the VICAR format. This format is not compatible with file readers supported by IRAF and STSDAS, which means that IUE data generated by IUESIPS cannot be read by them unless they are first rewritten to FITS (or ASCII) by an external package. NEWSIPS-generated files were stored as FITS binary files and can be accessed by a variety of FITS readers. However, NEWSIPS-generated files were stored in two different FITS structures, summarized as follows:

- SILO/SIHI, FES, RAW files: Stored as primary data FITS arrays, these may be read by rfits or STSDAS strfits Error-flag and cosmic-ray data are stored as image extensions in the SILO/SIHI files and can be read with ***strfits***.
- Extracted spectral files (MXLO/MXHI): Each order (1 for MXLO, about 60 for MXHI) is stored as a table row (which in turn store either 9 (MXLO) or 17 (MXHI) fields of string, integer, floating point, and vectors). These files may be read in IRAF only with the STSDAS package ***iuetools***, as described in Section III.

II. Additional Documentation

The reader may wish to consult documentation contained in the following sources:

- HST Data Handbook, Vol. 1., Chapter 2.2: "FITS File Format,",
  Description of FITS primary, image & table extension arrays, and syntax for use in STSDAS/TABLES tasks.
- IUEDAC User's Guide, Chapter 3 Working with various file formats.
- NEWSIPS Image Processing Manual, Chapter 12 ("Final Data Products"). Complete description of data file structures and contents.
- Web page pointing to various FITS i/o libraries: http://heasarc.gsfc.nasa.gov/docs/heasarc/fits/fits_libraries.html
- on line help page in ***iuetools*** of IRAF/STSDAS

III. The *iuetools* Package

In order to read MXLO/MXHI files, the user must have ***iuetools*** installed on his/her computer. This first requires IRAF version 2.11, STSDAS (version 2.0), and STSDAS/TABLES.

The ***iuetools*** package contains two tasks:

mxexpand: computes wavelength array from FITS header keywords and writes output file in form suitable for STSDAS and TABLES tasks.

mxtomultispec: extracts spectra in FITS binary tables created by ***mxexpand*** and outputs file in "multispec" (two-dimensional) format. This file can then be used in the ***onedspec*** package of IRAF/NOAO, such as ***splot***.

Notes:

1. Wavelength arrays: wavelengths in the MXLO (MXHI) order(s) are contained implicitly as header keywords, and can be expanded (calculated) into arrays via a linear dispersion relation. This calculation is the primary function of "mxexpand" task. Note that all wavelengths in NEWSIPS- generated data are monotonic as they refer to vacuum wavelengths.

2. Concatenating spectral orders: IRAF/STSDAS does not support scripts to splice MXHI orders. (To do this requires wavelength arrays and a designation of splice points. There are, however, IUEDAC routines which perform this function.) We recommend caution in writing software to merge spectral orders with a constant wavelength spacing since this requires a resampling of fluxes to a new wavelength grid.

3. Alternative to ***iuetools***: If the user does not have ***iuetools*** installed, it is possible to read NEWSIPS MXLO files in IRAF. In that case one would have to first run another program to convert the MXLO table array to a primary array. For example, if IDL is available, one may use the IUEDAC task ***mxcon*** for this FITS-to-FITS file conversion (see http://archive.stsci.edu/iue/iuedacfits.html).

IV. Examples of Use of *iuetools* Package for MXHI Files

1. Reconnoitering your MXHI file, e.g. swp56875.mxhi:

Evaluate the structure of the MXHI/MXLO file (after loading STSDAS & TABLES):

ta> **catfits swp58675.mxhi**
Output:

```
EXT#  FITSNAME       FILENAME   EXTVE DIMEN  BITPI OBJECT
 0    swp56875.mxhi                              8
 1    BINTABLE       MEHI       17Fx60R
```

Note that swp56875.mxhi is a 3-dimensional binary table with 60 rows and 17 fields. Each of these fields may be a scalar or a vector of a fixed length (from IUE image to image) and is described in the NEWSIPS NEWSIPS Image Processing Manual, Chapter 12.9 (or Chapter12.8 for the 9 fields of MXLO files). The length of the wavelength or (various) flux fields is 768. This can be verified by executing 'catfits' with the "long" keyword set to "yes" for the extension file:

ta> **catfits swp58675.mxhi[1] long=yes**

An extensive dump of the fits header is printed out. Keywords of the form TFORMxx, where xx denotes the number for the wavelength or flux fields gives the dimensionality, 768.

2. Using ***mxexpand*** for later work with STSDAS tasks:

a. Convert MXHI file to an expanded FITS table:

   ta> **mxexpand swp58675.mxhi**
   Output: ***Converted file swp56875.mxhi --> swp56875mxhi.fits***

   [Both input and output files are 3-dimensional binary tables.]

b. Evaluate the file produced by ***mxexpand***:

   ta> **catfits swp56875mxhi.fits**
   Output:

```
EXT#  FITSNAME       FILENAME   EXTVE DIMEN  BITPI OBJECT
 0    swp56875mxhi                               8
 1    BINTABLE       MEHI       18Fx60R
```

   [mxexpand has added a field of wavelength vectors; none of the old fields are deleted]

c. Create listing of header to look at column attributes

   To display column names, data type, format, and units, invoke 'tlcol' in TABLES:

   ta> **tlcol swp56875mxhi.fits[1] nlist=4** ,

   or to view labeled structure of table columns, load 'stsdas' and type:

   st> **tread swp56875mxhi.fits**

   To get out of the tread window, type "control-d" and "quit".

d. Having the column names from the last step, now make a simple plot:

   cl> **sgraph "swp56875mxhi.fits[r:order=100] wave_array abs_cal"**

   Note: [ ] syntax shows use of STSDAS selectors for FITS and TABLES files; for help go to http://ra.stsci.edu/bps/ovselector.html. For help on sgraph, click here.

   Alternatively, one can plot scalars among all the orders, e.g. order vs. starting wavelength:

   cl> **sgraph "swp56875mxhi.fits order wavelength"**

3. Use of the ***mxtomultispec*** task:

a. Convert output expanded file from MXEXPAND to multispec (.imh) format:

   ta> **mxtomultispec swp56875mxhi.fits swp56875ms**

   Output: ***The output file - swp56875ms.imh - has been written.***

   Note the result is necessarily an IRAF 2-dimensional image (imh) file. This can be checked with the command:

   cl> **imhead swp56875ms**

   Output:
   swp56875ms[768,60][real]: SWP56875_ABS_CAL6958G_R0001[1/1]

   This file may now be used with your favorite IRAF task, e.g.

   on> **splot swp56875ms[*,30]**

b. Comments:

   Note that the plot resulting from this simple command has defaulted to plotting the former columns wave_array (wavelength) vs. abs_cal (absolute flux) of order 30.

   The user may select an arbitary set of orders for the output file, e.g.

   mxtomultispec "swp56875mxhi.fits[r:order=(82:84,90)]" swp56875msabb selector syntax, including the use of quotes, (), [] symbols.)

   Let's check the structure of the new file:

   cl> **imhead swp56875msabb"**

   Output:
   swp56875msabb[768,4][real]: SWP56875_ABS_CAL6958O_R0036[1/1]

   This result tells us that we have an image containing 768 columns and 4 rows.

Need help with acronyms? Click here

IUE DATA ANALYSIS CENTER USER'S GUIDE

Prepared by the IUEDAC staff
IUE Observatory
Computer Sciences Corporation

Karen Levay
2/9/1998

IUE Target Search
IUE Home
Getting Started
Data Search & Retrieval
Search form
Retrieval form
Search help
Web Retrieval help
FTP Retrieval help
What's New
FAQ
Index of IUE topics
Data Reduction/Analysis
Go to ...
Instrumentation/Operations
Processing Information
Project Publications
Papers
Related Sites
Gallery
Acknowledgments

Contributed Data Analysis Software

- correct_astro.zip - This file contains an IDL program and auxiliary data sets produced by Derck Massa and Ed Fitzpatrick for recalibrating IUE NEWSIPS low dispersion data using HST FOS standards. The software and analysis is described in the paper "A Recalibration of IUE NEWSIPS Low-Dispersion Data", Massa, D., Fitzpatrick, E.L. 2000 ApJS, 126, 517 (2000ApJS..126..517M). Note the IDL program requires routines available from the IDL Astronomy User's Library.

Data Reduction/Analysis

Reading/Writing IUE data in FITS

- IUEDAC Routines for Reading/Writing IUE FITS Files
- IRAF Routines for Reading/Writing IUE FITS Files

Software Packages

- IUEDAC - IUE IDL library
- IUEDAC User's Guide
- Starlink and IUEDR software
- MIDAS data analysis software (for NEWSIPS data)
- IRAF/STSDAS IUE calibration software
- Contributed Software

Operation of a Multi-Year, Multi-Agency Project

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This article originally appeared as a chapter by the same name in *Exploring the Universe with the IUE Satellite* (Y. Kondo, ed., D. Reidel Publishing Company (and appears here with permission of Kluwer Academic Publishers), © 1987), and has been updated for mid-1994 by Jim Caplinger.

1. Operational Concepts

The IUE mission is based on real time control of the satellite and instrument and real time acquisition of the scientific data. Thus both the spacecraft operations staff and the science users must support IUE operations 24 hours per day, every day. Operations are shared between two very similar ground systems, one of which is located in the USA and operated by NASA. The other, provided and operated by ESA, is located in Spain and is used by European observers. According to the Memorandum Of Understanding between the three agencies, NASA has use of IUE for two thirds of the time, and ESA and SERC share equally the remaining third. For the purpose of operations it was decided to divide each day into three shifts of eight hours duration, and it was agreed that the NASA ground system would control the satellite for two shifts, and the ESA ground system for one shift.

The receiving site for NASA's ground system was, until April 1986, located at the Goddard Space Flight Center (GSFC), Greenbelt, Maryland. Subsequently it has been removed to NASA's facility at Wallops Island, Virginia (WPS). NASA's spacecraft and science operations facilities have always been located at GSFC. Commands and received data are now transmitted between GSFC and WPS by a commercial communications satellite link.

NASA has three principal areas of responsibility in operations: first, overall responsibility for monitoring and maintaining the health of the spacecraft; second, providing a backup system for the purpose of spacecraft safety during the shift controlled by ESA's ground station; and third, operating IUE for two 8 hour shifts each day, designated US1 and US2. The spacecraft-related tasks are carried out on a 24 hour per day basis by the GSFC IUE Operations Control Center (IUEOCC). The scientific operations are carried out by the IUE Science Operations Center (IUESOC), also at GSFC, in conjunction with the IUEOCC. The IUESOC comprises a Telescope Operations Control Center (TOCC) from which astronomical observations are controlled during the US1 and US2 operational shifts. An Image Processing Center (IPC), located near GSFC, carries out the standard processing of the IUE data.

All the elements of ESA's ground segment are located at Villafranca del Castillo near Madrid (VILSPA). ESA provides spacecraft control and science operations for one shift, designated VILSPA, and in a second shift the standard data processing is carried out. Because the ESA station has limited backup facilities, e.g. only one computer capable of controlling IUE, GSFC maintains readiness to take control and keep the spacecraft safe in the event of a failure in the VILSPA station.

The operational concept of sharing, internationally, the responsibility for operations was made possible by the choice of a geosynchronous orbit for IUE. Constraints on the orbital parameters arose since continuous viewing of IUE is required from the NASA receiving/transmission site and for at least one shift per day IUE must be in view from VILSPA. To insure reliable communications, IUE must be at least 10° above the local horizon at VILSPA for more than about 10 hours per day, which is the time required for an 8 hour shift, a shift handover of about 30 minutes, and a monthly adjustment by 2 hours in the shift starting time. The latter arises since the orbit is fixed in sidereal time but for the convenience of the operations staff the shift start remains at a fixed Universal Time during each month.

An elliptical geosynchronous orbit was chosen with a period of 23 hours 56 minutes, eccentricity 0.2, inclined at 28° to the equatorial plane and with the ground track initially centered over the Atlantic at about 70° west longitude. With this positioning the VILSPA viewing time usually averages 12 hours. As the orbital plane precesses westward due to natural perturbations the viewing time falls and when the 10 hour minimum is reached an orbit adjustment must be made. A maximum of 15 hours may be achieved at its most easterly position. Partly in consequence of these orbit adjustments, and partly as a result of other natural perturbations the ground track of the orbit has gradually evolved during life of the mission as shown in Figure 1. For example, as of late June 1994, the eccentricity has dropped to 0.13, while the inclination has risen to 35°.

Fig. 1. The IUE Ground Track.

An early project objective was that the IUE system would be an international research facility, available to a wide community of astronomers, and be organized much in the way that many ground based observatories are operated. The operations management plan and the ground system were specifically oriented towards achieving this. IUE has been operational since its launch, 26 January 1978, for over 16 years at the time of writing. It continues to provide excellent facilities to the scientific community. It can be unequivocally stated that all scientific objectives of the mission have been met or exceeded. The mission's success was made possible not only by the outstanding performance of the spacecraft and its scientific instrumentation, but also by the excellent cooperation of the technical and scientific staff of the participating agencies. These achievements have been widely acknowledged in the general scientific community as being unique in space exploration.

2. The IUE System

The operation of IUE, like any complex scientific satellite, involves many systems. The space segment includes the spacecraft and the payload systems. The ground segment includes: the ground station which transmits commands and receives telemetry; the operations control center, housing the ground control computers used by the controllers to analyze the telemetry and issue appropriate commands; the science operations center; the data reduction system; and a communications system to link the parts together. Descriptions of some aspects of the system may be found in Boggess *et al.* 1978 and Boggess and Wilson 1987. To prepare the reader for the discussion of operations that follows, this section summarizes the main characteristics of these systems and details are given of relevant systems not adequately covered elsewhere.

2.1 The Spacecraft

The sole purpose of the spacecraft is to support the Scientific Instrument (S/I) in achieving the scientific objectives for the mission. These objectives give rise to the basic performance requirements for the spacecraft. First the satellite should be able to point the telescope anywhere within the celestial sphere except within 45° of the Sun. Second the Attitude Control System (ACS) should on command move the telescope to a new target with a slew rate of $4.5° min^{-1} axis^{-1}$ and guarantee that, at the end of the maneuver, the desired target star falls into the 16 arc minute field of view of the Fine Error Sensor (FES), a unit which performs the dual functions of star field mapping and guide star tracking.

Three-axis stabilization of IUE was initially accomplished by an Inertial Reference Assembly (IRA) composed of 6 gas bearing single-degree-of-freedom gyroscopes operated with pulse rebalance electronics. The ACS was designed to hold a 1 arc second diameter star image within a 3 arc second entrance aperture to permit an integrated exposure of at least 1 hour by the spectrograph camera. Now, under the two-gyro/Fine Sun Sensor (FSS) control system, the FSS is also used as a sensor for spacecraft control. The ACS uses the outputs of the attitude control sensors (gyros, FES, and/or FSS) as inputs to the control program in the On Board Computer (OBC). The OBC then controls the spacecraft attitude and slews by changing the rotation speed of the pitch, yaw, and roll momentum wheels.

The primary power for IUE is derived from the two solar cell arrays which are shown in the general layout, Figure 2. The power output is a function of the angle between the Sun and the satellite pointing direction (+x axis). The supplement of this angle is designated Beta. In normal operations the satellite is rolled about the x-axis to keep the Sun close to the x-z plane. Thus the single angle Beta is useful to define the approximate orientation of the satellite with respect to the Sun, and will be so used here.

Fig. 2. IUE Configuration.

Central to the spacecraft control are the command system and the data multiplexer unit (DMU). The Command Decoder receives the commands, checks for errors, and then routes valid commands or OBC data block loads to the correct subsystem. The DMU samples the performance data from the spacecraft subsystems and generates two telemetry streams: one is dedicated to the OBC and its control of the spacecraft; the other is the ground telemetry stream, which includes both the science data and the spacecraft `housekeeping' data. The OBC also uses the ground telemetry stream.

The final key spacecraft element is the communications system, which warrants description in some detail. Two wavebands, S-band and VHF, are used for communication between IUE and the ground. The normal data telemetry link from IUE to the ground receiving site is by S-band (2249.8 MHz). This telemetry can be transmitted at several different bit rates: 40, 20, 10, 5, 2.5 and 1.25 kilobits per second (kbs). There is a convolved, half rate, data mode used to increase accuracy. (The 40 and 2.5 kbs telemetry rates are not used operationally because there is either a timing conflict in the generation by the DMU of the separate ground and telemetry data streams, or the OBC has a timing conflict in reading the two data streams.) There are two telemetry streams, one special for the OBC and the other a ground telemetry stream that is also read and used by the OBC. The dedicated OBC telemetry rate is normally held at 20 kbs for smooth spacecraft control. The telemetry rates are selected by the operations controller. Both spacecraft housekeeping data and science data come down in this S-band telemetry. There are four S-band power amplifier/antenna combinations distributed around the spacecraft, only one of which can be switched on at a time. Two are at the bottom on the sun- and the anti-sun-side respectively, and two are on the satellite upper body in similar locations. As a result, no matter what the attitude orientation relative to a ground station, there is at least one S-band antenna that can be used. There are two VHF transmitters (for redundancy) that operate at 136.86 MHz for the transmission of satellite data. A VHF transmitter is used during range and range-rate operations to determine IUE's location and also under conditions when S-band is not available, such as: spacecraft to ground S-band data link problems; during eclipses because it uses less power than the S-band; and during spacecraft emergency operations. The maximum data rate of the VHF system is 5 kbs. There are two VHF command receivers (148.98 MHz) and decoders for redundancy on board IUE. The command bit rate is 0.8 kbs. All operations and control are achieved through this command system.

2.2. The Ground System

The IUE ground system serves two general functions: controlling (commanding) the spacecraft operations and payload utilization; and receiving and processing telemetry, both science data and spacecraft housekeeping data. Science data processing is also carried out by the IUE computers and various ancillary systems. On account of the separation of the control center at GSFC from the command and receiving site at WPS, a complex communications network is used when operating IUE from GSFC. The ESA facility at VILSPA is very similar functionally but simpler partly because it is all situated at one site.

At GSFC the command of IUE is initiated either in the TOCC, or in the IUEOCC. VILSPA also divides control between a main control room and the observatory room. Operations of an observatory-type satellite are very complex and are achieved for IUE by calling up a set of pre-coded and extensively tested procedures, each carrying out a particular sequence of operations, such as camera preparation, exposure and reading. The procedures are run on the control centers' computers and can check the status of the satellite via the telemetry before selecting the appropriate command and issuing it at the appropriate time. A medium level and user-tolerant language known as Control Center Interactive Language (CCIL) was developed which is used by the operations staff to develop new procedures to meet the requirements of the guest observers (GOs).

The overall ground system is designed in such a way as to resemble functionally the operations of a modern ground-based telescope. A Resident Astronomer (RA) provides the necessary support to the GO. The Experiment Display System (EDS), which consists of an interactive control keyboard and display terminal, is operated by a Telescope Operator (TO), usually working in the TOCC. These personnel, the RA and the TO, possess the required knowledge of spacecraft maneuvering, target acquisition, and S/I operations needed to advise the GO how to carry out critical operations in an efficient way. They also actually carry out the operations, since the GO is not permitted to use the control functions of the EDS console. The EDS provides the observer with all the information needed to plan maneuvers, identify the target, and verify the quality of the spectral image and carry out a `quick-look' analysis of it.

3. Normal Operations

Normal operations are described below in an ordered sequence, commencing with proposal selection and the preparations made prior to the observing shift by a guest observer who has been allocated observing time, and followed by shift handover and normal spacecraft operations. Next, instrument operations are described in the form of the sequence for a typical observation. Finally, calibration observations and routine data reduction are considered.

3.1 Proposal Selection and Observation Planning

The proposals received by the deadline towards the end of each year are reviewed by panels of peers. In the USA, the panels report to NASA Headquarters which makes the final approval of shift allocations. In Europe, ESA and SERC at first allocated their shares separately, but following an agreement reached in 1981, a single joint allocation committee (of peers) selects the proposals and determines the shift allocation. Allocations for collaborative proposals which require both US and VILSPA time are negotiated between the three agencies. An annual schedule commencing in July is prepared from the selected programs, and these form IUE's observing years or observing episodes as they are known in the USA. The detailed schedule for a given month, however, is usually prepared only a month or two in advance to give observers as much time as possible to incorporate their research into their observing plans and change their plans as needed.

Once a GO is granted observing time with IUE, usually in the form of a number of 8 hour shifts, all targets specified in his or her proposal will be checked against Sun, Earth, Moon, spacecraft power, and thermal constraints in order to investigate target availability throughout the year. This information, combined with any time-dependent requirements specified by the GO, is used by the two ground stations to construct the schedules that assign GOs to specific shifts. In due time the GOs are contacted to carry out their observations. On arrival for his or her observing shifts the GO makes final preparations with the aid of an observatory RA, who checks the overall plan for the shift, in order to confirm the feasibility of the proposed observations, prepare any special procedures required, and establish whether suitable finder charts are available for star identification, etc.

If the GO already has some observing experience with IUE and the RA approves, the GO may carry out the observations in either a `remote' or `service' observing mode, in which case he or she does not need to be present at the ground station for the observations. In both cases, the TOCC staff keep in contact with the GO either by phone or over the computer networks as needed. Remote observers receive the raw data over the network and can display it using software similar to that used by the TOs to carry out their quick-look analysis, although they do not have the observatory's software to carry out the data reduction. (They may well have their own software to carry out the reduction themselves, however.) Service observers are not interested in looking at the raw data, and so do not need to have any special software.

3.2 Shift Handover and Spacecraft Operations

In the case of a transatlantic handover, the station assuming control will already be monitoring the spacecraft's telemetry and displaying its status when, about 30 minutes before handover is due, verbal contact is made between the control centers and details are passed to enable detailed planning of operations to commence. Handover itself is marked by the relinquishing station sending a command to change a telemetry bit that then indicates the other station has control.

Routine spacecraft operations include: maintaining communications with the spacecraft, principally by switching S-band antennas and sometimes adjusting the data rate; monitoring all spacecraft housekeeping data against given safety or operational limits for each system, carrying out corrective action when necessary, e.g. slewing to a power positive attitude to prevent excessive battery discharge; planning and execution of maneuvers ensuring pointing constraints will not be violated; correction of gyro drift using information from the FES; dumping of angular momentum by means of the hydrazine jets when the speed of a momentum wheel is too high; and recording processed telemetry data and its analysis for spacecraft trends. In addition, many of the problems described in Section 5, and the testing of new operating procedures give rise to new routine operational requirements. Finally, the operations team must always be prepared, in the event of an emergency, to take immediate action to insure spacecraft safety pending a more detailed analysis by the relevant experts.

3.3 A Typical Observation

The sequence of operations for a typical observation is as follows. The coördinates of the desired target are entered into the ground computer's maneuver generator which offers the operator the choice of several different maneuver sequences to reach the target. The operator selects one, configures the spacecraft appropriately and sends the maneuver command. On completion of the slew to the new target, the field of the FES is transmitted to the ground and displayed on the EDS, the target is identified by the observer, and IUE is moved to place the target in the required spectrograph entrance aperture. Next it is confirmed that the S/I is in the required observing mode. Then, assuming that the camera has already been prepared, an exposure may be started. During the exposure a camera in the other spectrograph can have its image read out, transmitted to ground and it can then be prepared for the next observation. At the end of the exposure the observer can choose to read out the image immediately, or, alternatively, he or she can commence the next operation without seeing the image and arrange for it to be read out later during an exposure with the other spectrograph or even during the slew to the next target. (This last option is not usually recommended as contamination of the image data frequently results.) The observer, with the help of a skilled RA to advise, can get the maximum from an 8 hour shift by planning carefully the sequence of targets in order to minimize slewing time, and also by performing camera preparation and readout during other operations if possible. This is especially important when the observer requires short exposures on several targets. Although a shift is planned in advance, many decisions have to be made on the spot. For example, there is in general no attempt made to coördinate the attitude at handover from one station (or observer) to the next, so the observer's choice of the first target in a shift is often made only 30 minutes before shift handover when the expected spacecraft position becomes known. (This lack of coördination allows the greatest possible flexibility in scheduling shifts among different observers, since otherwise a change in one observer's schedule would adversely affect the schedules of several other observers.)

The commands to generate these operations are transmitted from the ground by running procedures in the ground station's computer with appropriate parameters. The options available are described in more detail below.

3.3.1. Target Identification and Acquisition

Located at the focal plane of the telescope, the FES, in its mapping mode, provides an image of a 16 arc minute field of stars down to V = 14 mag. This has a dual role. First it serves a spacecraft function; identification of a star with known celestial position which can be used to update the ACS to remove the errors in position introduced by a slew. Second it serves the astronomical function of a finder field in which, if bright enough, the target star can be identified and moved to the appropriate entrance aperture of the spectrograph. For fainter targets a blind offset can be made from a brighter nearby object using offset coördinates prepared in advance from Schmidt sky survey or astrographic plates. The FES has an additional function during exposure since it can be used in a tracking mode to follow a field star and provide a fine guidance signal. This is essential for long exposures to avoid movement of the target star from the spectrograph aperture as a result of gyro drift or thermally induced flexure of the telescope tube. The operations of the FES are controlled by using the appropriate procedure. All this is done by the observatory staff. The only related responsibility of the observer, but an essential one, is to provide a finder map at an appropriate scale, usually reproduced from Schmidt sky survey plates, and to identify the target. Both stations also have software that allows them to display fields based on the

Hubble Guide Star Catalog, which, since the whole sky is instantly accessible in this manner, has substantially increased operational efficiency.

3.3.2 Telescope Focus

The temperature of the structure of the telescope tube determines the separation of the primary and secondary mirrors and thus affects the focus of the telescope. It is possible to use a mechanism to refocus but this was only used for the initial adjustment in orbit. Thereafter the mechanism has not been used because it is not redundant and any failure in an out-of-focus position would reduce the quality of the data. Instead, the operators keep the telescope in focus by thermal control, achieved by switching heaters on and off at the back of the primary mirror and on the camera deck, following procedures established during the commissioning phase.

3.3.3 Spectrograph Modes

The spectrograph is configured for the observation mainly by operating mechanisms, of which the principal ones, duplicated in each spectrograph, are the high/low dispersion selection mirror, the shutter for the large entrance aperture, and the prime/redundant camera select mirror. Special procedures are used for taking wavelength calibration images, which operate the sun shutter to move a prism reflecting the calibration lamp into the apertures, and for taking flat field images from the UV flood lamps, which require special sequences to insure they strike and warm up reliably.

3.3.4 Camera Operations

Camera operations are normally made very simple through use of CCIL procedures which carry out complex sequences involving 8 electrode voltages, scanning sequences, and checking for anomalous conditions that could lead to loss of image data or, worse, damage to a camera. For example, a single procedure call can carry out a timed exposure. Another carries out a read of the image, transmitting it to the ground computer, then automatically prepares the TV tube's SEC target by erasing the residuals from the previous image and establishing the correct bias voltage on the target for optimum performance on the next astronomical exposure.

As the target is read out the data are transmitted immediately to the ground and, shortly after completion of the whole read, a copy of the resulting image is transmitted from the control center computer to the EDS in the TOCC. There it can be examined by the observer using simple image processing facilities. The most important aspect of such examination is usually an assessment of the level of the exposure. Due to the restricted dynamic range of the SEC vidicon and the wide range of intensities present in many spectra, a repeat observation with a different exposure time may sometimes be necessary. Within 15 minutes of the termination of an exposure the observer can make a decision on the subsequent program based on a quick evaluation of the image. This time is not always wasted, since an exposure in another mode may have already been initiated on the same target, or, when it is clear that a repeat is unlikely, a new target slewed to and another observation started. In camera operations, as in planning of slewing, an efficient observer can optimize the scientific return from an 8 hour shift.

3.4. Calibration Observations

The RAs perform routine observations for the calibration of IUE. Regular images of the wavelength calibration lamp are used in the data reduction process to define the wavelength scale. The camera flat fields are monitored and occasionally some shifts are devoted to acquiring a set of images of the UV flood lamp in order to construct a new Intensity Transfer Function (ITF). The observation of a set of standard stars is regularly carried out to provide data for the absolute calibration of the fluxes measured by IUE and to monitor changes in the overall system sensitivity (see Harris and Sonneborn 1987). Other calibrations, e.g. FES photometric calibration, can be carried out using the data acquired during the GO programs. These astronomical calibrations, spacecraft engineering calibrations, and testing of new procedures are carried out during specific maintenance shifts which amount to about 8% of all the available shifts.

3.5 Data Reduction

The IUE Spectral Image processing System (IUESIPS) is used to reduce the data acquired into products that are usable by the GO and are suitable for archiving for future use by other interested astronomers. The input to IUESIPS is the raw image data that results from the initial stage of image reconstitution performed on the incoming telemetry by the computer supporting operations. The prime scientific purpose of IUESIPS is to produce data that are as free as possible from instrumental effects. This is accomplished by image processing staff using a VAX workstation and associated peripherals. The processing operations include: an implicit compensation for geometric distortion of the camera system; photometric correction of the images using pixel-by-pixel ITFs; fitting of the spectral orders to a spectral format template and extraction of the spectrum; application of intensity calibrations derived from observations of standard stars; and various optional procedures. The principal data product that is delivered to the GO and transmitted to the archives, is a magnetic tape containing the raw data image and the various stages of reduction to a calibrated spectrum.

Each ground station has to keep up with the continuing daily flow of raw data images without incurring an ever-increasing backlog. The goal is to give the GO a data tape within 24 hours of the observations, prior to departure for his or her home institution. For GSFC IUESIPS runs on a VAX workstation which receives the image data via an archive tape from the commanding ground computer. At VILSPA there is only one computer for both operations and data reduction, so the latter is carried out during the US shifts following the VILSPA observing shift.

Over the many years of the mission, various aspects of the IUESIPS reduction have been changed to take advantage of new algorithms or to calibrate changing properties in the detectors. An unfortunate consequence is that a spectrum taken early in the mission cannot be directly compared with a recent spectrum of the same target, unless both have been specifically processed using the same routines. To remedy this problem, and to make the data more readily available to the astronomical community, the staffs at both GSFC and VILSPA have undertaken to develop a data reduction system, NEWSIPS (NEW Spectral Image Processing System), which uses new algorithms and re-derived calibrations to process the voluminous data taken by IUE. All images will be processed with the same routines to create a `Final Archive' of IUE data, making direct comparisons easier for observations of the same target. Among the many additional benefits of the Final Archive are a reduction in the noise level present in many spectra, an error estimate for each extracted point in the spectrum, and more accurate relative and absolute calibrations. As of mid-1994, the algorithms for high dispersion spectra are nearing completion, while those for low dispersion are complete and are being used to process the archival SWP spectra.

4. Spacecraft Operational Constraints

Constraints have to be placed on IUE operations for a number of reasons. Many of these result in restrictions, often contradictory, on pointing. Since these generally have a significant impact on the user, they are explained in detail below. Numerous others exist mostly directed towards maximizing the useful life of IUE's subsystems, either by minimizing wear, or by avoiding risky situations. Some constraints are programed into the ground computers so that they cannot be inadvertently violated by ground station personnel.

4.1. Sun, Earth and Moon Constraints

The only celestial body that IUE is absolutely forbidden to view is the Sun, which would damage the detectors and the mirror coatings, and heat the focal plane. There is a sun shutter which should automatically close if sunlight enters the telescope tube, but it is only intended as a `last ditch' safety device in the event of a failure elsewhere. In fact, IUE is not designed to operate closer than 45° to the Sun (Beta = 135°), beyond which sunlight would enter directly into the sun shield. Prior to the failure of the fourth gyro (see Section 5.1) it was permissible to go to Beta = 0°, i.e., the anti-sun direction, but with the two-gyro/FSS system, Beta > 28° must be maintained so that the FSS can play its role in controlling the satellite.

IUE can be, and has been, pointed at the Earth and the Moon, but as far as normal operations are concerned these bodies are considered to form constrained zones as they obscure a part of the celestial sphere. Furthermore they produce a high background in the FES due to scattered light within about 10° of the sunlit limb. Unlike the Sun constraint these are not hard coded into the maneuver generator and so may be overridden.

4.2. Eclipses

One unavoidable constraint arising from the choice of orbit is that IUE experiences twice yearly seasons of solar eclipses caused by the Earth. This season of intermittent Earth shadow lasts from some 23 to 26 days, and during each season a daily eclipse occurs that varies from a few minutes partial eclipse up to 80 minutes total eclipse. During total eclipses the solar cells deliver no power and so IUE must operate from its batteries alone. To prevent excessive discharge of the batteries, operational constraints are imposed which restrict the collection of scientific data. There are adjustments to the shift times to share the burden of lost time between GSFC and VILSPA and to minimize the overall inconvenience. The annual shadow seasons are designated Winter and Summer, which occur during January/February and July/August respectively. The Summer eclipses are longer and deeper. While the first objective during eclipse is to maintain command and housekeeping telemetry contact, it has to be done in the least power-consuming manner possible. There are a set of flight operations directives (FODs) for use during eclipses which define various satellite configurations that progressively consume less power. These are employed as required to insure that the maximum planned depth of discharge of the batteries is not exceeded, but always keeping in view the goal of minimizing attitude disorientation, so that recovery time for science operations at the end of the eclipse is minimized. One power conservation measure that is adopted is to switch the telemetry downlink to VHF during deep shadow since VHF uses less power than S-band. Plans for shadow operations are made using predictions provided to the IUEOCC by the Flight Dynamics Group at GSFC. In addition to solar eclipses caused by the Earth, the Moon also eclipses the Sun. However these tend to be brief, partial eclipses and early in the mission did not require spacecraft reconfiguration. The two-gyro/FSS uses the Sun as one input to the control system, so all eclipses now require special spacecraft control configurations which use only the FES and gyros.

4.3. Spacecraft Power

Figure 3 shows how the solar array power output has changed with time due to the degradation of the solar cells in their radiation environment; such degradation was, of course, anticipated and its effects planned for. To insure long battery life it is essential that IUE is at a power positive attitude for nearly all the time, except for the unavoidable eclipses described above. At launch, the IUE power requirements were about 180 W, but at the time of writing with the two-gyro/FSS mode of operation in use (see Section 5.1), the requirement is between 131 W and 154 W, depending on the nature of the operations taking place. In February 1994, the power positive region was in the range 40° < Beta < 101° for the higher power requirement, while the range was 28° < Beta < 122° for the lower power level. These regions are narrower in August when the Earth is at aphelion.

Fig. 3. Solar Array Output.

Although the batteries can be used to supplement the solar cell power and support operations over a wider range of Beta, this is minimized to prolong battery life and conserve their capacity for the more critical eclipse seasons. An FOD limits the number of times IUE may be used in a power-negative or power-neutral situation in any one year and the duration of any one such session. There are also constraints on the magnitude of current drain and other related operational parameters.

4.4. Radiation

The principal source of radiation affecting IUE is the Earth's out trapped electron belt. Compared to a circular geosynchronous orbit which would lie on the upper side of this belt, IUE's elliptical orbit dips into a region of higher electron flux at perigee. Towards apogee, however, there is a large portion of the orbit where the radiation is substantially less. Based on calculations of the expected radiation, the sensitive elements of the IUE systems were provided with shielding to the maximum extent possible within weight and design constraints (see Boggess and Wilson 1987). At a late stage, because of concern about radiation levels, a particle detector was added to IUE. In April 1991, this detector began to fail, and the staff at GSFC developed an alternate method in which the electron flux levels measured by the weather satellite GOES 8 are analyzed to determine the approximate radiation level around IUE. This voltage is monitored on the ground and at the predefined safety limit of 3.6 V the operating cameras are switched to the standby mode. This limit is only occasionally reached, and at this radiation intensity the background induced in the camera precludes useful exposures, even short ones. The orbit is such that the radiation principally affects the US2 shift which is consequently mainly scheduled for programs with short exposures and for maintenance. In addition to camera background, the radiation was expected to adversely effect some of the electronics and possibly the magnesium fluoride camera faceplates by the end of the three year design life. Recently, accumulated radiation damage to the DMU has restricted operations to temperatures below 26.2°C. This limit is usually avoided by insuring that the OBC remains below its own temperature limits (see below.)

4.5. Temperature

It is essential to keep the temperature of the various IUE components and subsystems controlled within certain limits. To monitor these temperatures, there are thermistors located in critical areas; their output is delivered to the telemetry via a subcommutator. In the IUEOCC, the thermistor outputs are converted to temperatures for display on the monitors. Preset limits are built into the computer system, and these cause the temperature displays to flash or blink when the limit is reached. The limits are set so that the operating analysts are warned that the parameter is outside its normal range. Usually no immediate action is required at a blink limit; however, if the `redline' limit, an absolute value set by the design engineers, is exceeded then corrective action must be taken. The OBC and DMU are cases in point. Since their temperatures are affected by the sun angle, Beta, and also by the Earth-Sun distance, there is a thermal constraint on Beta that is most restricting at perihelion. Presently there is no limit on science operations if the OBC is below 54.6°C or if the DMU is below 26.2°C; but if the temperature stabilizes at one of these values then IUE must be maneuvered outside the range 40° < Beta < 105° within one hour in order to cool off. There are also special circumstances, e.g. prior to performing an orbit adjustment, when it is expeditious to cool the OBC before taking a particular action, even though it may be below the blink limit. There are some 90 telemetered temperature points that are subject to blink or redline constraints covering such components as batteries, gyros, electronics, propulsion systems, solar arrays, etc.

4.6. Momentum Wheel Speed

An FOD covers the control of the momentum wheels to provide smooth spacecraft control and to prevent excessive wear of the bearings. At the start of the mission the wheel speeds were normally kept between 250 and 1000 rpm in either direction. The wheel speeds are permitted to run through zero or to saturate during maneuvers. When the combination of gyros 1, 3, and 5 was no longer available for emergency attitude recovery, the momentum stored in the wheels had to be reduced so that they could always bring IUE to a safe hold attitude using the analog Sunbath mode. At that time the wheel speed for normal operations was changed to 200 to 500 rpm for roll and yaw and 200 to 1000 rpm for pitch. To date there have been no mechanical problems with the momentum wheels, and even if one of the orthogonally oriented ones should fail there is a spare that could contribute to any of the three axes.

5. Problem Areas

The problems that have occurred with IUE can generally be divided into two categories, those arising in spacecraft systems and those in ground facilities. With regard to the latter, most are related to an aging hardware system and operational software shortcomings which continue to be found throughout the lifetime of the program. However, the ground system problems, hardware or software, can be and are dealt with, although often at the expense of considerable effort. We will not dwell here on these ground system problems, for they are for the most part those common to any complex computer system. Although retrieval and repair of failed spacecraft has been demonstrated, this is very costly and can at present only be done for a low Earth orbit case. Until the development of robot repair missions, any anomaly occurring aboard the IUE spacecraft must be dealt with by changes to the commands transmitted to the satellite or by adopting workaround procedures or by switching to redundant subsystems.

In planning the operations of IUE a very high priority has been given to the safe preservation of the satellite and conservation of resources within the constraints of providing a scientifically effective and productive mission. Even with this approach anomalies can and have occasionally occurred in several systems, but those in three systems, the gyros, the OBC, and recently the FES, have caused the most concern and are described below. Other systems have degraded in an expected (non-anomalous) fashion, e.g. the solar cells which result in Beta constraints as described in Section 4.3. Problems have also occurred in the S/I. Those occurring in the camera system have been potentially the most serious and these are also described below.

5.1. Gyros

The most troublesome operational system (from the point of near catastrophe) has been the gyros, which are essential to the attitude control of IUE. Thanks both to careful and original design concepts and also to subsequent foresight and ingenuity by a number of people associated with the program, it has been possible to maintain the performance of the ACS. As a result, satisfactory scientific data collection has continued for over 16 years from launch to the time of writing. The original planning foresight was to build a six gyro package (see Figure 4) that was designed to maintain three-axis control as long as any three gyros were operational. This mode was used for 7.5 years during which three of the gyros failed.

Fig. 4. Inertial Reference Assembly.

The first three gyro failures occurred as follows. During the third eclipse season, in the Spring of 1979, three of the then six operating gyros (Gyros 2, 4 and 6) were turned off to conserve power. At the end of the eclipse season Gyro 6 failed to restart, although a number of attempts were made. (Hope has not been permanently abandoned for Gyro 6, as will be seen below.) In the middle of 1981, maneuver accuracy decreased and telemetry analysis indicated that Gyro 1 was suspect. It was taken off-line and a further analysis finally led to the conclusion that the feedback loop was open and the gyro was not recoverable. Gyro 1 was designated a permanent loss in March 1982. In July of the same year IUE began to slowly drift. Gyro 2 telemetry showed a rapid increase in current indicating that the gyro had stalled. At this point Gyro 2 was written off and the control software changed so that the spacecraft would be operating with the remaining Gyros 3, 4, and 5, at which point IUE had no spare gyros left. Seemingly, one more failure would mean the end of scientific observations. The IUE mission managers had anticipated this possibility even before the loss of the third gyro and had asked that the attitude control experts should prepare contingency plans.

They concluded that a method of attitude control could be worked out that used two active gyros and the Fine Sun Sensor (FSS). A program was planned and teams formed to develop, build and test such a system. The testing was done on simulators, as tests on the spacecraft were considered an unacceptable risk. By Spring 1983 the two-gyro/FSS control system had been carried as far as it could go, short of spacecraft usage. As it turned out, for three years (from July 1982 until August 1985) the satellite operated satisfactorily on the three remaining gyros. Then on 17 August 1985 the critical situation was eventually reached: Gyro 3 failed. The spacecraft's gyro body angles began to drift in a situation when they should have remained fixed and the Gyro 3 current fell from a normal operating level of 65 mA to 2 mA. The duty IUEOCC Operations Director immediately recognized the situation and took the action necessary to place the satellite in the safe, Sunbath, mode. The Sunbath mode uses analog information from the sun sensors to orient the satellite to Beta = 67° which gives the maximum output from the solar array. However the satellite slowly rotates about the yaw axis (z-axis) thus eventually requiring an attitude recovery exercise. After due consideration, it was decided to try to restart Gyro 3, but to no avail. A conference was called of all experts who could contribute to the situation, and it was decided to try to restart Gyro 6, but not so vigorously as to cause further damage in this already critical situation. If this failed, then the trusted but untried two-gyro/FSS system would be brought into play. Gyro 6 did not restart and the new system was now the only hope. It worked! Not smoothly at first, but with careful nurturing, it evolved in a few more weeks into a system that enabled IUE to gather scientific data essentially as well as in the old days of the three-gyro mode. At the time of writing it continues to do so, always with new improvements being evolved. This was a very great and ingenious achievement by the staff involved.

Even this two-gyro system is not seen to be the terminal control system, for considerable progress has been made in the development of a promising one-gyro/FSS system, and it is possible that, in the event of another gyro failure a workable system could be operational within a few months. The one-gyro/FSS system, unfortunately, may not be useable with the recent presence of the FES streak (see Section 5.3). Finally, even a no gyro operation may be possible using the FES and FSS and making only small slews from star to star but science operations would be greatly restricted.

5.2. On Board Computer (OBC)

The OBC is the other spacecraft component identified above as prone to operational anomalies. Indeed, prelaunch, the OBC was the cause of major concern due to malfunctions when running `hot'. If the ACS can be considered the nerve and muscle of IUE, then the OBC is certainly its brain, for its function is to tell the ACS and other systems what to do and when to do it. It does this through a number of installed software routines called `workers' which are in turn controlled by the computer executive system program. These workers are algorithms designed to perform specific spacecraft tasks. When there is a problem involving the OBC, it usually seems to involve the malfunctioning of the executive system hardware, with its subsequent effect on the performance of at least one of the workers. Over the lifetime of the satellite there have been numerous OBC malfunctions. While not always understood (mainly due to limited monitoring telemetry), most have not had any major impact on operations; i.e. the effect of the malfunction was easily and quickly corrected, usually by the simple retransmission of a command. However, there have been cases when attitude control was lost and recovery required a great deal of effort on the part of the RAs and the IUEOCC personnel. During the first three years of operation, 1978-80, the OBC was prone to crashes that caused loss of attitude. The OBC software analysts, OBC hardware engineers and operations personnel identified the conditions under which these crashes occurred. The software analysts then inserted code to detect the failures when they occurred, and restart the OBC control. As various failure modes occurred with time, the OBC code was modified until OBC crashes were no longer a significant operational problem. This worked so well that continuing failures, `hits', would have been undetected so a counter was inserted to record them. Many times there were several hundred `hits' per day from which recovery was automatically made without impact. The `hits' have decreased to only a few per day in recent years.

Another class of anomaly in the OBC was concerned with camera control. A VILSPA study of this phenomenon in June 1980 suggested, but not conclusively, that these problems might be associated with passage of IUE through transitional regions of the radiation belts. These OBC-related camera anomalies still occur on occasion, but are usually caught quickly enough to minimize the effect on the science.

One type of anomaly that has occurred twice, each time causing major concern, is the failure of the OBC to carry through a successful orbital adjustment (DELTA-V) to keep IUE on station. The first time that this occurred was on 12 January 1984. Prior to this DELTA-V there had been eight without incident. The magnitude of the DELTA-V is controlled by the duration of the firing of IUE's high thrust jets. The durations are calculated and the values are inserted into the Worker 19 command sequence which controls the operation. In January 1984 it was planned to fire the appropriate jets for 8.2 seconds but the program aborted after 1.64 seconds, leaving IUE in a slow spin. It took over four hours to restabilize the spacecraft and several hours more to determine its attitude. After analyzing the orbital data a new DELTA-V was planned and successfully carried out on 14 February 1984 without doing anything different except cooling the jets by orienting them away from the Sun prior to firing. The next DELTA-V in November 1984 also proceeded without incident but July 1985 brought a repeat of the fault of January 1984. After collective consultation with the experts it was concluded that differences between successful attempts and failure lay in the yaw phase data. The operational plan was modified so that the next try would emulate the successful DELTA-Vs, which had a negative yaw angle start. On 9 August the exercise was repeated and was successful. It is not known for certain whether the problem had been correctly identified since only eight days later the failure of the fourth gyro occurred and Worker 19 had to be extensively modified for use in the two-gyro/FSS mode. The two DELTA-Vs carried out since have both been successful.

5.3 The FES Streak

As stated earlier (see Section 3.3.1), the FES can, in theory, identify stars as faint as V = 14 mag. There have been some problems in recent years which have come to significantly affect the FES's abilities. On 5 February 1991, VILSPA reported the presence of a uniform scattered light background in the field of view, comparable to what one might see from V = 12 mag stars filling the field. This occurred during the Winter shadow season which, among other things, subjected IUE to greater temperature changes than it experiences at other times of the year, and may have caused this anomaly to appear. The speculation was that some of the thermal insulation had peeled off of the telescope tube and was now reflecting sunlight into the tube.

The scattered light intensity correlated very well with Beta, in the sense that higher Beta yielded a higher background, and was virtually non-existent at lower Beta. There were also fluctuations in intensity as time went on for any given Beta which were not predictable. Although initially alarming, the scattered light's presence did not have a substantial effect on IUE's observing capabilities. Faint targets were acquired as blind offsets, long wavelength high dispersion and short wavelength high and low dispersion spectra were not contaminated, and long wavelength low dispersion spectra were contaminated only for exposures longer than several hours.

Then on 14 September 1992 the scattered light anomaly became even more anomalous. At the end of a maneuver to a target near the Orion Nebula, the staff noticed that there was a bright streak of light in the field of view, comparable to a V = 5 mag star. They were not initially alarmed because they believed this feature was simply the Earth's limb, which they knew was nearby. However, this feature did not go away as they expected it to, and the staff became very concerned that a potentially mission-threatening event had occurred. The feature disappeared without any trace a few hours later while it was being investigated, leaving the staff to wonder if it would be seen again. A month or so later, it did return for a few days, then it was absent, but over time it became a regular feature in the field of view. As it started to make its presence felt, the streak (as it is known and loathed) became more of a problem, filling up to 80% of the field of view and at times saturating the FES detector in parts of that field. The staff concluded that this new problem, like the previous scattered light trouble, is being caused by some of the thermal insulation scattering sunlight, and sometimes Earth light, into the telescope tube. This insulation, while causing the streak, is not physically blocking the tube, since stars can still be seen throughout the field of view; the streak simply adds to the star's intrinsic brightness.

Remarkably enough, science efficiency and data quality have not been substantially affected since the streak's appearance. The staffs at both VILSPA and GSFC quickly developed workarounds for acquiring targets. The same variation with Beta angle that was seen with the scattered light is present with the streak, although there is no Beta at which it disappears altogether. Also, the streak has changed appreciably in the past year, and may be getting less intense as time goes on. As with the previous background, only long wavelength low dispersion spectra show any contamination, but that contamination can now appear in less than one hour. The staffs at both ground stations, as well as several independent observers, are working to find ways of reducing or eliminating this contamination from target spectra. The fact that spectra of the streak are similar to spectra of solar-type stars supports the conclusion that the illumination sources are the Sun and Earth.

The greatest impact has yet to be realized. The one-gyro/FSS system that was previously developed relies criticaly on the FES's ability to identify stars brighter than about V = 9 mag to maintain IUE's stability while on target. The streak intensity at Betas > 75° can wash out all but the brightest stars, which frequently leaves nothing visible in the field of view. This situation is not a problem with the two-gyro/FSS system since IUE can function quite well without the FES in the attitude control loop for the better part of an hour. After that, a short maneuver (on the order of a few arc minutes) is needed to find a star to verify IUE's pointing. But if there is another gyro failure, it is quite likely that, at best, IUE will be confined to observing targets at low Betas, and then only when bright enough stars are in the field of view.

5.4. Fine Sun Sensor (FSS)

Since the FSS is now a key part of the ACS, used to provide both roll and pitch information, its anomalies have assumed greater importance than before. It will play an even greater role in the attitude control if the one-gyro/FSS has to be installed. The FSS contains dual systems, each of which consists of an electronics package and dual detector heads. The two systems each cover an angular range of ±32° in pitch and roll centered on Beta = 45° and Beta = 105° respectively. There is an anomaly in the low-Beta FSS that prohibits operations below Beta = 28° since the two-gyro/FSS control system was put into operation.

5.5. Cameras

Four problems have occurred with the cameras. The first two, microphonic noise and scan control logic failures, have been largely overcome by changed operating procedures. The third has been the almost certain loss of use of the back-up or `redundant' camera in the short wavelength spectrograph (SWR). Fourthly, a high voltage discharge developed in the redundant long wavelength camera (LWR) and it can now only be operated at reduced gain.

The IUE TV camera tubes are very sensitive to mechanical vibrations particularly at frequencies in the range 500 Hz-10 kHz. This sensitivity arises because the support structure of the SEC target is a 2 cm diameter film of aluminum oxide 50 nm thick, which has high-Q resonances in this frequency range. The target, connected to a very sensitive amplifier, acts as a condenser microphone. During the commissioning of the S/I, severe microphonics frequently occurred. This was tracked down to the panoramic attitude sensor (PAS) which was used to sense the Earth limb in order to determine IUE's attitude during the initial attitude acquisition process. After use, the PAS had been left switched on with its scanning prism rotating but, on discovery, was switched off.

Occasionally important data were lost due to a microphonic `ping' lasting 10 seconds that affected the LWR images by producing a band of interference across the image. It was eventually discovered that this `ping' was induced by the warm up of the heater in the readout gun of the LWR tube. By increasing the delay between turning up the heater voltage and the commencement of the readout scan, it was possible to insure the `ping' occurred before the scan started.

The second problem occurred in the setting up of the digital logic circuits that perform the readout scan of the LWP camera. When the circuits have remained unused for some hours, e.g. during a long exposure, the serially loaded set-up coördinates fail to pass a specific bit in the line scan register. When the scan is initiated the register then counts correctly but from the wrong starting point so that only part of the SEC target is read out. The solution to this, which took quite some time to develop into a reliable form, was to include in the operating procedure the initiation of a dummy scan to insure the logic was unlatched prior to commencing the readout scan.

The third problem has been the intermittent operation of the SWR camera tube arising from a loss of the G1 on voltage, which controls the electron readout beam current. The SWR camera was selected at the outset to be set up and calibrated in orbit for routine use in the short wavelength spectrograph. In the middle of this commissioning period the intermittent operation first occurred. At that time the decision was made to use the SWP camera routinely and this has operated flawlessly to date. At intervals, attempts were made to operate the SWR camera and it was soon observed that successful operation was much more likely when the camera electronics module was cold. As time has gone by successful reads have become less frequent even at low temperatures, and it seems unlikely that the SWR camera would be of any use in the event of the failure of the SWP. One possible cause of the failure is the loss of the clock pulse input to the G1 modulator. Such problems had occurred on the ground due to a poorly mating connector.

The fourth major problem has been the high voltage discharge or `flare' that has developed in the LWR camera. A proximity focussed intensifier, whose output is coupled by fiber-optic windows to the TV tube, acts as a UV-to-visible wavelength converter. The high electric field (3.8 kV mm^{-1}) is near the maximum that the materials used for the photocathode and the anode can stand without a discharge developing. Any enhancement of the electric field caused, for instance, by a sharp point on the photocathode or contamination by a low workfunction electron emitter can result in an electron (or ion) discharge that gives rise to a point of light in the output image of the converter. The flare intensity increases rapidly as the voltage across the converter is raised, the image is enlarged due to scattering and halation, and further flares with a higher threshold voltage may appear. The phenomenon caused very considerable problems during the development of the IUE cameras. It was only after considerable labor by the project, and the eventually-successful converter manufacturer, ITT, that acceptable converters were made. The development was very successful. The high photocathode efficiency and very low background count rate (in the absence of radiation), which were better than specification, directly contributed to the performance of IUE. A difficult compromise had to be made between tube gain, safety margin from flares and reasonable production yields. The converters were formally rated at a maximum of 6 kV and some testing for flares and background was carried out at that voltage, but for all other testing and operations a voltage of 5 kV was selected.

In 1983 a weak flare was discovered in long exposures on the LWR camera. The center of the discharge was just outside the field of view of the TV camera but well within the working area of the converter, so only a crescent of light was picked up by the TV tube. Subsequently the flare steadily increased in intensity and therefore affected shorter exposures. The size of the light patch has also greatly increased. Fortunately the LWP had been calibrated and was made available to observers since it offered improved sensitivity in some parts of the spectrum. In October 1983 the decision was made to switch to the LWP for all normal observations. At first, use of the LWR was still permitted at 5 kV to complete series of observations of variable objects, but from April 1985 operation has been restricted to 4.5 kV which is at present below the flare threshold. This has reduced the gain by 27%.

On one occasion in 1976, during laboratory acceptance tests on the LWR converter before coupling to its TV tube, an extremely weak pinpoint of light was detected when making a 2 hour exposure at 6 kV but this did not recur on subsequent tests. The position of that flare is exactly coincident with the deduced center of the flare now seen through the TV camera. It is assumed that some aging process has lowered the flare threshold voltage. The extreme difficulty in producing completely flare-free converters forced the project to take the risk of including this one in the flight equipment. With hindsight this gamble has been well justified by five years of trouble-free operation by the LWR. Obviously such aging effects as have been seen in the LWR now raise the question of whether flares may in time appear in other cameras. These were not tested above 6 KV so there is no information as to whether they may have had incipient flare points which could appear at higher voltages.

6. Operational Performance

Despite the problems described above, IUE is still operating at high efficiency nearly 16 years into a mission which was originally designed for three years with consumables sized for five years. The ability to reconfigure IUE and achieve the mission objectives in quite different ways has been one of the important factors contributing to its extended life.

The scientific efficiency of IUE was not high in the first month or two after launch. The operational procedures and the ground computer software needed some debugging and extensive tuning to reduce unproductive overhead time when IUE was essentially waiting for the next command to be uplinked. As the operations staff gained confidence in the use of the improving software IUE soon achieved an average efficiency (defined as the fraction of time spent collecting astronomical photons) of about 60%. It was expected that the increased constraints on pointing in recent years would tend to reduce efficiency but this has been compensated by increased attention to efficient scheduling. At some point in the future it may be necessary to employ integrated operations so as to maintain efficiency by forming an optimum observing sequence from all the target lists of several GOs in one time interval.

At the time of writing, IUE is still in very good shape, with its scientific performance essentially unimpaired since launch over 16 years ago in January 1978. The targets it had observed by March 1986 included:

- 90 Solar System objects (planets, moons, asteroids, and comets).
- 5330 Hot stars (O, B, A, S, WD, and WR).
- 2060 Cool stars (F, G, K, and M).
- 1340 Variable stars (novae, Cephids, T Tauri, and binaries).
- 910 Nebulae (planetary, HII, and SNR).
- 1200 Extragalactic objects (galaxies, Seyferts, and QSOs).

These observations have resulted in the production of almost 95,000 spectral images, collected on behalf of more than 1200 astronomers, and have resulted in over 2100 papers being published in refereed journals.

The IUE archive has assumed increasing importance (see Giaretta *et al.* 1987); any image can be obtained after expiration of the 6 months exclusive data rights held by the original observer. Currently over 70,000 spectra per year are requested and the rate of requests now exceeds the rate of acquiring new spectra.

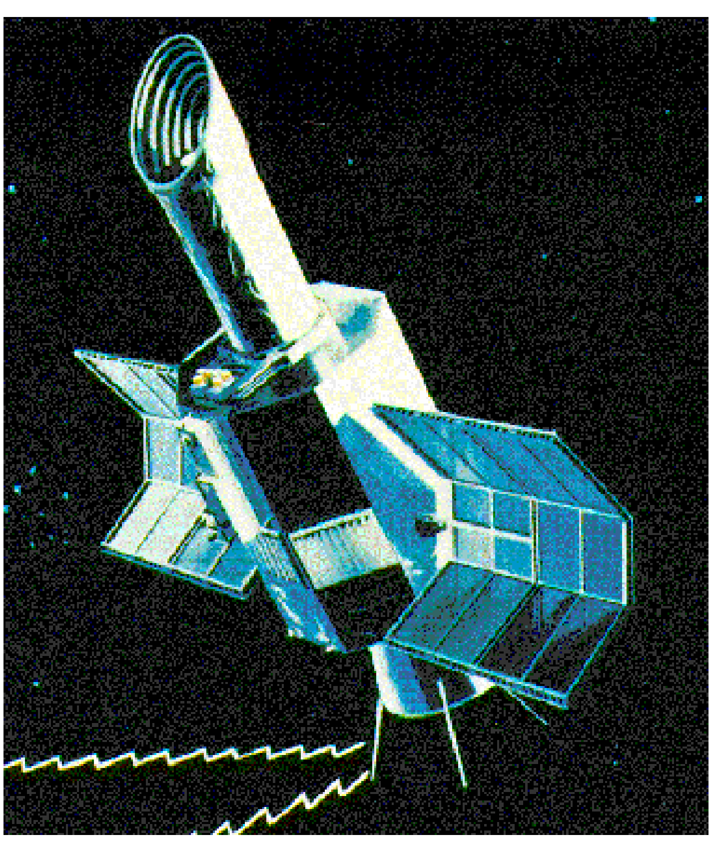
7. Abbreviations

It is convenient and customary among the IUE community to use abbreviations when referring to the various complex systems. We have restricted their use here to the more common ones. A list follows of all those used in this paper both those specific to IUE and those in more general use.

- ACS Attitude Control System
- CCIL Control Center Interactive Language
- DELTA-V Orbit Adjustment Maneuver
- DMU Data Multiplexer Unit
- EDS Experiment Display System
- ESA European Space Agency
- FES Fine Error Sensor
- FOD Flight Operations Directive
- FSS Fine
- G1 Grid 1 (of the vidicon)
- GO Guest Observer
- GSFC Goddard Space Flight Center
- IPC Image Processing Center
- IRA Inertial Reference Assembly
- ITF Intensity Transfer Function
- IUE International Ultraviolet Explorer
- IUEOCC IUE Operations Control Center
- IUESIPS IUE Spectral Image Processing System
- LWP Long Wavelength Prime (camera)
- LWR Long Wavelength Redundant (camera)
- NASA National Aeronautics and Space Administration
- NEWSIPS New Spectral Image Processing System
- OBC On Board Computer
- PAS Panoramic Attitude Sensor
- RA Resident Astronomer
- S/I Scientific Instrument
- SEC Secondary Electron Conduction (vidicon tube)
- SERC Science and Engineering Research Council
- SWP Short Wavelength Prime (camera)
- SWR Short Wavelength Redundant (camera)
- TO Telescope Operator
- TOCC Telescope Operations Control Center
- US1 First US Shift
- US2 Second US Shift
- UV Ultraviolet
- VHF Very High Frequency
- VILSPA Villafranca del Castillo, Madrid, Spain
- WPS Wallops Island Facility

Last updated: 29 July 1997
Jim Caplinger

The IUE Spacecraft



Mass: 644 kg at launch, 462 kg in orbit

Dimensions: 4.2 m by 1.45 m by 1.45 m

Power: 2 solar panels, which provide operating power to the spacecraft, and 2 batteries, which provide power during biannual Earth shadow seasons

Slewing: 3 reaction wheels (1 backup, never used)

Attitude sensors: 2 gyros (out of original 6), 1 Fine Sun Sensor (1 backup)

Computers: 1 8k on-board computer (1 backup, never used)

Orbit: synchronous, with semi-major axis 42167 km, inclination 34.7 deg, and eccentricity 0.132 (as of mid-1994)

Telemetry: uplink at 148.98 MHz (VHF) at 0.8 kbits/sec; S-band downlink at 2249.80 MHz at rates from 1.25 to 20 kbits/sec (standard), or VHF downlink at 136.86 MHz at rates from 1.25 to 5 kbits/sec

Ground stations: NASA IUE Observatory at Goddard Space Flight Center, Greenbelt, MD, USA (via Wallops Island Flight Facility, VA, USA), and ESA IUE Observatory at Villefranca del Castillo, Madrid, Spain

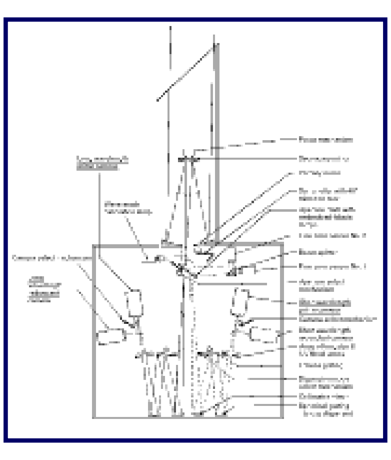
Command method: Real-time commanding by on-station personnel under advice from peer-selected guest observers; no coordination with TDRSS or other ground communication systems needed

More information?

Please see the article "Operation of a Multi-Year, Multi-Agency Project" describing the IUE mission (Falker, J., Gordon, F., Sanford, M.C.W., 1987, *Exploring the Universe with the IUE Satellite* , Reidel (and appears here with permission of Kluwer Academic Publishers): Dordrecht, ed. Y. Kondo, pg. 21).

Also, the IUE Observing Guide gives a description of the spacecraft, instrument, observing constraints, and so forth. (Important updates and details on the instrumental status were added by J. Caplinger in 1994.)

Scientific Instrument



The IUE scientific instrument consists of a telescope, acquisition camera, two ultraviolet spectrographs, and four cameras.

Telescope: The telescope is a 45-cm aperture, f/15 telescope of Ritchey-Chretien design. The primary mirror is made of beryllium. Thermal heaters mounted on the back of the mirror and on the camera deck are used for focus control.

Acquisition camera: The Fine Error Sensor (FES) is an image dissector device sensitive to a broad range of visual wavelengths. It has a 16 arcmin field of view and effective image resolution of about 8 arcsec. The device is used in camera mode to obtain a visual star field image for target identification and acquisition. It is then used in tracking mode for offset guiding, providing a pointing stability of about 1/2 arcsec.

Apertures: Each spectrograph may be used with either of two apertures. The large aperture is a slot (approximately 10 by 20 arcsec) and the small aperture is a circle about 3 arcsec in diameter. The apertures are known as LWLA (long-wavelength large aperture), LWSA (long-wavelength small aperture), SWLA (short-wavelength large aperture), and SWSA (short-wavelength small aperture). The image quality of the IUE telescope's optics yields a roughly 3 arcsec image, so observations using the small aperture result in some light loss. The large apertures are used most frequently since they give photometric reliability with little or no loss of resolution.

Spectrographs: The long-wavelength spectrograph operates in a wavelength range of 1850 to 3300 Å. The short-wavelength spectrograph operates in a wavelength range of 1150 to 2000 Å.

Dispersion modes: Each spectrograph has two dispersion modes. High resolution employs an echelle grating and cross-disperser, giving roughly 0.2 Å resolution). Low resolution employs the cross-disperser grating alone, and yields approximately 6 Å resolution.

Cameras: There are four cameras, two for each spectrograph. One is designated prime and the other backup. In the long-wavelength range, both the prime (LWP) and redundant (LWR) cameras were used during the mission. With the short-wavelength spectrograph, only the prime camera (SWP) was fully functional. The redundant camera (SWR) was used to obtain a handful of images early in the mission. Each camera consists of an SEC Vidicon with and ultraviolet converter. Each exposure is obtained by integrating over the requested exposure time, then performing a destructive readout of the camera target. The signal is digitized and transmitted to the ground via the spacecraft telemetry stream.

Data format: Each IUE image consists of a 768 by 768 pixel array of 8-bit values (0 to 255). The raw data are archived with a header recording Telescope Operator comments, automatic activity log, and spacecraft engineering data.

IUE OBSERVING GUIDE

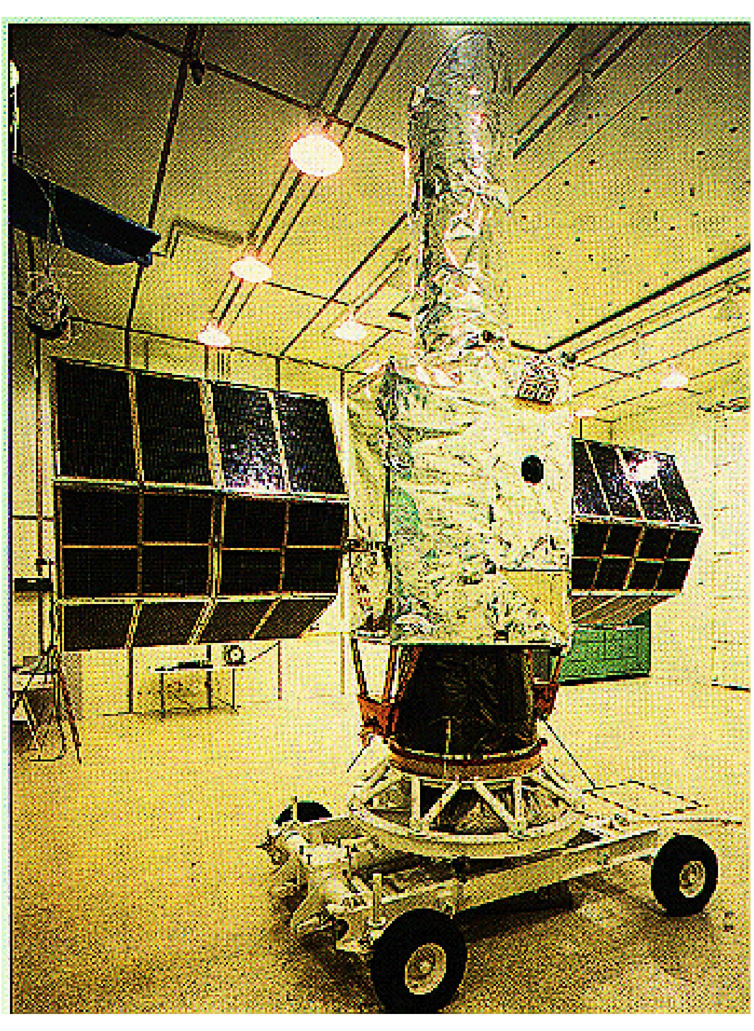
Jeffrey S. Newmark, Albert V. Holm, Catherine L. Imhoff, Nancy A. Oliverson, Ronald E. Pitts and George Sonneborn

IUE Observatory and Computer Sciences Corporation

May 1992

This document originally converted to html by Jim Caplinger 29 July 1997.

The Early History of IUE



IUE in the Clean Room Before Launch

The beginning of IUE goes back to the late 1960's and the success of the early astronomical satellites such as OAO-2 and Copernicus (OAO-3) in the US and TD-1 in Europe. Various studies were being pursued at NASA and within the European Space Research Organization (ESRO, the predecessor of ESA) for new astronomy satellites. One such study, for an Ultraviolet Astronomical Satellite (UVAS), was proposed by a team from the UK. This became the basis for a joint project among NASA, ESRO, and the UK's Science Research Council (SRC).

The approval process was especially challenging, since it involved three different agencies. But approval for the International Ultraviolet Explorer was won in 1971. Under the interagency agreement, NASA was reponsible for the overall system design, design and construction of the telescope, spectrograph, and spacecraft, the launch, and the US spacecraft control station at Goddard Space Flight Center (GSFC). The UK was responsible for the design and construction of the cameras and contributed to the optical design and the sunshade. ESA provided the solar arrays and the European spacecraft control station near Madrid, Spain.

Several unique design elements were part of the planned IUE mission.

First, the spacecraft was to be placed into geosynchronous orbit. This would allow it to be controlled in real time and thus be operated much like a ground-based observatory. Weight was therefore a major consideration. One compromise was to place the spacecraft into an eccentric orbit. In this orbit, the spacecraft dipped into the Van Allen belts at perigee. This became the "US2" high radiation shift, during which observers took shorter exposures because of the radiation background affecting the cameras.

Second, the goal of a long scientific mission was incorporated into the project design. The scientists pushed hard for a five-year mission. But the engineers would agree only to a three-year design lifetime, with a five-year "goal" as a compromise. Ironically IUE lasted *much* longer than five years!

Finally, control of the satellite would be passed between two control stations on two different continents. This concept caused some concern, since a clear chain of command is required for safe, successful spacecraft operations. Various steps were taken to insure well-coordinated operations. A standard protocol was used for "handover" of command between the two stations. The Goddard control center stayed online during VILSPA shifts to monitor and backup the European operations. Both stations used essentially identical command computers, software, and Flight Operations Directives.

Concerns about the radiation enviroment resulted in the last-minute installation of a radiation monitor. As it turned out, the radiation environment was not as bad as feared, but the radiation monitor was very useful in helping the observers better estimate exposure times during the high radiation shift.

IUE was launched on January 26, 1978, on a Delta rocket from Cape Canaveral, Florida. It was placed initially in an eccentric transfer orbit, then the apogee boost motor was used to circularize the orbit. After this IUE was so close to its nominal station (i.e. longitude) that it was not neccesary to use the jets move the spacecraft orbit. Initial check-out of the hardware went smoothly. The first spectrum, of the calibration star Eta Ursae Majoris, was obtained on the third day.

The spacecraft was then operated for 60 days under a Commissioning Period. Various high priority calibration and science observations were performed. For each spectrograph, there were prime and redundant cameras. It was quickly learned that the Short-Wavelength Redundant (SWR) camera was not functioning properly, and it was not used after the Commissioning Period. The SWP camera experienced significant microphonic noise, a major concern, until the source of the noise was found (the Panoramic Attitude Sensor, used for attitude determination after launch) and turned off. The LWP camera, in some ways better than the LWR, experienced sporadic scan errors, so the LWR was chosen as the default long-wavelength camera.

Routine operations began on April 1, 1978... and continued until October 30, 1996, an amazing 18 years and 9 months!

More information?

Please see "The History of IUE" (Boggess, A., Wilson, R., Barker, P. J., and Meredith, L. M. 1987, in *Scientific Accomplishments of the IUE*, Reidel: Dordrecht, ed. Y. Kondo, pg. 3). Most of the information above is condensed from this excellent article.

In addition, please see the series of articles written about IUE published in *Nature* , beginning with Boggess, A., *et al.* , 1978, *Nature* , **275** , 372. The first paper describes IUE, while the others describe the results of the Commissioning Period observations of various types of astronomical objects.

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- Search help
- Web Retrieval help
- FTP Retrieval help

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IUE Observing Script/Preview Image Selection Form

Enter Camera Name & Image Sequence Number (e.g., swp05003):

Select Item to be Displayed:
(•) Observing Script ( ) Preview-Image

Select file type (for preview-image only):
(•) MX ( ) SI

Submit | Reset Form

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IUE Programs sorted by Program ID

TRG - Theodore R. Gull (NASA/GSFC)
Commissioning Period Program

BFTS - Theodore P. Snow ( )
Stellar Winds in B and Be Stars

6D60Y - Ronald Downes (Applied Research Corporation)
WX Ceti

AA410 - A. Altamore (Roma)
Proposal for IUE Observations of Symbiotic Stars During Minimum

AA545 - A. Altamore (Rome)
IUE Observations of Symbiotic Stars During Minimum

AAEJL - John B. Lester (Toronto-Erndl)
A Test of Convective Model Atmospheres

AANAD - Andrea K. Dupree (Harvard CFA - SAO)
Periodic Variability in the Hybrid Supergiant: Alpha Aquarii

AAPAD - Andrea K. Dupree (Harvard CFA - SAO)
Supersonic Chromospheric Winds

AB040 - A. Baglin (France)
A Study of the Peculiar Variable Star Gamma Boo

AB588 - A. Bianchini (Padova)
UV Observations of the Old- Nova GK PER = A0327+43

ABJTS - Theodore Simon (NASA/GSFC)
Short Term Variability of HD 163296

ABKTS - Theodore Simon (Hawaii)
Activity Cycle of Ab Aurigae

ABOTS - Theodore Simon (U Hawaii)
Activity Cycle of the Herbig Ae Star AB Aurigae

ABPGB - Geoffrey S. Burks (Colorado - CASA)
A Study of Radio Continuum Loop I Absorption near the 3C273 Sight Line

AC163 - Angelo Cassatella (Vilspa)
Cool Giant Variables

AC414 - Angelo Cassatella (Vilspa)
UV Observations of R CRB Stars

ACDAK - Daniel A. Klinglesmith (NASA/GSFC)
Star A Centauri (B3 III)

ACHEB - Erika Bohm-Vitense (Washington)
Age Dependence of the Boundary Line for Chromospheric Emission in the HR Diagram

ACHSA - Saul J. Adelman (The Citadel)
The Population II A Type Star HD 109995. II

ACIIA - Imad A. Ahmad (Imad-Ad-Dean)
Accretion in 22 Vul

ACIRP - Ronald S. Polidan (Arizona)
Accretion Disks in Massive Binaries

ACLFB - Frederick C. Bruhweiler (Catholic U)
C IV in A Stars: Bridging the Gap Between Early and Late-Type stars

ACPEG - Edward F. Guinan (Villanova University)
Activity Cycles in Stars with Highly Active Chromospheres

ADIFW - Frederick M. Walter (Colorado - CASA)
Transition Regions in A Dwarfs

ADOAC - Anne P. Cowley (Arizona State University)
The Precessing Accretion Disk in the Black-Hole Binary LMC X-3

AE556 - A. Elvius (Stockholm)
Observations of Seyfert 1 Galaxies

AEETS - Theodore Simon (Hawaii)
Temporal Changes in the Ultraviolet Spectrum of Ab Aur

AEHJL - Jeffery L. Linsky (Colorado)
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AEITS - Theodore Simon (Hawaii)
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AEKCI - Catherine L. Imhoff (CSC IUE)
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AFGSA - Saul J. Adelman (The Citadel)
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AG307 - A. Greve (Bonn)
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AGHAB - Albert Boggess (NASA/GSFC)
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AGHCW - Chi-Chao Wu (CSC)
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AGHGF - Gary J. Ferland (Kentucky)
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AGHGR - Gail A. Reichert (CSC)
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AGIBP - Bradley M. Peterson (Ohio St.)
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AGICW - Chi-Chao Wu (CSC)
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AGIDW - Daniel W. Weedman (Penn State)
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AGIGR - Gail A. Reichert (CSC)
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AGIMM - Matthew A. Malkan (CAL LA)
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AGJBP - Bradley M. Peterson (Ohio State University)
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AGJFB - Frederick C. Bruhweiler (Catholic University)
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AGJGR - Gail A. Reichert (CSC)
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AGJJS - J. Michael Shull (Colorado - CASA)
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AGKGR - Gail A. Reichert (CSC IUE)
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AGLCM - D. Christopher Martin (Col. Astro Lab)
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AGLDH - Donald J. Hutter (CSC)
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AGLGM - Gordon M. MacAlpine (Michigan)
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AGLWS - Wei-Hsin Sun (NASA/GSFC)
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AGMBP - Bradley M. Peterson (Ohio State)
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AGMCG - C. Martin Gaskell (Michigan)
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AGMLW - Lee Anne Willson (Iowa State)
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AGMRG - Richard F. Green (KPNO)
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AGMSL - Susan A. Lamb (Illinois)
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Chromospheric Emission of W Ursae Majoris Stars

CBDJL - James W. Liebert (Arizona University)
An Attempt to Detect a Hot Degenerate Companion to the Dwarf Carbon Star G77-61

CBDMP - Mirek J. Plavec (UCLA)
Interacting Close Binary Stars of Longer Period

CBDSS - Steven N. Shore (Case Western Reserve University)
Luminous, Extended Atmosphere Stars in the Magellanic Clouds

CBDTM - T. Matilsky (Rutgers University)
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CBEAC - Anne P. Cowley (Michagan)
UV Observations of the Symbiotic Star AR PAV in Eclipse & Two Mass-Transfer X-Ray Binaries

CBEAD - Andrea K. Dupree (CFA)
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CBECW - Chi-Chao Wu (CSC)
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CBEDL - David L. Lambert (Texas)
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CBEEO - Edward C. Olson (Illinois)
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CBEJE - Joel A. Eaton (Vanderbilt)
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CBEJL - Jeffrey L. Linsky (Colorado)
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CBENM - Nancy D. Morrison (Toledo)
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CBEPS - Paula Szkody (Washington)
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CBESP - Sidney B. Parsons (NASA/GSFC)
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CBFAH - Albert V. Holm (CSC)
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CBFBH - B. M. Haisch (Lockheed)
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CBFMP - Mirek J. Plavec (UCLA)
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CBGEB - Erika Bohm-Vitense (Washington)
Dynamical Masses for Population I and Population II Cepheids

CBGEG - Edward F. Guinan (Villanova)
Vertical Atmospheric Structure of the K-Dwarf Component of the Eclipsing Binary V471 Tauri

CBGJE - Joel A. Eaton (Indiana University)
Non-Radiative Heating in Stellar Atmospheres: A-Type W UMA Binaries

CBGMP - Mirek J. Plavec (UCLA)
Circumstellar Emission Regions in Algols

CBGNE - Nancy Remage Evans (CSC)
Frequency of Multiple Systems Among Cepheid Binaries: Implications For Star Formation

CBGRP - Ronald S. Polidan (USC)
A Study of Long Term, Periodic Light Variations in Algol Binaries

CBIEG - Edward F. Guinan (Villanova)
Eclipsing Binary Systems in Conflict with General Relativity: As Camelopardalis

CBIJE - Joel A. Eaton (Indiana University)
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CBIKL - Kam-Ching Leung (Nebraska)
Far UV Study of Supergiant Semidetached and Contact Systems

CBIMP - Mirek J. Plavec (UCLA)
Emission in Non-Degenerate Interacting Binaries: Intensities and Spatial Distributions

CBINE - Nancy Remage Evans (CSC)
Cepheid Binarity and Star Formation

CBJJS - Jorge Sahade (Argentina)
Origin and Meaning of Red-Displaced 0.00 EV Lines in Gamma 1 Velorum

CBJMP - Mirek J. Plavec (UCLA)
Emissions From Interacting Non-Degenerate Binaries

CBJNE - Nancy Remage Evans (Canada)
Binary Cepheids

CBJTA - Thomas B. Ake (CSC)
The Atmospheric Eclipsing Binary HR 2554

CBKBH - Bruce J. Hrivnak (Valparaiso)
UV Observations of the High Mass-Ratio Contact Binary OO AQL

CBKGP - Geraldine J. Peters (USC)
UV Observations of AU MON Through its Long-Term Light Cycle

CBKJE - Joel A. Eaton (Indiana University)
Interacting Binaries Containing Cool Giants

CBKMP - Mirek J. Plavec (UCLA)
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CBKRP - Ronald S. Polidan (Arizona)
Simultaneous Ginga, Voyager, and IUE Observations of Beta Lyrae

CBLEG - Edward F. Guinan (Villanova)
Gas Dynamics, Accretion, and Evolution of Algol-Type Binaries

CBLFF - Francis C. Fekel (Vanderbilt)
Synchronization in Chromospherically Active Binaries

CBLGP - Geraldine J. Peters (USC)
UV Observations of AU MON Through its Long-Term Light Cycle

CBNES - Edward M. Sion (Villanova University)
IUE Echelle Studies of the Very Luminous ROSAT EUV Source SFC1631+782

CBNJE - Joel A. Eaton (Tennessee State University)
The Chromosphere and Wind of Al Velorum

CBNRK - Robert H. Koch (U Pennsylvania)
Hot, Massive Close Binaries

CBOEG - Edward F. Guinan (Villanova University)
UV Chromospheric Acitivity in Cool, Short-Period Contact Binaries

CBORK - Robert H. Koch (U Pennsylvania)
Hot, Massive Close Binaries

CBRRK - Robert H. Koch (U Pennsylvania)
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CC110 - C. Chavarria (Heidelberg)

Peculiar Young Emission Line Objects

CC164 - C. Casini (Milano)
Interacting Galaxies

CC392 - C. Cassini (Milano)
Observations of Interacting Galaxies

CC533 - C. Cacciari (Madrid)
Blue Globular Clusters in the Large Magellanic Cloud

CC554 - C. Cacciari (Madrid)
UV Observations of Globular Clusters in the Magellanic Clouds

CC560 - C. Casini (Milano)
Observations of Interacting Galaxies

CCAKD - Andrea K. Dupree (Harvard-Smithsonian)
Investigations of Stellar Chromospheres and Coronas

CCBAD - Andrea K. Dupree (Smithsonian)
Ultraviolet Studies of Stellar Chromospheres and Coronae

CCBDM - Dermott J. Mullan (Delaware)
Observable Influence of Stellar Winds on Late-Type Chromospheres

CCBEB - Erika Bohm-Vitense (Washington)
Classical Stellar Chromospheres and Dependence on Teff, and Chemical Abundances

CCBJL - Jeffery L. Linsky (Colorado)
Chromospheres, Transition Regions, & Coronae in DME Flare & Comparison Dwarf Stars

CCCAW - A. Walker (Stanford)
Chromospheres Coronae and Transition Regions of Main Sequence and Giant Stars in Hyades

CCCBB - Bernard W. Bopp (Toledo)
Studies of New Bright Chromospherically Active Stars

CCCEB - Erika Bohm-Vitense (Washington)
Dependence of Stellar Chromospheres on Metal Abundance Rotation, and Age

CCCJL - Jeffery L. Linsky (Colorado)
A Fresh Look at Capella Dichotomy J

CCCKH - Kenneth Hallam (NASA/GSFC)
Rotational Modulation and Cyclic Behavior of Ultraviolet Chromospheric Emission in Near-Solar Type Stars

CCCLK - L. Kuhi (California)
A Study of Chromospheric Activity in Spectroscopic Binary Systems

CCCMG - Mark S. Giampapa (Arizona)
The Evolution of the Chromospheres and Transition Regions in Dwarf Stars

CCCRS - Robert E. Stencel (Colorado)
Study of Chromospheres and Circumstellar Envelopes in G, K, M Supergiants

CCDAD - Andrea K. Dupree (Harvard CFA - SAO)
UV STudies of Evolved Chromospheres & Coronae in Giants in the Praesepe Cluster

CCDAW - A. Walker (Stanford)
A Study of the Chromospheres, Coronae and Transition Regions of Main Sequence and Giant Stars

CCDHJ - H. M. Johnson (Lockheed)
IUE Studies of X-Ray K-M Dwarfs

CCDJL - Jeffery L. Linsky (Colorado - JILA)
Chromospheres & Transition Regions of Young Stars in Ursa Major Cluster & Stream

CCDKH - Kenneth Hallam (NASA/GSFC)
Rotational Modulation & Cyclic Behavior of UV Chromospheric Emission in Near-Solar Type Stars

CCDMG - Mark S. Giampapa (CFA)
The Transition Regions & Coronae of Solar-Type Stars

CCDRN - Robert Noyes (Smithsonian Astrophysical Observatory)
Study of Active Regions on Solar-Type Dwarfs as a Function of Rotation and Age

CCDRS - Robert E. Stencel (Colorado)
Chromospheric Densities & Geometrical Extensions of Late-Type Giant & Supergiants

CCDTA - Thomas R. Ayres (Colorado)
SWP Echelle Spectra of Chromospherically Active Dwarf Stars

CCEBB - Bernard W. Bopp (Toledo)
Southern Active Chromosphere Variables

CCEJL - Jeffrey L. Linsky (Colorado)
Chromospheric Densities and Geometrical Extensions of Late-Type Giants

CCEKH - Kenneth L. Hallam (NASA/GSFC)
Solar-Like Activity Cycles of Stellar Chromospheres

CCETA - Thomas R. Ayres (Colorado)
The Wilson-Bappu Effect & Beyond

CCFAD - Andrea K. Dupree (CFA)
Chromospheres in Metal Deficient Giants

CCFDS - David R. Soderblom (CFA)
Ultraviolet Studies of Stars in a Pleiades Moving Group

CCFEB - Erika Bohm-Vitense (Washington)
Chromospheric Emission of Close Binaries

CCFEG - Edward F. Guinan (Villanova)
Coordinated Ultraviolet Spectroscopy and Optical Photometry of FK Comae

CCFFF - Francis C. Fekel (SM Systems and Research Corp)
Ultraviolet Observations of Unusual Chromospherically Active Giant Stars

CCFJL - Jeffery L. Linsky (Colorado)
An Emission Measure Analysis of Stars Near the Transition Region Dividing Line

CCFLH - Lee W. Hartmann (CFA)
A Study of Chromospheric Emission Decay in Old Stars

CCFMZ - Marie-Christin Zolcinski (W Connecticut)
IUE Survey of Hyades Stars, Part IV: The K and M Dwarfs

CCFSW - Simon P. Worden (Air Force)
Coordinated Magnetic and Chromospheric/Coronal Synoptic Observations

CCFTA - Thomas R. Ayres (Colorado-LASP)
The Hydrogen Emission of Active Red Dwarfs

CCFTS - Theodore Simon (Hawaii)
A Study of Yellow Giants in the Hertzsprung Gap

CCFWW - Wayne L. Waldron (Delaware)
Coronal Effects on the Winds of Early Type Stars

CCGAD - Andrea K. Dupree (CFA)
Chromospheres in Metal Deficient Giant Stars

CCGAS - Andrew Skumanich (HAO-NCAR)
Properties of a Rapidly Rotating DME Star & of H-Alpha Anomalous Low-Mass Stars

CCGCI - Catherine L. Imhoff (CSC)
An Archival Investigation of the Chromospheres of the T Tauri Stars

CCGDG - David M. Gibson (New Mexico Tech)
Flare-Like Activity in Single G, K, and M Stars

CCGDS - David R. Soderblom (CFA)
Chromospheres & Transition Regions of Stars in the Ursa Major Group

CCGFF - Francis C. Fekel (Vanderbilt)
Dispersion in the Rotation-Activity Relations

CCGGS - Graeme Smith (CFA)
An Ultraviolet Study of the Chromospheres of M67 Giants

CCGJL - Jeffery L. Linsky (Colorado)
Differences in Chromospheres of M Giants & Supergiants as a Function of Dust/Gas Ratio

CCGKH - Kenneth L. Hallam (NASA/GSFC)
Survey of Chromospheres in F-G-K Dwarfs

CCGMG - Mark S. Giampapa (NOAO)
The Transition Regions of X-Ray Emitting Main-Sequence A Stars

CCGSB - Sallie L. Baliunas (CFA)
Flares & Activity in FF Aquarii & Lambda Andromedae

CCGTS - Theodore Simon (Hawaii)
The Evolution of Stellar Chromospheres

CCHDM - Dermott J. Mullan (Delaware)
Statistical Study of Mass Loss Fluctuations

CCHHJ - Hollis R. Johnson (Indiana University)
High-Resolution Spectroscopy of the Cool Carbon Star HD 20234

CCHJE - Joel A. Eaton (Indiana University)
Ultraviolet Colors of Late-Type Stars with Different Amounts of Chromospheric Activity

CCHJL - Jeffrey L. Linsky (Colorado - JILA)
Stellar Winds in Cool Giants and Supergiants

CCHMG - Mark S. Giampapa (NOAO)
Coordinated Magnetic and Chromospheric Observations of Stars

CCHTA - Thomas R. Ayres (Colorado-LASP)
A Far-Ultraviolet Echelle Survey of Young F Stars in the URSa Major Cluster

CCHTS - Theodore Simon (Hawaii)
The Nature of Stellar Active Regions

CCIFF - Francis C. Fekel (Vanderbilt)
UV Observations of Single Chromospherically Active Giants

CCIJL - Jeffrey L. Linsky (Colorado - JILA)
Chromospheric & Coronal Heating for a Statistically Complete Sample of K Stars

CCIKJ - Kenneth Janes (Boston)
UV Study of the Chromospheres of M67 Giants

CCINE - Nancy Remage Evans (CSC)

The Mass of the Classical Cepheid SU Cygni

CCJAB - Alexander Brown (Colorado)
Chromospheric and Transition Region Structure of AK SCO and V351 ORI

CCJEB - Erika Bohm-Vitense (University of Washington)
High Resolution Studies of F and G Star Transition Layer Lines

CCJFF - Francis C. Fekel (Vanderbilt)
UV Observations of Single Chromospherically Active Giants

CCJTS - Theodore Simon (NASA/GSFC)
The Onset of Chromospheric Activity

CCKDS - David R. Soderblom (STScI)
Coronal Mass Ejections from a Young K0 Dwarf Star

CCKTA - Thomas R. Ayres (Colorado - CASA)
The Debit Side of the Chromospheric Energy Budget

CCKTT - Terry J. Teays (CSC IUE)
Chromospheres of Delta Scuti Stars

CCLTS - Theodore Simon (Hawaii)
The Dependence of Chromospheric Activity Upon Mass, Age, and Rotation

CCMAB - Alexander Brown (Colorado)
Long-Term MG II Variability of Hybird-Chromosphere Stars

CCMBH - Bernhard M. Haisch (Lockheed)
The Corona-Transition Region Relationship in Evolved Stars

CCMDS - David R. Soderblom (STScI)
Chromospheres and Transition Regions of Stars in the Ursa Major Group II

CCMFB - Frederick C. Bruhweiler (Catholic University)
Search for Lyman-Alpha and Chromospheric Emission in A and F Stars

CCMSB - Suchitra C. Balachandran (Sets Inc.)
Chromospheric Activity in F and G Subgiants

CCMTA - Thomas R. Ayres (Colorado - CASA)
The IUE/Rosat Coronathon

CCNAB - Alexander Brown (Colorado - JILA)
Long-Term MG II Variability of Hybrid-Chromosphere Stars

CCNDB - David Burstein (Arizona State University)
Age Calibration of Mg II Chromospheric Emission

CCNTA - Thomas R. Ayres (Colorado - CASA)
Coronathon Follow-On

CCNTS - Theodore Simon (U Hawaii)
Chromospheric Activity in the Hyades Cluster

CCOAB - Alexander Brown (Colorado - JILA)
Long-Term MG II Variability of Hybrid-Chromosphere Stars

CCOTT - Terry J. Teays (CSC - IUE Observatory)
Short Period Type II Cepheids with Carbon Star Characteristics

CCQNE - Nancy Evans (Space Astrophysics Laboratory)
Resolved Companions of Cepheids

CD596 - C. Loore (Brussels)
Mass Loss and Analysis of the Spectrum of the Hot BR Component of the Pulsating X-Ray Nova A0535+262

CDDMS - Michael L. Sitko (Minnesota)
A Study of Variable Ultraviolet Extinction in Hot Stars with Circumstellar Dust Shells

CDESB - Scott R. Baird (Clemson)
RV Tauri Star Circumstellar Dust

CDFJH - James H. Hecht (Aerospace Corporation)
Dust Extinction in HR 5999

CDFMK - Minas Kafatos (George Mason University)
Ultraviolet Extinction in Symbiotic Stars

CDIPS - Paula Szkody (Washington)
Archival Study of Disks in Cataclysmic Variables at Quiescence

CDJTS - Theodore P. Snow (Colorado - CASA)
Depletions in Dense Diffuse Clouds

CEITS - Theodore P. Snow (Colorado - CASA)
Extinction and Grain Properties in Circumstellar Shells

CEJLL - Jeffrey L. Linsky (Colorado - JILA)
Observations of Chromospheric Emission Lines From F-M Dwarfs and Giants

CEKTS - Theodore P. Snow (Colorado - CASA)
Circumstellar Extinction in Red Giants and Supergiants

CEQNE - Nancy Evans (Space Astrophysics Laboratory)
Masses for Two Classical Cepheids

CERBM - Bruce M. McCollum (CSC - Astronomy Programs)
First High Resolution Monitoring of a Type II Cepheid

CERNE - Nancy Remage Evans (ISTS)
Pulsating Atmospheres: V473 Lyr

CGHAD - Andrea K. Dupree (CFA)
The Chromosphere and Wind of HD 6833

CGHHB - Howard E. Bond (STScI)
Winds and Shells Around Low-Mass Supergiants

CGHTS - Theodore Simon (Hawaii)
Chromospheric Activity and Spindown in the Hertzsprung Gap

CGIEB - Erika Bohm-Vitense (Washington)
MG II Line Profiles in W VIR

CGIHB - Howard E. Bond (STScI)
Winds and Shells Around Low-Mass Supergiants

CGJEB - Erika Bohm-Vitense (Washington)
Masses for Four Cepheids

CGKEB - Erika Bohm-Vitense (Washington)
Masses for Four Cepheids

CIPJG - James C. Green (Colorado - CASA)
High Velocity Circumstellar Material From Evolved Massive Stars

CJ112 - C. Jager (Utrecht)
Beta CMA Stars

CJ118 - C. Jamer (Liege)
Autoionisation in Peculiar Stars

CJ342 - C. Jager (Utrecht)
Observation of the Dynamical State of the Outer Atmospheres of Beta Cephei Stars

CJQMM - Melissa McGrath (STScI)
IUE Observations of the Impact of Comet Shoemaker-Levy with Jupiter

CJQTL - Timothy Livengood (NASA/GSFC)
Auroral Consequences of Comet Shoemaker-Levy IX's Perturbation of the Jovian Magnetosphere

CJQWH - Walter Harris (University of Michigan)
Observation of the Shoemaker-Levy/Jupiter Collision

CL331 - C. Loore (Brussels)
Mass Loss and Variability of the Hot Components of BE X-Ray Binaries

CL369 - C. Laurent (Verrieres-Le-Buisson)
The Extent of a Gaseous Galactic Halo

CL571 - C. Laurent (Verrieres-Le-Buisson)
The Extent of a Gaseous Galactic Halo

CL609 - C. Laurent (Buisson)
Investigation of High-Velocity Components in the Great Carina Nebula

CLNSC - Salvador Curiel (Harvard CFA - SAO)
UV Spectra of H2 Emitting Shocks

CLNWB - William P. Blair (Johns Hopkins University)
Scattering and Grain Destruction in the Cygnus Loop

CLOJR - John C. Raymond (Harvard CFA - SAO)
IUE Observations of HUT and ROSAT Targets in the Cygnus Loop

CLPWB - William P. Blair (Johns Hopkins University)
Cloud Crushing in the Southeast Cygnus Loop

CLQJR - John Raymond (CFA - SAO)
IUE Observations of a Marginally Radiative Shock Wave

CLRLD - Laura Danly (STScI)
Searching for the High Velocity Cloud Toward HD 135484

CM2GH - Graham Hill (Dominion Astrophysical Observatory)
Gravity Darkening in Rotating Stars

CMBAM - Andrew G. Michalitsianos (NASA/GSFC)
Observations of Circumstellar Shells Around Late Type Stars

CMBBS - Blair D. Savage (Wisconsin)
Ultraviolet Studies of Hot Stars with Circumstellar Dust

CMBRS - Robert E. Stencel (NASA/GSFC)
A Study of Chromospheres and Circumstellar Envelopes in G,K, and M Supergiants by Obtaining and Analyzing IUE Profiles

CMGDH - Doyal A. Harper (Chicago)
UV Observations of Vega System Material

CMGMS - Michael L. Sitko (Minnesota)
Ultraviolet Studies of HD 44179 and HD 97048

CMGTS - Theodore P. Snow (Colorado-Lasp)
Column Densities in the Circumstellar Shells of B and Be Stars

CMHMJ - H. M. Johnson (Lockheed)
Investigations of Circumstellar Matter

CMIES - Edward M. Sion (Villanova)
Expanding Circumbinary Gas Around V471 Tauri

CMIFB - Frederick C. Bruhweiler (Catholic University)
Beta Pictoris and Other Candidate Proto-Planetary Systems Near the Sun

CMJFB - Frederick C. Bruhweiler (Catholic University)
Beta Pictoris and Other Candidate Proto-Planetary Systems Near the Sun

CMKCG - Carol A. Grady (CSC IUE)
Protoplanetary Disk and Circummstellar Shells in a Stars

CMKRS - Robert E. Stencel (Colorado - CASA)
Mapping Circumstellar Shells of Red Supergiant Stars

CNJSS - Sumner G. Starrfield (Arizona State University)
Ultraviolet Observations of Three Bright Classical Novae

CNKSS - Sumner G. Starrfield (Arizona)
Ultraviolet Observations of Nova Vul 1984 ,2 and Nova Vul 1987

CNMSS - Sumner G. Starrfield (Arizona)
Late Stages in the Outburst of Classical Novae

COETA - Thomas B. Ake (CSC)
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COHNO - Nancy A. Oliversen (CSC)
Masses and Nebular Velocity Structure of Symbiotic Stars

COOKC - Kenneth G. Carpenter (NASA/GSFC)
A Search for CO Molecular Absorption in Far-UV Spectra of Cool Stars

COOMA - Michael F. A'Hearn (U Maryland)
IUE Observations of Comets and Related Bodies

COOPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

COPKC - Kenneth G. Carpenter (NASA/GSFC)
CO Molecular Absorption in Far-UV Spectra of Cool Stars

COPMA - Michael F. A'Hearn (U Maryland)
IUE Observations of Comets and Related Bodies

COPPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with IUE

CORCU - C. Megan Urry (STScI)
The Continuum Source in Blazars

CORMA - Michael F. A'Hearn (U Maryland)
IUE Observations of Targets of Opportunity (Comets and Related Bodies)

CORNE - Nancy Remage Evans (ISTS)
"Little h" and Chi Per: Rotation and Be Stars

COWMJ - W. J. Jackson (Howard University)
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CP035 - O. Citterio (Milano)
UV Observations of Compact Extragalactic I R Emitters

CPIJH - J. P. Halpern (Columbia Astrophysics Labratory)
Rapid Variations in the Far-Ultraviolet Spectrum of the Cool Ap Star 21 Com

CS357 - C. Sollazzo (Napoli)
Study of Chromospheres in Cepheid Variables

CSBKN - K. R. Nicolas (Naval Research Laboratory)
UV Spectroscopy of Cool Stars in Luminosity Classes I-V

CSBLD - Lowell R. Doherty (Wisconsin)
Observations of MG II 2800 A in Cool Stars

CSCAD - Andrea K. Dupree (CFA)
Evolutionary Study of Late-Typr Single, Dwarf Stars

CSCJL - Jeffery L. Linsky (Colorado)
High Dispersion, Short Wavelength Studies of Selected Cool Stars

CSCRW - Robert F. Wing (Ohio State University)
Further Studies of the UV Spectra of Late-Type Stars

CSDCB - C. Stewart Bowyer (University of California)
Magnetic Variability in Zeta Bootes A

CSDCS - Christopher Sneden (University of Texas at Austin)
IUE Observations of Weak G-Band Stars

CSDGH - G. H. Herbig (UC Santa Cruz)
Evolutionary Decay of the Chromospheres of G0-G2 Dwarfs

CSDHJ - Hollis R. Johnson (Indiana University)
Studies of the Ultraviolet Spectra of Carbon Stars

CSDJL - Jeffery L. Linsky (Colorado)
High Resolution Spectra of an Evolved Solar-Like Star, Beta HYI (G2IV)

CSDRS - Robert E. Stencel (Colorado)
SWP High Resolution Spectra & Emission Measure Analysis of Yellow Bright Giants with Coronae

CSDSP - S. H. Pravdo (Cal Tech)
IUE Observations of Stars and X-Ray Sources in an X-Ray Active Region of Orion

CSDTA - Thomas R. Ayres (Colorado)
Calibration of the SWP Echelle Mode for Chromospheric Emission Sources

CSDTS - Theodore Simon (Hawaii)
Ultraviolet Observations of Young Field Stars

CSEJL - Jeffrey L. Linsky (Colorado)
High Dispersion SWP Spectra of Yellow and Red Giants

CSELH - Lee W. Hartmann (CFA)
Dynamics of Hot Gas Surrounding Hybrid Stars

CSEMG - Mark S. Giampapa (CFA)
Magnetic & Chromospheric Synoptic Observations of Late-Type Stars

CSFHJ - Hollis R. Johnson (Indiana University)
Studies of the Ultraviolet Spectra of Carbon Stars

CSFJL - Jeffrey L. Linsky (Colorado - JILA)
UV Variability and Rotational Modulation of T Tauri Stars

CSFKB - Karl-Heinz Bohm (Washington)
The Environment of the Cohen-Schwartz Star

CSFNM - Nancy D. Morrison (Toledo)
The Ultraviolet Energy Distribution of PHI Cassiopeiae

CSFRW - Robert F. Wing (Ohio State University)
A Search for Molecular Absorption Features in the Photospheric Spectra of Cool Stars

CSFTA - Thomas R. Ayres (Colorado-LASP)
Determination of Absolute Velocities for Emission Lines of Late-Type Stars

CSGAD - Andrea K. Dupree (CFA)
Intensive Multi-Frequency Observations of Alpha Orionis

CSGCI - Catherine L. Imhoff (CSC)
Ultraviolet Spectra of Young Stars Relevant to Earth's Early Atmosphere

CSGEB - Erika Bohm-Vitense (Washington)
G and Early K Giant UV Continua and Early Emission Line Intensities

CSGHJ - Hollis R. Johnson (Indiana University)
Studies of the Ultraviolet Spectra of Carbon Stars

CSGJL - Jeffrey L. Linsky (Colorado - JILA)
Properties of Stellar Winds: FE II, C II, and Variability

CSGSB - Sallie L. Baliunas (Harvard CFA-SAO)
Coordinated Ultraviolet Spectroscopic and Optical Photometric Observations of Capella

CSGTA - Thomas R. Ayres (Colorado-LASP)
Far-Ultraviolet Fluorescence of Carbon Monoxide

CSGTS - Thomas Y. Steiman-Cameron (Cal Tech-MT.Wil)
Chromospheric Activity, Tio Strength and Spectral Types in M Giants

CSHDB - David Burstein (Arizona State University)
K Giant Spectra for Stellar Population Models

CSHDH - Doyal A. Harper (Chicago)
Observations of Vega-Type Circumstellar Nebulae

CSHHJ - Hollis Johnson (Indiana University)
The Carbon Proto-Planetary Nebula HD 59643

CSHJL - Jeffrey Linsky (University of Colorado)
High Resolution Spectroscopy of Late K and M Supergiants

CSIDY - Donald G. York (Chicago)
Oscillator Strenghts for SI II

CSIHJ - Hollis R. Johnson (Indiana University)
The Carbon Proto-Planetary Nebula HD 59643

CSIJL - Jeffrey L. Linsky (Colorado - JILA)
Ultraviolet Emission from Cool Stars with Measured Magnetic Fields

CSITS - Theodore P. Snow (Colorado - CASA)
Comparison of Gas Abundances in Oxygen-Rich and Carbon-Rich Circumstellar Envelopes

CSJAB - Alexander Brown (Colorado)
High Dispersion Study of Coronal K Bright Giants

CSJJB - Jay A. Bookbinder (Colorado)
Hydrogen Lyman Alpha Enission From High Radial Velocity Stars

CSJRS - Robert E. Stencel (Colorado - CASA)
The Ultraviolet Circumstellar Shell of Alpha Ori

CSKBB - Bernard W. Bopp (Toledo)
By Draconis Stars

CSKHJ - Hollis R. Johnson (Indiana University)
The Upper Atmospheres of Late M Stars

CSKJE - Joel A. Eaton (Indiana University)
Chromospheric Variability in M Giants

CSKTA - Thomas R. Ayres (Colorado - CASA)
Sleuthing the Dynamo

CSLLW - Lee Anne Willson (University of Colorado)
Dust Nucleation and the Efficiency of Grain Formation: Clues From the Unstable Wind of l2 Pup

CSLTA - Thomas R. Ayres (Colorado - CASA)
Sleuthing the Dynamo II

CSMAD - Andrea K. Dupree (Harvard SAO - CFA)
Pulsation-Driven Wind from a Yellow Supergiant

CSMPJ - Phipig G. Judge (Colorado - JILA)
Understanding the Circumstellar Shell of the Carbon Star Tx psc

CSMRS - Robert E. Stencel (Colorado - CASA)
Mapping the UV Circumstellar Nebulae of Cool Stars

CSMTA - Thomas R. Ayres (Colorado - CASA)
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CSNMS - Michael L. Sitko (U Cincinnati)
Variable Extinction in Hot Stars with Circumstellar Dust

CSPGC - Geoffrey C. Clayton (Colorado - CASA)
Emission Line Regions in Cool Hydrogen Deficient Carbon Stars

CTOTA - Thomas R. Ayres (Colorado - CASA)
Coronal Topology

CVBCW - Chi-Chao Wu (CSC)
Ultraviolet Observations of Cataclysmic Variables and Related Objects

CVBDL - David L. Lambert (Texas)
Ultraviolet Spectroscopy of Symbiotic Stars

CVBJG - John S. Gallagher (Illinois)
Observations of Galactic Novae

CVBJN - J. Nelson (UC Berkeley)
Exploring Selected Problems in the Dynamics of Close Binary Systems

CVBJO - J. Beverly Oke (Cal Tech)
Ultraviolet Observations of Cataclysmic Variables in Their Non-Eruptive States

CVBPS - Paula Szkody (Washington)
UV Observations of Selected Cataclysmic Variables

CVCAH - Albert V. Holm (CSC)
Ultraviolet Light Curves of Eclipsing Dwarf Novae

CVCCW - Chi-Chao Wu (CSC)
Target of Opportunity Observations of Novae and X-Ray Novae

CVCDL - David L. Lambert (Texas)
UV Spectroscopy of Symbiotic Stars, Recurrent and Old Novae

CVCFC - France Anne Cordova (Lanl)
UV Observations of X-Ray Emitting Cataclysmic Variable Stars

CVCPS - Paula Szkody (Washington)
UV Study of Short Period Cataclysmic Variables (Su Uma and Am Her Stars)

CVCRP - Robert J. Panek (Penn State University)
Time Resolved Spectrophotometry of UX UMA

CVCRW - R. E. Williams (Arizona)
UV Spectroscopy of the GK PER/DQ Her Novae Shells

CVCSS - Sumner G. Starrfield (Arizona)
Ultraviolet Observations of Galactic Novae

CVDAH - Albert V. Holm (CSC)
UV Study of UX UMA and Related Objects

CVDAK - A. L. Kiplinger (Applied Research & Systems)
A Study of Time-Dependent Disk Accretion in Dwarf Novae

CVDCW - Chi-Chao Wu (CSC)
Target of Opportunity Observations of Nova & X-Ray Nova

CVDDL - David L. Lambert (Texas)
UV Spectroscopy of Symbiotic Stars, Recurrent & Old Novae

CVDEG - Edward F. Guinan (Villanova)
Ultraviolet Studies of Nova-Like Variables

CVDFC - F. Cordova (Lanl)
The Dwarf Nova Outburst & X-Ray Emitting Cataclysmic Variable Stars

CVDHB - Howard E. Bond (Louisiana State)
A Search for Cataclysmic Binaries Containing Strongly Magnetic White Dwarfs

CVDPS - Paula Szkody (Washington)
Short Period Cataclysmic Variables

CVDSS - Sumner G. Starrfield (Arizona)
Ultraviolet Observations of Galactic Novae

CVECW - Chi-Chao Wu (CSC)
Target of Opportunity Observations of Nova & X-Ray Nova

CVEFC - France Anne Cordova (Los Alamos)
Degenerate Stars in Eclipsing Close Binary SYS & Search for Corona

CVEHB - Howard E. Bond (Louisiana State)
A Search for Cataclysmic Binaries Containing Strongly Magnetic White Dwarfs

CVEJL - James W. Liebert (Arizona)
Bright, Optically Thick Accretion Disks

CVEJP - Joseph Patterson (CFA)
Ultraviolet Spectra of White Dwarf Pulsars

CVEPS - Paula Szkody (Washington)
Short Outburst Period Cataclysmic Variables

CVESS - Sumner G. Starrfield (Arizona)
Ultraviolet Observations of Galactic Novae

CVFAH - Albert V. Holm (CSC)
The 1978 Outburst of WZ Sagittae

CVFCW - Chi-Chao Wu (CSC)
Target of Opportunity Observations of Nova and X-Ray Nova

CVFES - Edward M. Sion (Villanova)
Continued Ultraviolet Studies of UX Ursa Majoris Stars

CVFJN - John Nousek (Pennsylvania State University)
Newly Discovered AM Her Systems: E2003+223 and E1045-451

CVFJN - John A. Nousek (Penn State University)
Newly Discovered AM HER Systems: E2003 + 223 and EL405-451

CVFJP - Joseph Patterson (CFA)
Accretion Disk Parameters in Cataclysmic Variables

CVFJR - John C. Raymond (CFA)
Development of P Cygni Profiles in Dwarf Nova Outburst

CVFPA - Prahlad C. Agrawal (Tata Ins)
Ulteaviolet Observations of Newly Discovered AM Herculis-Like X-Ray Binary H0139-68

CVFPS - Paula Szkody (Washington)
Extended Outburst/High Excitation Cataclysmic Variables

CVFRP - Robert J. Panek (CSC)
Outburst Rise of Dwarf Novae

CVFSS - Sumner G. Starrfield (Arizona)
Ultraviolet Observations of Galactic Novae in Outburst

CVGCW - Chi-Chao Wu (CSC)
Target of Opportunity Observations of Novae and X-Ray Novae

CVGFC - France Anne Cordova (Lanl)
IUE Observations of High-Inclination Close Binary Systems

CVGJR - John C. Raymond (CFA)
P Cygni Profile Variations in Dwarf Novae

CVGRP - Ronald S. Polidan (USC)
IUE and Voyager Observations of SS Cygni in Outburst

CVGSS - Sumner G. Starrfield (Arizona)
Ultraviolet Observations of Galactic Novae in Outburst

CVGWB - William P. Blair (CFA)
Accretion Disk Parameters in Cataclysmic Variables

CVHDG - Daya P. Gilra (S M Systems)
Analysis of High Resolution Spectra of Slow Nova RR TEL

CVHES - Edward M. Sion (Villanova)
IUE Spectroscopy of Pre-Cataclysmic Binaries

CVHFC - France Anne Cordova (LANL)
High Dispersion SWP Studies of Winds in Cataclysmic Variable Stars

CVHGS - George Sonneborn (CSC)
Time-Resolved Spectroscopy of Superhumps in the Light Curves of Eclipsing Su Uma Systems

CVHJE - Juan Echevarria (Mexico)
International Search Program of Dwarf Novae During the First Day of Outburst

CVHJR - John C. Raymond (CFA)
Mass Loss from Cataclysmic Variables

CVHPS - Paula Szkody (Washington)
A Study of the Accretion Characteristics of Six Unique Cataclysmic Variables

CVHRP - Ronald S. Polidan (Arizona)
Simultaneous IUE and Voyager Observations of the Dwarf Nova Z Camelopardalis

CVHRW - Richard A. Wade (Arizona)
The White Dwarfs and Inner Accretion Disc of 3 Unusual Dwarf Novae

CVHSS - Sumner G. Starrfield (Arizona)
Ultraviolet Observations of Nova Vulpeculae 1984 and Other Novae in Outburst

CVHTK - Timothy R. Kallman (NASA/GSFC)
Measurements of Wind Features From Cataclysmic Variables

CVIFC - France Anne Cordova (Lanl)
The Nature of Accretion Disk Winds

CVIGS - George Sonneborn (CSC)
Superoutburst Development in Eclipsing Su Uma Systems

CVIJP - Joseph Patterson (Columbia)
Pseudo White Dwarfs in Cataclysmic Variables

CVIJR - John C. Raymond (CFA)
Line Emission in Quiescent Dwarf Novae

CVIKH - Keith Horne (STScI)
Accretion Disks and White Dwarfs in Eclipsing Dwarf Novae

CVIPS - Paula Szkody (Washington)
A Study of the Cataclysmic Variables V426 Oph and Ip Peg

CVISS - Sumner G. Starrfield (Arizona)
Target of Opportunity Observations of Galactic Novae in Outburst

CVJGS - George Sonneborn (CSC)
Ultraviolet Spectroscopy of Dwarf Novae in Outburst

CVJJP - Joseph Patterson (Columbia)
Pseudo White Dwarfs in Cataclysmic Variables

CVJPS - Paula Szkody (Washington)
UV Cooling in Long Outburst Period Dwarf Novae

CVJSS - Sumner G. Starrfield (Arizona)
Target of Opportunity Observations of Novae in Outburst

CVKCM - Christopher W. Mauche (Lanl)
The P Cygni Profiles of Z Cam at Standstill

CVKGS - George Sonneborn (CSC IUE)
Ultraviolet Spectroscopy of Dwarf Novae in Outburst

CVKPS - Paula Szkody (Washington)
Long Term Heating/Cooling of White Dwarfs/Disk in Cvs

CVKSS - Sumner G. Starrfield (Arizona)
Target of Opportunity Observations of Novae in Outburst

CVLAH - Albert V. Holm (CSC)
Searching for the White Dwarf in Dwarf Novae

CVLCM - Christopher W. Mauche (Los Alamos)
The P Cygni Profiles of Z Cam at Standstill

CVLJR - John C. Raymond (CFA)
The Temperature Structure of V1082 Sagittarii

CVLPS - Paula Szkody (Washington)
The Hot Component in 3 New Cvs

CVLSS - Sumner G. Starrfield (Arizona State University)
Ultraviolet Observations of Nova Qu Vul 1984 ,2, Nova Gq Mus 1983 and Novae LMC 1988 , 1 & 2

CVLTM - Thomas R. Marsh (STScI)
Evolution of the Wind in the Dwarf Nova IP Peg During Outburst

CVMJT - J. R. Thorstensen (Dartmouth College)
IUE Spectra of a Complete Sample of Cataclysmic Variables

CVMPS - Paula Szkody (Washington)
The Peculiar Cvs FSV 1132-11 and S193

CVNCB - C. Stuart Bowyer (UC Berkeley)
Coordinated IUE and EUVE Observations of Cataclysmic Variables

CVNES - Edward M. Sion (Villanova University)
Evolutionary State of Helium Transfer Cataclysmics

CVNGS - George Sonneborn (NASA/GSFC)
Outburst Studies of High Galactic Latitude Large-Amplitude Cataclysmic

CVNJP - Joseph O. Patterson (Columbia University)
X-Ray Selected Cataclysmic Variables

CVNJR - John C. Raymond (Harvard CFA - SAO)
UV Spectra of Nearly Synchronous Magnetic Cataclysmic Variables

CVNPS - Paula Szkody (U Washington)
An IUE Study of Two Interesting New Novalikes

CVNSS - Sumner G. Starrfield (Arizona State University)
Coordinated Multiwavelength Observations of Late Stages in the Outburst of Classical Novae

CVODL - Donald G. Luttermoser (Iowa State University)
Flourescent Clues to the Atmospheric Shock Structure of Cool Variables

CVPPS - Paula Szkody (U Washington)
Cooling Timescales and Accretional Heating of White Dwarfs in WZ Sge Type CVs

CVPSH - Steven B. Howell (Planetary Science Institute)
IUE Observations of ROSAT Selected Magnetic Cataclysmic Variables

CVQPS - Paula Szkody (University of Washington)
Monitoring the Long Term Changes in NLs

CVRPS - Paula Szkody (U Washington)
IUE Observations of New, Magnetic HEAO/ROSAT Sources

CWFJN - ( )

CYOJE - Joel A. Eaton (Tennessee State University)
Mapping the Chromosphere of 31 Cygni

CYPJE - Joel Eaton (Tennessee State University)
Long-Term Observations of 31 Cygni

CZ104 - C. Zwaan (Utrecht)
Chromospheres

CZ502 - C Zwaan (Utrecht)
Magnetic Structure of F, G, and K Type Stars

DAHJH - Jay B. Holberg (Arizona)
Measurement of a Gravitational Redshift With IUE

DAIJH - Jay B. Holberg (Arizona)
Hottest Most Luminous DA White Dwarfs

DAJJH - Jay B. Holberg (Arizona)
Youngest DA White Dwarfs

DALDK - Detlev Koester (Louisiana State)
Ultraviolet Observations of a New, Extremely Hot DA White Dwarf

DAMFW - Francois Wesemael (Canada)
Stratified Atmospheres in the DAB White Dwarfs

DAMGB - Gibor S. Basri (UC Berkekey)
Temperatures of Hot DA White Dwarfs

DANJH - Jay B. Holberg (University of Arizona)
IUE Observations of the DAB White Dwarf G104-27 & Its Interstellar Environment

DAOJH - Jay B. Holberg (U Arizona)
A Study of a Sample of EUV Selected Hot DA Dwarfs

DAOJL - James W. Liebert (U Arizona - Steward Obser)
DA White Dwarfs with Peculiar Line Profiles

DAPCB - C. Stuart Bowyer (UC Berkeley - CEA)
Heavy Element Abundance in Hot DA White Dwarfs

DAPJH - Jay B. Holberg (U Arizona)
IUE Observations of EUV Selected Hot DA White Dwarfs

DBBPF - Paul D. Feldman (Johns Hopkins)
Stellar Corrections to Diffuse Background Observations

DBDAW - Adolf N. Witt (Toledo)
Correlation of Far-UV Extinction with the Strength of the Lamda 4430 Diffuse Interstellar Band

DBMMP - Mirek J. Plavec (UCLA)
EO Aurigae: A Non-Conformist Binary

DCBDD - D. A. Doschek (NRL)
Spectra of Cepheid Variables and Late-Type Stars

DCBES - Edward Schmidt (Nebraska)
Ultraviolet Observations of Quasistellar Objects and the Intergalactic and Intracluster Medium

DCCDM - D. H. McNamara (Brigham Young University)
Ultraviolet Studies of the Components of Cepheid Variables

DCCES - Edward Schmidt (Nebraska)
Ultraviolet Spectroscopy of Bright Cepheids

DCDAH - A. A. Henden (SASC)
An Investigation of the Beat Cepheid TU CAS

DCDNE - Nancy Remage Evans (Toronto)
Ultraviolet Spectroscopy of the Binary Cepheid SU Cygni

DCEEB - Erika Bohm-Vitense (Washington)
Observation of Ultraviolet Light VAriations of POP II Cepheids

DCEES - Edward G. Schmidt (Nebraska)
Ultraviolet Spectroscopy of Bright Cepheids

DCFCS - Conrad R. Sturch (CSC)
Ultraviolet Observations of Three Dwarf Cepheids

DCFSP - Sidney B. Parsons (NASA/GSFC)
Chromospheres of Type I and Type II Cepheids of Long Period

DCGEB - Erika Bohm-Vitense (Washington)
Variations of POP. II Cepheid UV Energy Distributions

DCGNE - Nancy Remage Evans (CSC)
The Mass of the High Luminosity Ceoheid T Monocerotis

DCHDM - Dermott J. Mullan (Delaware)
A Study of Mass Loss in a Long-Period Cepheid Variable

DCHNE - Nancy Remage Evans (CSC)
Reddening and Temperature Scales for Cepheids

DCIES - Edward G. Schmidt (Nebraska)
Chromospheres of Delta Scuti Stars

DCINE - Nancy Remage Evans (CSC)
Long Period and Overtone Cepheids

DCKEB - Erika Bohm-Vitense (Washington)
Emission Lines of the Long Period Cepheid L Carinae

DCKNE - Nancy Remage Evans (Canada)
The Cepheid + Supergiant Eclipsing System BM Cas

DCKTT - Terry J. Teays (CSC IUE)
Cepheid Temperatures: Delta Cephei

DCLDS - Dimitar D. Sasselov (Canada)
Quantitative Chromospheric Diagnostics in Cepheids: Zeta Gem

DCLNE - Nancy Remage Evans (Canada)
The Mass of the Cepheid SU Cygni

DCLTT - Terry J. Teays (CSC)
The Unique Type II Cepheid Ru Cam

DCMNE - Nancy Remage Evans (Canada)
The Mass of the Cepheid SU Cygni

DCMTT - Terry J. Teays (CSC - IUE)

Cepheid Temperatures

DCNNE - Nancy Remage Evans (York University - Canada)
Classical Cepheid Luminosities

DCOHB - Howard E. Bond (STScI)
White-Dwarf Companions of Dwarf Carbon Stars

DCPCI - Catherine L. Imhoff (CSC - Astronomy Programs)
Star Formation in the Taurus-Auriga Dark Clouds

DD517 - D. Dravins (Lund)
Coronal Transition Region in the Solar-Type Star Beta Hydri

DEOGC - Geoffrey C. Clayton (Colorado - CASA)
Catching It In the Act: Predictable Declines in V854 Centauri

DEPGC - Geoffrey Clayton (University of Colorado)
Catching it in the Act: Predictable Declines in V854 Centauri

DERDC - Daniella Calzetti (STScI)
Reflection Nebulae as Probes of Dust Extinction in Starburst Galaxies

DF010 - D. R. Flower (France)
Observations of CIII Emission in Planetary Nebulae

DG185 - Daya P. Gilra (Groningen)
Satrs in Dusty HII Regions

DG388 - Daya P. Gilra (Groningen)
UV Observations of HII Regions and Reflection Nebulae

DG389 - Daya P. Gilra (Groningen)
UV Observations of the Hot Companions of Late-Type Stars

DG420 - Daya P. Gilra (Groningen)
HII Regions in the Magellanic Clouds

DG566 - Daya P. Gilra (Groningen)
Study of Peculiar Be Stars

DG567 - Daya P. Gilra (Groningen)
UV Observations of Stars in Dusty HII Regions and Reflection Nebulae

DGDSL - David S. Leckrone (NASA/GSFC)
Ultraviolet Spectroscopy of Dwarf and Giant B-A Stars

DGJTT - Trinh X. Thuan (Virginia)
Bimodal Star Formation in Blue Compact Dwarf Galaxies

DK149 - Detlev Koester (Kiel)
Hot White Dwarfs

DK183 - D. Kunth (ESA)
Compact Emission Line Galaxies

DK360 - D. Kunth (ESA)
Ultraviolet Observations of Low-Redshift Radio Quiet QSOS

DK518 - Detlev Koester (Kiel)
Spectroscopy of White Dwarfs with Helium-Rich Atmospheres

DK602 - D. Kunth (Paris)
Observations of Low-Redshift Radio Quiet QSOS

DLOGM - George E. McCluskey (Lehigh University)
Mass Flow in the Interacting Semi-Detached Binary Delta Librae

DMEJL - Jeffrey L. Linsky (Colorado)
High Dispersion SWP Spectra of Two DME Stars

DMHJL - Jeffrey L. Linsky (Colorado - JILA)
Magnetic Activity in Very Late M Dwarfs: Enhanced or Reduced?

DMHJR - John C. Raymond (CFA)
Active Sectors of YY Gem

DMIJL - Jeffrey L. Linsky (Colorado - JILA)
Coordinated Observations of Stellar Flares

DMIMG - Mark S. Giampapa (NOAO)
Chromospheric and Coronal Emission in DM Stars

DMMSS - Steven H. Saar (Harvard SAO - CFA)
Studies of Intermediate Activity M Dwarfs

DMNDB - David Burstein (Arizona State University)
Detection of Tau Neutrino Decay Photons

DNLCM - Christopher W. Mauche (Los Alamos)
Observations of U Gem in Outburst

DNLRP - Ronald S. Polidan (Arizona)
Slow Rise Symmetrical Outbursts in SS Cyg

DNMRP - Ronald S. Polidan (NASA/GSFC)
Slow Rise Symmetrical Outbursts in SS Cyg

DNOCM - Cathy S. Mansperger (CSC - IUE Observatory)
Orbital Coverage of Dwarf Novae in the Ultraviolet

DNOLW - Lee Anne Willson (Iowa State University)
Dust Nucleation and Mass Loss in Miras - L2 Puppis and V CVn

DNPPS - Paula Szkody (U Washington)
Target of Opportunity: Humps in V503 Cyg

DP552 - D. Ponz (Madrid)
Symbiotic Stars During Activity Phases

DPKDM - Derck L. Massa (ARC)
Dust Above the Galactic Plane

DR148 - D. Reimers (Kiel)
Mass Loss from Supergiants and Giants

DR370 - D. Reimers (Kiel)
Mass Loss of K and G Supergiants/Red Giants with Variable Circumstellar Lines

DR578 - D. Reimers (Hamburg)
Winds and Coronae in Red Giants with Variable Circumstellar Lines

DR580 - D. Reimers (Hamburg)
Mass Loss of Red Giants with Hot Companions and Mass Loss Carbon Stars

DR590 - D. Reimers (Hamburg)
Accretion Disks Around White Dwarfs In Non-Close Binary Systems

DS524 - D. Schoenberner (Kiel)
Ultraviolet Spectroscopy of Extreme Helium Stars

DSERP - Robert J. Panek (CSC)
UV Variability of Delta Scuti Stars

DSGTA - Thomas R. Ayres (Colorado-Lasp)
A Far-Ultraviolet Study of the Bright Delta Scuti Variable Beta Cassiopeia

DSJFW - Frederick M. Walter (Colorado - CASA)
Delta Scuti Stars

DSJTA - Thomas R. Ayres (Colorado - CASA)
Further Studies of Beta Cassiopeiae

DWPSS - Steven N. Shore (CSC - GHRS)
Monitoring the Most Massive Stars

DWRSS - Steven N. Shore (Indiana University - South Bend)
Monitoring the Most Massive Stars in the LMC and the Galaxy

EA007 - S. D'Odorico (Germany)
The Brightest Hot Stars in the Local Group Galaxies M 33 and M 31

EA008 - R. P. Kudritzki (Germany)
Non-Lte Analysis of Central Stars of Planetary Nebulae

EA014 - V. Weidemann (Germany)
Ultraviolet Spectroscopy of White Dwarfs

EA015 - D. Schonberner (Germany)
Pulsational Variability of Extreme Helium Stars

EA024 - H. Nussbaumer (Switzerland)
The Protoplanetary Nebula V 1016 CYG

EA025 - B. Wolf (Germany)
The Brightest Star of the LMC

EA026 - B. Wolf (Germany)
High Resolution UV Spectrograms of the Hubble-Sandage Variable S Dor

EA027 - S. R. Pottasch (Holland)
Continuum Radiation From Hot Central Stars of Planetary Nebulae

EA032 - R. Stalio (Italy)
Simultaneous X-Ray, UV, Optical, Ir Observations of Late-B and Early-A-Type Stars

EA035 - K. Hunger (Germany)
Effective Temperatures of Subdwarf B-Stars

EA051 - R. Freire (France)
Search for Chromospheres in A Type Stars: 1) Slow Rotators A Stars, 2) A Stars in Binary Systems

EA068 - V. Caloi (Italy)
Evolved Globular Cluster Stars

EA069 - Tjin A. Djie (Holland)
Ultraviolet Studies of the Shells of Herbig AE Stars

EA080 - V. Doazan (France)
Simultaneous IUE/Ground-Based/Exosat Observations of BE StarS

EA087 - H. F. Henrichs (Holland)
Short Time Variations in the Mass-Loss Rate of Early Type Stars

EA093 - K. A. Van der Hucht (Holland)
The Iron Curtain of WC9 Stars

EA100 - F. Praderie (France)
Temporal Changes in the Chromosphere of the Herbig AE Star AB Aur

EA107 - F. Praderie (France)
Emission, Mass Loss and Chromospheres in Herbig AE Stars (III)

EA115 - B. Baschek (Germany)
Lambda Bootis Stars

EA137 - M. Perinotto (Italy)
Nuclei of Evolved Planetaries

EA138 - C. Casini (Italy)
Observations of the Interacting Galaxy System NGC 3991, 3994, 3995

EA143 - C. Loore (Belgium)

Simultaneous Exosat/IUE/Ground-Based Studies of O and Wolf- Rayet Stars

EA144 - G. Vauclair (France)
Chemical Composition and Diffusion in High Gravity Stars

EA165 - M. Grewing (Germany)
High Resolution Studies of Planetary Nebulae

EA166 - A. M. Hubert-Delplace (France)
Structure of the Envelope of BE Stars

EA170 - K. S. De Boer (Germany)
Supra BHB Stars in Globular Clusters

EA173 - Angelo Cassatella (Spain)
UV Observations of Three Peculiar Be Stars

EA182 - J. Koppen (Germany)
High Dispersion Observations of Planetary Nebulae

EA213 - K. Nandy (Royal Observatory Edinburgh)
Effective Temperature and Radii of LMC Giants and Main Sequence Early Type Stars

EA226 - A. Evans (United Kingdom)
Development of the 2200A Extinction Feature in Post-Eruptive Novae

EA254 - M. J. Seaton (England)
Planetary Nebulae and Their Central Stars

EA269 - David Giaretta (England)
Mass Loss From Beta Orion and Similar Stars

EBHEG - Edward F. Guinan (Villanova)
Ultraviolet Observations of Eclipsing Binary Systems with Highly Eccentric Orbits

EBHJL - Jeffrey L. Linsky (Colorado - JILA)
The Unique Eclipsing Binary System TZ Fornacis

EBKRP - Ronald S. Polidan (Arizona)
High Ionization Emission Lines in V356 SGR

EBKTA - Thomas B. Ake (CSC)
Atmospheric Eclipsing Binaries: Tau Per

EBLES - Edward M. Sion (Villanova)
Observations of V471 Tauri at Critical Phases

EBMJS - Jorge Sahade (Argentina)
Discrete Absorption Components and Dynamics of Eclipsing Binaries

EBMTA - Thomas B. Ake (CSC - GHRS)
The Eclipse of Gamma Persei

EBMTM - Thomas R. Marsh (STScI)
The Ultraviolet Flux from the Eclipsing Binary, PG1550+131

EBPEG - Edward F. Guinan (Villanova University)
Eclipsing Binaries in the Magellanic Clouds: Fundamental Properties and Distances

EBPTS - Theodore Simon (U Hawaii)
Timing the Eclipse of HD 185510

EBQEG - Edward Guinan (Villanova University)
Eclipsing Binaries in the Magellanic Clouds: Fundamental Properties and Distances

EC004 - K. Fredga (Sweeden)
Stellar Activity Cycle in Beta Hydri

EC013 - B. Gustfsson (Sweden)
SWP Echelle Mode Observations of Two Late-Type Binaries with Extensive Circumstellar Material

EC048 - Osmi Vilhu (Finland)
Period-Activity Relationships in Contact and Related Binaries

EC052 - M. Saxner (Sweden)
Ionizing Radiation in F Dwarfs

EC067 - C. Cacciari (Vilspa)
IUE Observations of a Grid of Population II Standard Stars

EC081 - C. Zwaan (Holland)
Magnetic Structure of F, G, and K Type Stars, II

EC116 - D. Reimers (Germany)
Winds and Coronae in Red Giants

EC123 - B. Reipurth (Denmark)
The Energetics of Herbig-Haro Objects

EC125 - B. Reipurth (Denmark)
Star Formation in a Bok Globule

EC140 - D. Reimers (Germany)
Mass Loss From Red Giants with Hot Companions

EC146 - O. Engvold (Norway)
Emission Measure Analysis of SWP-HI Spectra of Representative Yellow Giants and Red Giants ANd Supergiants

EC152 - F. Querci (France)
Carbon Stars Sequence: R to N Stars

EC175 - Angelo Cassatella (Vilspa)
Ascending Giant Branch to Planetary Nebula Phase: UV Observations of Two Candidates

EC201 - B. F. Madore (Toronto-Canada)
Search for Companions to Non-Pulsating Yellow Supergiants in or Near the Instability Strip

EC202 - C. J. Butler (Northern Ireland)
Simultaneous IUE, Exosat and Optical Observations of Flare Stars

EC206 - E. Budding (England)
Chromospheric Activity in the Short Period Subgroup of RS CVN Stars

EC209 - J. E. Beckman (England)
Magnetic Variability of Late-Type Stars

EC223 - J. R. Walsh (England)
The UV Continuum in NGC 2261 and R Monoceros

EC228 - A. Evans (United Kingdom)
Ultraviolet Observations of RCB Standard Stars

EC232 - C. Jordan (England)
The Structure, Energy Balance and Dynamics of Stellar Chromospheres and Coronae

EC262 - A. D. Andrews (Northern Ireland)
Studies of Spots and Plages in by Draconis-Type Variables Stars

EC267 - Alexander Brown (England)
EUV Studies of Pre-Main-Sequence Stars Coordinated with Exosat and Ground-Based Observations

EC268 - O. K. Moe (Norway)
UV Centre-To-Limb Variations in Solar Type Bright Eclipsing Binaries

EC271 - Michael V. Penston (England)
Mild T Tauri Stars

EC272 - D. J. Stickland (England)
RV Tauri Stars

EC279 - Michael V. Penston (England)
Lyman Alpha and Civ Line Profiles in T Tauri Stars

EC283 - G. E. Bromage (England)
Coordinated Multi-Waveband Study of M-Dwarf Flares

ECHJL - Jeffrey L. Linsky (Colorado - JILA)
A Long Look at Zeta Aurigae During Total Eclipse

ECJMK - Minas C. Kafatos (George Mason University)
IUE Observations of the Cooling Flow in the Cluster A1795

ECRPB - Patricia Boyd (USRA)
Probing an Expanding Shock Wave in Eta Carinae with IUE: The Final Chapter

EE006 - N. Panagia (Italy)
UV Observations of Supernovae

EE010 - Gustavo A. Bruzual (Venezuela)
Ultraviolet Spectrum of Spiral Galaxies

EE037 - G. G. C. Palumbo (Italy)
UV Emission From Normal Bright Spiral Galaxies

EE044 - D. Kunth (France)
Absorption Systems in Lower Redshift Quasars

EE045 - Jean Clavel (France)
Simultaneous UV, X-Ray, and Optical Observations of NGC 4593

EE049 - J. Bergeron (France)
Intermediate Redshift Quasars with a 'BLack-Body UV Component'

EE077 - N. Brosch (Netherlands)
Ultraviolet Spectrophotometry of Galactic Nuclei Under Neighbourhood Density Criteria

EE082 - E. G. Tanzi (Italy)
Coordinated UV, Optical and X-Ray Studies of Selected Qsos and Bl Lac Objects

EE085 - D. Kunth (France)
Wolf Rayet Stars in Dwarf Emission Line Galaxies

EE097 - H. E. Jorgensen (Denmark)
The Central Galaxy NGC 4696 in the Centaurus Cluster

EE098 - B. Rocca-Volmerange (France)
Star Formation and Gas in S0 Galaxies

EE102 - V. Caloi (Italy)
Integrated Spectra of Globular Clusters

EE104 - C. Cacciari (Vilspa)
UV Observations of Haol-Type G;obular Clusters in the Magellanic Clouds

EE130 - B. Marano (Italy)
Ultraviolet Observations of Galaxies with Spiral Structure in the Nucleus

EE148 - J. Bergeron (France)
Spectroscopy of Narrow Line Active Nuclei with Radiative Balmer Decremeny

EE159 - K. H. Fricke (Germany)
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EG546 - E. H. Geyer (Bonn)
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EGAMS - Andrew M. Smith (NASA/GSFC)
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EGBDM - D. L. Meier (CIT)
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EGBMP - M. Peimbert (Universidad Nacional Autonoma de Mexico)
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EGCJH - J. K. Hill (Systems and Applied Sciences)
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EGCMP - M. Peimbert (Madrid)
Physical Conditions in Nuclei of Galaxies and in Extragalactic H2 Regions

EGCTT - Trinh X. Thuan (Virginia)
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EGDCW - Chi-Chao Wu (CSC)
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EGDEW - E.J. Wampler (UC Santa Cruz)
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EGDJC - Judith G. Cohen (CIT)
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EGDJG - J.E. Gunn (Princeton University)
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EGEGB - Gustavo A. Bruzual (C.I.D.A.)
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EGETT - Trinh Thuan (University of Virginia)
Ultraviolet Studies of Strong Nuclear Radio Sources in NormaSpiral Galaxies: Mini-Seyfert Nuclei or Starburst?

EGFJH - John P. Huchra (CFA)
Ultraviolet Spectrophotometry of Hot Galaxies

EGFJM - (UC Santa Cruz)
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EGFKD - Kris Davidson (Minnesota)
UV Spectroscopy of Two Special Extragalactic Objects

EGFPH - Paul W. Hodge (Washington)
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EGGAC - Anne P. Cowley (Arizona State University)
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EGGDE - Dennis C. Ebbets (STScI)
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EGGDY - Donald G. York (Chicago)
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EGGEH - Esther Hu (Space Telescope Science Institute)
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EGGJH - John P. Huchra (CFA)
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EGGSF - Sandra M. Faber (UC Santa Cruz)
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EGGWB - William A. Baan (Arecibo Observatory)
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EGGWR - William Romanishin (NASA/GSFC)
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EGHBA - Bruce M. Altner (A. R. CORP.)
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EGHDW - Daniel W. Weedman (Penn State)
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EGHFB - Frederick C. Bruhweiler (Catholic University)
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EGHGM - Gordon M. MacAlpine (Michigan)
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EGHJH - John P. Huchra (CFA)
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EGHRD - Reginald J. Dufour (Rice University)
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EGHRP - Robert L. Pennington (Minnesota)
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EGHSS - Steven N. Shore (CSC)
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EGIDB - David Burstein (Arizona State Uninversity)
Observations of the UV Energy Distributions of Elliptical Galaxies

EGIJH - Jules P. Halpern (Columbia)
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EGIJS - J. Michael Shull (Colorado - CASA)
Archive Studies of Seyfert Absorption Components

EGIMM - Matthew A. Malkan (CAL LA)
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EGITT - Trinh X. Thuan (Virginia)
The Effects of Cluster Environment on Star Formation in Dwarf Galaxies

EGJDW - Donna E. Weistrop (Applied Research Corp.)
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EGKAD - Anthony C. Danks (ARC)
UV Diagnostics of the Starburst in the Interacting Galaxy Pair ES296-IG11

EGKDB - David Burstein (Arizona State University)
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EGKGR - Gail A. Reichert (CSC IUE)
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EGKRW - Rosemary Wyse (Johns Hopkins)
NGC 6166 An Extreme UV-Excess Elliptical Galaxy

EGKTT - Trinh X. Thuan (Virginia)
Ultraviolet Spectral Synthesis of Starburst Galaxies

EGLAC - Adeline Caulet (NASA/GSFC)
NGC 1275, High Velocity Filamentary System

EGLFB - Frederick C. Bruhweiler (Catholic University)
The Extended NLR of NGC 1068: A Test of Ionization Models

EGLGR - Gail A. Reichert (CSC)
Simultaneous EUV and UV Observations of Active Galaxies

EGMAD - Anthony C. Danks (ARC)
A Study of the Stellar Population in Selected SO Galaxies

EGMAS - Alfred B. Schultz (STScI)
UV Spectroscopy of Starburst Regions in Selected Ring Galaxies

EGMDB - David Burstein (Arizona State University)
UV Energy Distributions of Mildly-Star-Forming Early-Type Galaxies

EGMPH - Paul W. Hodge (Washington)
Galaxies Behind the Magellanic Clouds

EGNES - Evan D. Skillman (U Minnesota)
The Carbon Abundance in SBS 0335-052 and the Time Evolution of C/O

EHEBS - Blair D. Savage (Wisconsin)
A Study of Magellanic Cloud Halo Gas

EHEEJ - E. B. Jenkins (Princeton)
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EHFBM - Bruce Margon (Washington)
A Sensitive Probe for an Extended Galaxian Halo

EHFBS - Blair D. Savage (Wisconsin)
Continued Studies of Magellanic Cloud Halo Gas

EHFCB - C. Stuart Bowyer (Berkeley)
Search for Emission Lines in the Gaseous Halo of Edge-On Galaxies

EHFDY - Donald G. York (Chicago)
Absorption Measures of Gas in Galactic Halos

EHFEJ - Edward B. Jenkins (Princeton)
Lyman-Alpha Halos of Galaxies

EHFFB - Frederick C. Bruhweiler (CSC)
The Lyman Alpha Absorption Forest in QSOS of Intermediate Redshift

EHFWS - Wallace L. Sargent (CIT)
Long Exposure Observations of Extragalactic Objects

EHGEJ - Edward B. Jenkins (Princeton)
Lyman-Alpha Halos of Galaxies

EHJPH - Paul W. Hodge (Washington)
H II Regions in M31

EI012 - G. Klare (Germany)
High Dispersion UV Spectroscopy of the Dwarf Nova TT ARI

EI020 - H. Ritter (Germany)
Ultraviolet Spectroscopy of HZ Her Near X-Ray Eclipse

EI029 - G. Hammerschlag (Holland)
Simultaneous Exosat/IUE/Ground Based Observations of Low Mass X-Ray Binaries: HER X-1, SCO X-1 and CYG X-2

EI030 - G. Hammerschlag (Holland)
Simultaneous Exosat/IUE/Ground-Based Observations of Massive X-Ray Binaries to Study the Interaction Between the X-Rays

EI039 - M. Hack (Italy)
The Atmospheric Eclipsing Binary Epsilon Aurigae

EI060 - J. M. Bonnet-Bidaud (France)
Ultraviolet Observations with IUE of Newly Discovered X-Ray Sources

EI073 - J. Rahe (Germany)
Interacing Binary Systems

EI075 - H. Drechsel (Remeis-Observatory)
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EI079 - J. Krautter (Germany)
Observations of Cataclysmic Variables in Minimum and Maximum State

EI094 - A. C. Fabian (Holland)
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EI099 - A. Altamore (Italy)
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EI105 - W. Wargau (Germany)
Study of X-Ray Emitting Dwarf Novae and Novalike Objects

EI108 - M. W. Pakull (Germany)
LMC X-1 and LE 0501.8-7037 Two Recently Identified Massive X-Ray Binaries in the LMC

EI109 - F. Giovannelli (Italy)
UV Behaviour of SS Cygni During an Outburst

EI110 - F. Giovannelli (Italy)
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EI113 - A. M. Hubert-Delplace (France)
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EI121 - G. F. Bignami (Italy)
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EI127 - C. Kindl (Switzerland)
The Symbiotic Star MH SGE

EI145 - M. Friedjung (France)
Time Variations of PU Vulpeculae (Kuwano's Object)

EI151 - R. M. West (Germany)
The Very Heavy, Symbiotic Star RY Scuti

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The Symbiotic Star HBV 475

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EI203 - M. Groot (Norht Ireland)
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EI215 - J. E. Pringle (England)
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EI273 - D. J. Stickland (England)
The Sometimes Eclipsing WH Star CV Serpentis

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UV Observations of Epsilon Aurigae

EITOO - Esa Too Team (UCL)
Novae as Targets of Opportunity

EJKFB - Frederick C. Bruhweiler (Catholic University)
The Extended (O III) and Starburst Knots in NGC 1068

ELNAM - Andrew G. Michalitsianos (NASA/GSFC)
Coodinated IUE-Groundbased Observations of the Peculiar Object MWC 560

EM063 - H. J. Fahr (Germany)
High Resolution Spectroscopy of the ISW Lyman-Alpha Emission

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Mapping the Variable Extinction in the Extreme Nuclei of the H and X Persei Clusters

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Bright Rims Around Elephant Trunks

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A Far UV Study of Interstellar Matter in the Small Magellanic Cloud

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Properties of Dust in External Galaxies

EM221 - A. Boksenberg (United Kingdom)
High Velocity Gas Motions in the Carina Nebula

EM222 - A. Boksenberg (United Kingdom)
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EM233 - J. Christopher Blades (England)
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EM236 - P. M. Gondhalekar (Rutherford Appleton Labs)
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EM242 - A. J. Willis (England)
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EM264 - J. Christopher Blades (England)
Study of Interstellar Gas Adjacent to Two Spiral Arms

EM282 - M. Pettini (Royal Greenwich Observatory)
A Large Scale Survey of Interstellar Absorption in the Galactic Halo

ENLJR - John C. Raymond (CFA)
The Onset of Cooling in Cygnus Loop Shock Waves

ENMRR - Robert H. Rubin (NASA - AMES)
Silicon and Carbon Abundances in the Orion Nebula

EODCM - Donald C. Morton (Australian Observatory)
Extragalactic and Stellar Spectroscopy

EPEJC - Judith G. Cohen (Cal Tech)
Research on the Stellar Population of Normal Galaxies

EPFJG - John S. Gallagher (Illinois)
High Star Formation Rate Irregular Galaxies and the IMF of Massive Stars

EQFRM - Richard L. Moore (CIT)
UV/Optical/IR Spectropolarimetry of Low Polarization Quasars

ERNEG - Edward F. Guinan (Villanova University)
ER Vul: Laboratory for Studying Solar Magnetic Activity in the Extreme Levels

ES009 - K. H. Fricke (Germany)
The Long-Term Variability of the Lyman Alpha Emission from Jupiter, Saturn, and Uranus

ES058 - C. Festou (France)
Observations of Comets

ES117 - M. Combes (England)
UV Observations of Giant Planets and Their Satellites

ES190 - J. L. Bertaux (France)
Study of the IO Torus

ES284 - D. H. Clark (England)
Coma and Tails of Weaker Comets

ESATO - ( )
Targets of Opportunity

ESCON - ( )
ESA Observatory Contingency Program

ESFWS - Wallace L. Sargent (CIT)
Ultraviolet and Optical Variability in Bright Seyfert 1 Galaxies

ESLGW - George Wallerstein (Washington)
High Resolution Observations of the Eruptive Symbiotic PU Vulpeculae

ESTOO - Eso Too Team (CNRS)
Comets as Targets of Opportunity

ET113 - E. G. Tanzi (Milano)
X-Ray Qso's

ET343 - E. G. Tanzi (Milano)
Observations of X-Ray Emitting Cataclysmic Variables

EVAL1 - ( )
Commissioning Period Program

EVAL3 - ( )
Commissioning Period Program

EVPCA - Carol W. Ambruster (Villanova University)
Simultaneous IUE and EUVE Spectroscopy of the Flare Star EV Lac

EXNDM - Derck L. Massa (Applied Research Corp.)
The UV Extinction Properties of Carina Nebular Dust

EXNDW - Daniel E. Welty (U Chicago)
UV Extinction in High Latitude Clouds. II

EXRKM - Koji Mukai (USRA)
Orbital and Spin Variability of UV Spectra in the Intermediate Polar Ex Hydrae

FA009 - M. Fracassini (Milano)
UV Observations of Blue Stragglers

FA010 - B. Baschek (Heidelberg)
High-Resolution Spectroscopy of Blue Halo Stars

FA011 - J. Koppen (Heidelberg)
High Dispersion Observations of Planetary Nebulae

FA013 - B. Reipurth (Copenhagen)
Star Formation in NGC 5367

FA027 - Heber (Kiel)
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FA032 - A. Wolf (Heidelberg)
Massive Post-Main-Sequence Envelope Objects of the LMC

FA035 - K. Nandy (Edinburgh)
Very Low Excitation (vle) Compact Nebulae in the Magellanic Clouds

FA050 - B. Baschek (Heidelberg)
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FA060 - M. Perinotto (Arcetri)
Mass Loss From Central Stars of Planetary Nebulae

FA074 - Waters (Utrecht)
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FA082 - M. J. Seaton (London)
Lines From Nebular Envelopes of Importance for Spectroscopic Diagnostic and Abundance Determinations

FA083 - M. Barlow (London)
Ultaviolet Spectrophotometry of Planetary Nebulea in the Magellanic Clouds

FA084 - M. Barlow (UCL)
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Evolution of Blue Horizontal Branch and Subdwarf B Stars

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Stellar Wind Variations in the Enigmatic Subluminous Star HD 45166 (QWR+B8V)

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FA114 - R. P. Kudritzki (Munchen)
Non-Lte Analysis of Central Stars of Planetary Nebula

FA115 - R. P. Kudritzki (Munchen)
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FA141 - Molaro (Trieste)
UV Observations of Stars Rotating Very Close to Theoretical Breakup Velocity

FA144 - A. M. Hubert-Delplace (Paris)
Structure of the Envelope of BE Stars

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FA153 - V. Doazan (Paris)
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FA155 - V. Caloi (Frascati)
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FA180 - A. Heck (Vilspa)
Ultraviolet Observations of V348 SGR During Ascending and Descending Phases

FA181 - H. R. Tjin (Amsterdam)
Ultraviolet Studies of the Shells of Herbig Ae and Be Stars

FA183 - J. Christopher Blades (Vilspa)
Absolute Spectrophotometry of Blue Stars for Calibration of Space Instruments, Including Space Telescope

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Study of Blue Stars in the LMC Emission Nebula N 144

FA194 - Antonio Talavera (Meudon)
The Shell Structure of the Herbig AE Star HD 250550

FA195 - G. Praderie (Paris)
Emission, Mass Loss and Envelopes in Herbig AE Stars

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FA255 - H. F. Henrichs (Amsterdam)
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FARAD - Andrea K. Dupree (Harvard CFA - SAO)
Face of Betelgeuse!

FARBP - Bradley M. Peterson (Ohio State University)
International AGN Watch: Variability of the High-Luminosity AGN Fairall 9

FB418 - F. Bertola (Padova)
UV Continuum Energy Distribution in the Nuclear Region of Dwarf Elliptical Galaxies

FB421 - F. Bertola (Padova)
UV Continuum Energy Distribution in the Nuclei of Giant Elliptical Galaxies

FB582 - F. Bertola (Padova)
UV Continuum Energy Distribution in the Nuclei of Elliptical Galaxies

FB584 - F. Bertola (Padova)
UV Energy Distribution of CD Galaxies

FBB24 - F. Bertola (Padova)
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FBBJG - Jesse L. Greenstein (Cal Tech)
IUE Observing Time and Support of Research on Faint Blue Stars

FBBRG - Richard Green (CIT)
A Study of Hot White Dwarfs from the Palomar Green Survey

FBBVK - V. G. Kurt (USSR)
Study of Feige-4

FBCAD - Andrea K. Dupree (CFA)
Accretion on to White Dwarfs

FBCGW - Gary A. Wegner (Penn State)
Ultraviolet Study of Peculiar White Dwarfs

FBCJL - J. D. Landstreet (Western Ontario)
Hot Magnetic White Dwarfs

FBCMS - M. Savedoff (Rochester)
Spectra of Degenerate Stars of Known Mass

FBCRG - Richard Green (Arizona)
A Study of the Low Luminosity Hot Stars from the Palomar-Green Supply

FBCSH - Sara R. Heap (NASA/GSFC)
Hot, Subluminous Stars and Associated Nebulae

FBDAH - Albert V. Holm (CSC)
Phase-Resolved Spectrophotometry of the ZZ Ceti Variable G 29-38

FBDCB - C. Stuart Bowyer (Berkeley)
High Dispersion Observation of HZ 43

FBDCW - Chi-Chao Wu (CSC)
UV Observations of the Probable Stellar Remnant of Supernova AD1006

FBDJL - J. D. Landstreet (Western Ontario)
UV Spectrophotometry of the Magnetic White Dwarf GD 229

FBDRG - Richard F. Green (U Arizona)
Very Hot Pre-Degenerate & Mixed Atmosphere Subdwarfs from the Palomar-Green Survey

FBDTA - Thomas B. Ake (CSC)
UV Observations of the Unseen Companion to Zeta Cancri C

FBEAH - Albert V. Holm (CSC)
Phase-Resolved Spectrophotometry of the ZZ Ceti Variable G29-38

FBPBB - Bernard W. Bopp (U Toledo)
Pulsationally Induced Mass-Dumping in F + B Binaries

FC015 - S. Rucinski (Munchen)
UV Variability of FK Comae

FC016 - K. Fredga (Stockholm)
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FC017 - Pallavicini (Firenze)
Active Chromospheres and Coronae of Late-Type Stars

FC027 - P. L. Bernacca (Osservatorio Astrofisico DI Asiago)
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FC029 - M. Hack (Trieste)
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FC055 - C. Jordan (Oxford)
Coronae and Chromospheres of Cool Giants and Supergiants Dependence on Spectral Type

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FC124 - Oxford (Oxford)
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FC138 - Michael V. Penston (RGO)
Short Wavelength Line Profiles in T TSuri stars

FC142 - M. Fernandez-Figueroe (Madrid)
Chromospheric and Coronal Activity in Regular-Period RS CVN-Like Stars

FC150 - C. Jordan (Oxford)
The UV Variability and Rotational Modulation of T Tauri Stars

FC187 - Osmi Vilhu (Copenhagen)
Simultaneous Exosat and IUE Observations of VW Cep and 44 Boo

FC198 - Mewe (Utrecht)
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FC199 - Reza (Brazil)
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FC201 - L. Bianchi (Torino)
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FC210 - G. F. Gahm (Stockholm)
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FC220 - S. Catalano (Catania)
UV Observations of the Secondary Component of Algol-Type Binaries

FC221 - S. Catalano (Catania)
MG II Emission of MS Stars in Open Clusters

FC225 - O. Engvold (Oslo)
Determination of Absolute Velocities for Emission Lines in Late-Type Stars

FC231 - W. Eichendorf (Munchen)
Masses of Cepheids

FC232 - W. Eichendorf (Munchen)
Classical Cepheids and Their Blue Companions

FC241 - F. Querci (Toulouse)
High Resolution Ultraviolet Spectra of the Carbon Star Tw Hor

FC249 - M. Rodono (Catania)

IUE Observations of Surface Structure of Eclipsing and Non-Eclipsing RS CVN Systems

FC251 - B. Gustafsson (Uppsala)
High Dispersion Study of Luminous Cool Stars

FC254 - C. J. Butler (Arnagh)
Time Scsales of Dwarf Flares

FC265 - M. Querci (Toulouse)
Carbon Stars Sequence: R to N Stars

FC268 - C. Cacciari (Vilspa)
IUE Observations of Pop II Standaed Stars

FD175 - F. D'Antona (Francati)
Hot White Dwarfs

FDJJL - Jeffrey L. Linsky (Colorado - JILA)
First Observations of the Pleiades Transition Region Line Emission

FDLTS - Theodore Simon (Hawaii)
Chromospheric Activity in the Early F Stars

FE002 - F. Fusi-Pecci (Bologna)
The Integrated Spectra of Globular Clusters in M31 and the Fornax Dwarf Galaxy

FE019 - J. Meaburn (J. Meaburn)
A Star Burst

FE021 - P. M. Gondhalekar (RAL)
UV Spectroscopy of Blue Dwarf Galaxies

FE022 - N. Panagia (Bologna)
UV Observations of Supernovae

FE045 - Jean Clavel ( )
IUE Observations of Strong X-Ray Sources Embedded in Otherwise

FE052 - M. H. Ulrich (Munchen)
Observations of Variable Seyfert Nuclei

FE056 - J. Bergeron (Paris)
Study of the Emission Line Profile ans Continuum in Very Blue Quasars of Low Redshift

FE059 - Durret (Paris)
Spectroscopy of High Excitation Narrow Emission Line Galaxies with Radiative Balmer Decrement

FE063 - Jean Clavel (Meudon)
Simultaneous UV, X-Ray and Optical Observations of NGC 4593

FE067 - J. Bergeron (Paris)
Absorption from Companions to Quasars or From the Quasar Itself?

FE070 - M. H. Ulrich (Munchen)
Observations of the Seyfert Galaxy NGC 5548

FE073 - R. S. Ellis (Durham)
Stellar Populations in Lenticular Galaxies

FE086 - Robert Wilson (London)
Rapid Fluctuations in Low-Luminosity Seyfert I Galaxies

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Ultraviolet Variations in Selected Seyfert Galaxies

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A Study of the UV Variations of the Double Quasar

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An Attempt to Apply the Gun Peterson Test to Intergalactic Helium

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UV-Observations of Bright, Compact Open Cluster and Neighbouring Young Globular Cluster of the LMC

FE108 - G. Thompson ( )
Studies of Nuclear Regions of Sersic-Pastoriza Galaxies II

FE112 - H. Norgaard (Copenhagen)
Lyman-Alpha Emission from X-Ray Clusters with Cooling Cores

FE113 - F. Bertola (Padova)
UV Energy Distribution in CD Galaxies

FE130 - Lawrence (RGO)
Completion of UV Observations of an All-Sky Sample of X-Ray Active Galaxies

FE131 - E. J. Pagel (RGO)
Abundances and Excitation Mechanisms in Peculiar Emission-Line Nuclei of Galaxies

FE132 - Michael V. Penston (RGO)
Continued Monitoring of NGC 4151

FE137 - T. Snijders (RGO)
A Study of Ultraviolet Variability of Seyfert 2 Galaxies

FE139 - Michael V. Penston (RGO)
Long Exposure Observations of Extragalactic Sources

FE148 - M. H. Ulrich (Munchen)
Observations of a Bl Lac Object

FE156 - V. Caloi (Frascati)
Integrated Spectra of Globular Clusters

FE162 - Kollatschny (Gottingen)
Variability of AKN 120

FE164 - K. H. Fricke (Gottinger)
Barred Spirals with X-Ray Nuclei

FE174 - Treves/Maraschi (Milano)
Simultaneous UV and X-Ray Observations of Active Galactic Nuclei

FE176 - E. G. Tanzi (Milano)
Coordinated UV and Optical Observations of Bl Lac Objects

FE177 - C. Casini (Milano)
Star Formation in Irregular Galaxies

FE178 - P. Benvenuti (Vilspa)
A Search for UV Variability in the Clumpy Irregular Galaxy Markarian 297 (=NGC 6052)

FE182 - J. Christopher Blades (Vilspa)
Near Ultraviolet Observations of the High-Redshift BL LAC Object 0215+015

FE184 - J. Christopher Blades (Vilspa)
Observations of Lyman Alpha Haloes of Galaxies, Using Qsos as Background Probes

FE191 - M. Grewing (Tubingen)
Far UV Study of an X-Ray Selected Sample of Active Galactic Nuclei

FE212 - A. C. Fabian (Cambridge)
UV Observations of Star-Forming Coolong Flows

FE223 - D. Cocco (Bologna)
Coordinated Ultraviolet-X Ray Observations of Seyfert Galaxies

FE227 - Joubert (Marseille)
Wolf Rayet Stars in Dwarf Emission Line Galaxies

FE229 - McMahon (Cambridge)
Lyman Continuum Observations of Broad Absorption Line Qsos

FE235 - Bergvall (Uppsala)
Star Formation and Chemical Enrichment in Two Blue Compact Galaxies

FE237 - Per Olof Lindblad (Stockholms Observatorium)
Nuclear Region of the Galaxy NGC 1365

FE243 - F. Bertola (Padova)
UV Energy Distribution of the Dwarf Elliptical Galaxy NGC 205

FE248 - S. d'Odorico (Munchen)
Carbon Abundance in M33 and M31 From Supernova Remnants

FE257 - Willem Wamsteker (Vilspa)
Probing Seyfert I Nuclei Through Observations Over a Large Wavelength Interval

FE258 - Willem Wamsteker (Vilspa)
High Resolution UV Spectra of M 83 (=NGC 5236)

FE260 - Netzer (Tel Aviv)
2000-5000 a Observations of Weak FE II Line Seyferts

FE272 - D. Alloin (Groningen)
Star Forming Activity in Interacting Galaxies

FEGMP - Mirek J. Plavec (UCLA)
Two Iron Stars

FEHTA - Thomas R. Ayres (Colorado-LASP)
How Steady are the Far-Ultraviolet Emissions of the F Stars?

FEJRR - Ronald Remillard (Massachusetts Institute of Technology)
IUE Spectra of AGN with Strong Fe II Emission

FEJRR - Ronald A. Remillard (MIT)
AGN with Strong FE II Emission

FEOJB - Jay A. Bookbinder (Harvard CFA - SAO)
Fe Line Diagnostics of Multiply Shocked Stellar Atmospheres: The Mira S Carinae

FERFB - Frederick C. Bruhweiler (Catholic University)
Multifrequency Observations and Variability of Blazars

FERWZ - Wei Zheng (Johns Hopkins University)
UV Spectra for Super Fe II-Emitters

FF536 - F. Fusi-Pecci (Bologna)
UV-Bright Stars in Globular Clusters

FG004 - ( )
Same as FG006

FG176 - F. Giovannelli (Frascati)
RS CVN Stars

FG177 - F. Giovannelli (Frascati)
HD 245770

FG332 - F. Giovannelli (Frascati)
UV Spectra of HDE 245770/AO535+26

FGILW - Lee Anne Willson (Iowa State)
High Temperature Regions in Cepheid Atmospheres and Winds

FGLWF - Walter A. Feibelman (NASA/GSFC)
FG Sagittae and Its Planetary Nebula

FGNEB - Erika H. Bohm-Vitense (U Washington)
Transition Layers of F and Early G Giants

FGPEG - Edward F. Guinan (Villanova University)
FG Sagittae: Stellar Evolution - Caught in the Act!

FI007 - G. Hammerschlag (Amsresdam)
Simultaneous X-Ray, Ultraviolet and Optical Observations of the AM Her Type System 2A0526-328

FI031 - H. Nussbaumer (Zurich)
The Protoplanetary Nebula V 1016 CYG

FI041 - H. Drechsel (Nuernberg)
High Dispersion Soectroscopy of Interacting Binaries

FI043 - Molaro (Trieste)
Detection of a Gas Stream in Algol

FI048 - G. Hammerschlag (Amsterdam)
Simultaneous X-Ray, Ultraviolet and Optical Observations of Massive X-Ray Binaries in LMC

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The Symbiotic Star HBV 475

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High Resolution and Time Resolved Spectroscopy of Cataclysmic Variables

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UV Observations of Nova-Like Cataclysmic Variables

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High Resolution Spectroscopy of White Dwarf Accreting Systems

FI076 - Angelo Cassatella (Vilspa)
The UV Activity Phase of the Recurrent Nova T CRB

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High Dispersion Spectroscopy of HZ HER: The Nature and Origin of the Emission Lines

FI091 - Robert Wilson (London)
Spectrophotometry of HZ HER: The Accretion Disk

FI094 - A. J. Willis ( )
UV Spectral Variations of HD 50896 (WN5+?) Do WR+Collapsar Systems Exist

FI101 - D. J. Stickland (RGO)
UV Observations of Epsilon Aurigae

FI128 - Michael V. Penston (RGO)
Best Possible UV Line List From RR Tel

FI146 - Koubsky (Ondrejov)
UV Observations of the Interacting Binary CX DRA

FI158 - M. J. Coe (Southampton)
Periodicities in X-Ray Sources

FI166 - A. Altamore (Roma)
The Outburst of AG Draconis

FI175 - L. Maraschi (Milano)
Coordinated X-Ray and UV Observations of Magnetic White Dwarfs in Binaries

FI196 - Heise (Utrecht)
Dwarf Novae in Outburst, Simultaneously with Exosat

FI217 - F. Giovannelli (Frascati)
Mass Loss Rate From a 0535+26/ HDE 245770 System in Quiescence and in Outburst

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Ultraviolet Observations of Newly Discovered X-Ray Sources

FI247 - Krautter Munchen (Germany)
Simultaneous UV, Optical and X-Ray Observations of Cataclysmic Variables

FKFJL - Jeffrey L. Linsky (Colorado - JILA)
High Resolution Spectroscopy of Two FK Comae Stars

FKJFW - Frederick M. Walter (Colorado - CASA)
Spectral Imaging of HD199178

FKLCA - Carol W. Ambruster (Villanova)
Evolution in FK Vomae Stars

FKLJL - Jeffrey L. Linsky (Colorado - JILA)
Ultraviolet Observations of Two Possible FK Comae Stars

FKMCA - Carol W. Ambruster (Villanova)
The Evolution of Coalescence: Spun Down FK Comae Stars

FKNRR - Richard D. Robinson (CSC - GHRS)
Structure and Dynamics of HD32918

FKQDH - David Huenemoerder (Massachusetts Institute of Technology)
Contemporaneous UV, Optical, and X-Ray Observations of FK Com

FLUXL - ( )

FLUXS - ( )

FM004 - J. Welsh (UCL)
Interstellar Studies of the Gas in Galactic Giant HII Regions

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Interstellar Extinction and a Study of Early Type Supergiants in the SMC

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Studies of High Galactic Latitude Gas

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The Extent of the Gaseous Galactic Halo

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Study of The Interstellar Medium in the Scorpius-Ophiuchus Region

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Diagnostics of Velocity Fields, Mass-Loss and Chromospheres in A Type Giants and Supergiants

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Study of the Transition Zone in Late A-Type Stars

FP364 - F. Praderie (Meudon)
Emission, Mass Loss and Chromospheres in Herbig AE Stars

FP534 - F. Praderie (Paris)
Emission, Mass Loss and Chromospheres in Herbig AE Stars II

FP543 - F. Praderie (Paris)
Study of the Transition Zone in Late A-Type Stars

FQ409 - F. Querci (Meudon)
Carbon Stars Sequence: R to N Stars

FQ606 - F. Querci (Paris)
Carbon Stars Sequence: R to N Stars

FS118 - K. H. Fricke (Bonn)
The Long-Term Variability of the Lyman Alpha Emission From Jupiter, Saturn, and Uranus

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Periodic & New Comets

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Spatial Coverage of Jupiter and Saturn

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Spatial Variation of the Plasma Electron Temperature in the IO Torus

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Check of Models of Population II Stars

FS592 - F. Spite (Paris)
Check of Structure and Evolution of Population II Stars

FSCJL - Jeffery L. Linsky (Colorado)
Collaborative Monitoring of a Flare and By DRA Variable Star

FSDJL - Jeffery L. Linsky (Colorado)
High Resolution Spectra of Two Bright Spotted Stars

FSDJR - John C. Raymond (CFA)
Stellar Flares

FSEJL - Jeffrey L. Linsky (Colorado)
Coordinated Observations of Flares on UV Ceti-Type Stars

FSESB - Sallie L. Baliunas (CFA)
Stellar Flares

FSETA - Thomas R. Ayres (Colorado)
The Many Faces of HR 1099

FSFBH - Bernhard M. Haisch (Lockheed)
Temporal Evolution of UV Emission Lines During Flares on DME Stars

FSFMG - Mark s. Giampapa (Aura)
Observations of Flare Activity on Selected DME Flare Stars

FSGBH - Bernhard M. Haisch (Lockheed)
Coordinated Observations of Strllar Flares

FSGKL - Kenneth R. Lang (Tufts University)
IUE and VIA Observations of the Nearby Dwarf M Flare Stars YY Gem, YZ CMI & AD LEO

FSHJL - Jeffrey L. Linsky (Colorado - JILA)
A Phase-Linked Study of Emission Lines in the Flare Star Ev lac

FSHKL - Kenneth R. Lang (Tufts University)
Coordinated IUE and VLA Observations of Dwarf M Flare Stars and RS CVN Type Stars

FSHTA - Thomas R. Ayres (Colorado)
A Deep SWP Echelle Exposure of a Red Dwarf Flare Star: At Microscopii

FSIJL - Jeffery L. Linsky (Colorado)
Mass Motions During a Major Flare on AD Leonis

FSIKL - Kenneth R. Lang (Tufts University)
Simultaneous IUE and VLA Observations of Dwarf M Flare Stars and RS CVN Type Stars

FSJCA - Carol W. Ambruster (Colorado - JILA)
Simultaneous IUE and Magnetic Field Observations of HD 17433

FSKJL - Jeffrey L. Linsky (Colorado - JILA)
Simultaneous Multiwavelength Observations of Stellar Flares

FSKSS - Steven H. Saar (CFA SAO)
Temporal Variability of Magnetic Structures on BD +26 730

FSLJL - Jeffrey L. Linsky (Colorado)
A Coordinated Study of Flares and Active Regions on the by Draconis-Type Star CC Eridani

FSLKC - Kenneth G. Carpenter (NASA/GSFC)
Simultaneous IUE/HST-GHRS Observations of AU MIC

FSMJB - Jay A. Bookbinder (Harvard SAO - CFA)
Stellar Flares on AD LEO: Multiband Observations

FSPEB - Erika H. Bohm-Vitense (U Washington)
Transition Layers of Hyades F Stars

FUMRL - Russel M. Levreault (Wesleyan University)
UV Observations of the "High" State of Z Canis Majoris

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Observations of the "High" State of FU Orionis Variable Z Canis Majoris

FURGP - Geraldine J. Peters (USC)
The Chemical Compositions of Three Fundamental Early B-Type Standards

GA008 - Wolf (Heidelberg)
Massive Post-Main-Sequence Envelope Objects of the LMC

GA009 - Reid (Sussex)
Spectroscopy of Hot White Dwarfs

GA032 - K. Nandy (Edinburgh)
Spectrophotometric Investigation of Very Low Excitation (VLE) Compact Nebulae in the Magellanic Clouds

GA039 - Prinja (London)
Coordinated UV and X-Ray Observations of XI Per

GA056 - R. P. Kudritzki (Munchen)
Non-Lte Analysis of Central Stars of Planetary Nebula

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Rapid Variability in the Stellar Wind of a Subdwarf O-Star

GA079 - A. E. Lynas-Gray (London)
An Analysis of the Subdwarf-B Eclipsing Binary BD-7 3477

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Extreme Horizontal Branch Stars

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Non-LTE Analysis of Subdwarf O-Stars

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UV Observation of White Dwarfs from Hipparcos Program

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Spectral Photometry of Blue Stragglers

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High Dispersion Spectroscopy of the Hot, Pulsating White Dwarf PG1159-035

GA100 - A. J. Willis (London)
Stellar Wind Variations in the Enigmatic Subluminous Star HD 45166 (QWR + B8V)

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Spectral Analysis of Blue Halo Stars

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Blue Edge of the ZZ Ceti Instability Strip

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UV Stellar Classification Programme

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Low Resolution Observations of Apparently Normal, Unreddened High-Latitude, Eleventh Magnitude B Stars

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UV Observations of the Hot Hydrogen-Deficient Star HD 144941

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High Resolution Short Wavelength Observations of the Herbig AE Star HD 250550

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Ultraviolet Studies of the Shells of Herbig AE and BE Stars

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UV Monitoring of the P Cygni Star AG Carinae

GA146 - H. J. Lamers (Utrecht)
Probing the Wind of P Cygni by Studying the Variable Shell of 1983-84

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The Hot End of HB in Galactic Globular Clusters

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Absolute Spectrophotometry of Faint Blue Stars for Calibration of the Space Telescope

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Energy Distrubution of BE/Shell Stars

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Simultaneous Voyager, IUE, Visual Observations of Active BE Stars

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Variable Chromospheric Activity in the Herbig AE Star AB Aur

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Hot-Extreme-Soft X-Ray Emitting White Dwarfs

GANLD - Laura Danly (STScI)
IUE Observations of a Possible Galactic Chimney

GAPDT - David A. Turnshek (U Pittsburgh)
Damped Lyman-alpha Absorption from Galaxies with Redshift < 1.6

GARAL - A. Lonne Lane (JPL)
Mid-UV Spectroscopy of the Galilean Satellites

GARKS - Kenneth R. Sembach (MIT)
Kinematics of Halo Gas: IUE Spectroscopy of Five Distant Stars

GARRH - Robert C. Hartman (NASA/GSFC)
Coordinated UV Observations of Gamma-Ray Selected Blazars

GATOO - ( )
Hot Stars (A and Hotter) Observed as Too

GB594 - G. F. Bignami (Milano)
Investigation on the Binary Nature of the Radio and X-Ray Star LSI+61 303

GC011 - S. Rucinski (Cambridge)
MG II Emission in Shortest Period Contact Binaries

GC023 - M. hack (Trieste)
The Atmospheric Eclipsing Binary Epsilon Aurigae

GC024 - D. Reimers (Hamburg)
Mass Loss of Red Giants with Hot Companions

GC025 - J. E. Beckman (London)
Chromospheric Modelling of Late-Type Dwarfs

GC026 - D. Reimers (Hamburg)
Winds and Coronae in Red Giants

GC027 - D. Reimers (Hamburg)
High-Resolution Study of C III and SI III Lines in Hybrid Stars

GC028 - S. Rucinski (Cambridge)
Effects of Binarity and Age in the Chromospheric Activity of Rapidly Rotating Very Late-Type Stars

GC072 - D. Dravins (Lund)
Stellar Activity Cycle in Beta Hydri

GC075 - L. Bianchi (Torino)
IUE Observations of FK Comae Stars with Simultaneous Ground-Based

GC083 - L. Bianchi (Torino)
Observations of Orion Variables Emitting Soft X-Rays

GC084 - L. Bianchi (Torino)
UV Observations of Active Late-Type Stars (Newly Identified Soft X-Ray Emitters)

GC089 - O. Engvold (Oslo)
Limb Crossing of an Active Region on Sigma Gem

GC090 - O. Engvold (Oslo)
A Precise Radial Velocity Study of SI III) Lambda 1892 and C III) Lambda 1909 Emission of Beta Draconis Winds or Antiwin

GC091 - O. K. Moe (Oslo)
Atmospheric Inhomogeneities in Late Type Dwarf Stars

GC103 - Fernandez (Madrid)
Stellar Activity in Regular-Period RS CVN-Like Stars

GC108 - Reza (R. De Janeir)
Simultaneous Ground Based and UV Observations of Post T Tauri Stars

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Ultraviolet Study of Chamaeleon T Association

GC134 - Deasy (Dublin)
Mass-Loss of Cepheid Variables

GC135 - Doyle (Ireland)
Atmospheric Structure of RS CVN Stars

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Orange Giants of Fundamental Importance

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Simultaneous X-Ray, Ultraviolet, Optical and Infrared Observations of RU Lupi

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High Resolution Ultraviolet Spectra Of Cool Carbon Stars

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The Chromospheres, Coronae and Winds of Hybrid Bright Giants

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The Chromospheres, Coronae and Winds of Low Gravity Stars

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The Evolution of Stellar Chromospheres

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Chromospheres of Red Giant Stars in Globular Clusters

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High and Low Dispersion Spectral Study of Active Regions in RS Canum Venaticorum Systems

GC199 - V. Doazan (Paris)
The L1551 IRS5 Jet

GC219 - Stalio (Trieste)
UV Observations of T Tauri Stars

GC230 - C. Zwaan (Utrecht)
The Interacting Binary HD 352 (5 CET)

GC231 - C. Zwaan (Utrecht)
Outer Atmospheres of Evolved Starss of Low Activity

GC243 - Rodono (Catania)
Coordinated Ultraviolet, Optical and Radio Study of Stellar Flares

GC245 - S. Catalano (Catania)
MG II Emission of MS Stars in Open Clusters

GC246 - S. Catalano (Catania)
Short Wavelength High Dispersion Observations of the Giants HD 85444 and HD 141714

GC250 - M. Querci (Toulouse)
Carbon Stars Sequence: R to N Stars

GC262 - A. Evans (Keele)
Ultraviolet Observations of RCB Stars

GCBAC - Authur D. Code (Wisconsin)
Ultraviolet Studies of Horizontal Branch Stars and of Globular Clusters in the Milky Way and The Magellanic Cloud

GCBHG - Herbert Gursky (Optical and Infrared Astronomy)
Observation of Ultraviolet Cores in Globular Clusters with IUE

GCCAC - Authur D. Code (Wisconsin)
UV Studies of Globular Clusters in the Magellanic Clouds

GCCJG - J. E. Grindlay (Harvard)
Globular Clusters and X-Ray Bursters

GCCTM - Terry Matilsky (Rutgers University)
Observation of Ultraviolet Emission from Globular Clusters Using IUE

GCDAC - Authur D. Code (Wisconsin)
Study of the UV Population in Globular Clusters of the Magellanic Clouds

GCFRZ - Robert Zinn (Yale University)
Integrated Spectra of Globular clusters in M31 and the Fornax Dwarf Galaxy

GCGAD - Andrea K. Dupree (CFA)
Chromospheres of Red Giants in Globular Clusters

GCGBA - Bruce M. Altner (A. R. CORP.)
UV Properties of Blue Horizontal Branch Globular Clusters

GCHAC - Anne P. Cowley (Arizona State University)
The Stellar Content of M31 Globular Clusters

GCHRB - Roger A. Bell (Maryland)
IUE Observations of Globular Clusters

GCHRK - Richard G. Kron (Chicago)
Integrated Spectra of Globular Clusters in M31

GCIBA - Bruce M. Altner (A. R. CORP.)
Advanced Evolution in BHB Globular Clusters

GCIRB - Roger A. Bell (Maryland)
Globular Cluster Studies

GCJAD - Andrea K. Dupree (CFA SAO)
Giants in Globular Clusters

GCJBA - Bruce M. Altner (Applied Research Corp.)
Further IUE Investigations at the Core of M 79

GCJJS - J. Micheal Shull (Colorado - CASA)
IUE Observations of Collapsed-Core Globular Clusters

GCKAC - Anne P. Cowley (Arizona State University)
Intermediate-Age Clusters in the Large Magellanic Cloud

GCKBA - Bruce M. Altner (ARC)
Two Dimensional Spatial Analysis of Globular Cluster Cores

GCLAC - Anne P. Cowley (Arizona State University)
Evolved Clusters in the Large Magellanic Cloud

GCLRR - R. Michael Rich (Columbia University)
Ultraviolet Spectroscopy of Galactic Globular Clusters

GCMRR - R. Michael Rich (Columbia University)
Ultraviolet Spectroscopy of Galactic Globular Clusters

GCPKC - Kwang-Ping Cheng (NASA/GSFC)
The Brightest Star in M79 at 1500 Angstroms: A future White Dwarf?

GD2GH - Graham Hill (Dominion Astrophysical Observatory)
Gravity Darkening in Rotating Stars

GDHBS - U. Wisconsin (Wisconsin)
Studies of Interstellar Gas in the Galactic Disk and Halo

GDJWC - Webster C. Cash (Colorado - CASA)
Simultaneous UV/EUV Observation of Capella and G191B2B

GDKEG - Edward F. Guinan (Villanova)
HD 129333

GDKJC - Jean-Pierre Caillault (Georgia)
MGI I Observations of Solar-Type Stars in the Hyades and Pleiades

GDKTS - Theodore Simon (Hawaii)
Chromospheric Activity of Hyades Dwarfs

GE010 - R. S. Ellis (Durham)
Stellar Populations in Lenticular Galaxies

GE030 - M. Ward (Cambridge)
A Study of the Excitation Mechanisms in Galaxies Showing Strong Line Emission

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Ultraviolet Spectrophotometry of Hot Galaxies

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The Nucleus of NGC 1705

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Stellar Winds in Nearby Galaxies

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UV Observations of Supernovae

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Reconstruction of the Hot Stellar Population in the Giant HII Region NGC 604

GE118 - Joseph (London)
Ultraviolet Observations of Interacting Galaxies

GE125 - Rosa (Munich)
Extragalactic HII Regions

GE136 - Olofsson (Sweden)
Evolution and Chemical Enrichment in Blue Compact Galaxies

GE149 - Angelo Cassatella (Vilspa)
The Stellar Content of Young Open and Globular Clusters in the

Magellanic Clouds

GE157 - J. Christopher Blades (Baltimore)
Observations of Lyman-Alpha Halos of Galaxies, Using Qsos as Background Probes

GE173 - F. Bertola (Padova)
Metallicity and the Level of the UV Rising Branch in Elliptical Galaxies

GE228 - Deharveng (Marseille)
Lyman Alpha Emission in Blue Compact Emission Line Galaxies

GE251 - Israel (Leiden)
Two Unique Objects in the Large Magellanic Cloud

GE252 - Willem Wamsteker (Vilspa)
High Resolution UV Spectra of NGC 5236 (=M 83)

GE255 - Panagia (Bologna)
OB Assocition Contamination in Spectra of SN Evans 1983 in M 83

GETOO - ( )
Extragalactic Objects Observed as Too (SN...)

GG005 - G. F. Gahm (Stockholm)
Ultraviolet Spectrum of T Tauri Stars

GG116 - G. F. Gahm (Stockholm)
T Tauri Stars

GG140 - G. Gaida (Heidelberg)
BL Lac Objects

GG162 - G. Galleta (Padova)
Dusty Galaxies

GG354 - G. Gaida (Heidelberg)
Ultraviolet Continuum Study of BL Lacertae Objects

GG365 - G. F. Gahm (Stockholm)
Exploration of the Ultraviolet Spectrum of T Tauri Stars

GG591 - G. F. Gahm (Stockholm)
Exploration of Ultraviolet Spectrum of Young Stars

GH141 - G. Hammerschlag (Amsterdam)
X-Ray Binaries

GH197 - G. Henriksson (Uppsala)
Cepheid Multiple Systems

GH309 - G. Hammerschlag (Amsterdam)
IUE Observations of X-Ray Binaries

GH504 - G. Hammerschlag (Amsterdam)
IUE Observations of X-Ray Binaries: High Resolution Observations of SMC X-1

GH506 - Cas (G. Hammerschlag)
Short Time Variations in the Mass-Loss Rate of Early Type Stars: The Case Of

GHDBS - Blair D. Savage (Wisconsin)
Studies of Gas in Galactic Halos

GHDDY - Donald G. York (Princeton)
Absorption Measures of Gas in Galactic Halos

GHDTG - Theodore R. Gull (NASA/GSFC)
Long Exposure Observations of Extragalactic Objects

GHEBS - Blair D. Savage (Wisconsin)
Continued Studies of Milky Way Halo Gas

GHEDY - Donald G. York (Princeton)
Absorption Measures of Gas in Galactic Halos

GHEST - Scott D. Tremaine (MIT)
The Extent of a Hot Gaseous Galactic Halo

GHFBS - Blair D. Savage (Wisconsin)
Investigation of Motions in the Gaseous Galactic Halo

GHFFB - Frederick C. Bruhweiler (Catholic University)
An Ultraviolet Search for High Velocity Gas at High-Galactic Latitudes

GHFLH - Lewis M. Hobbs (Chicago)
The Distrubution of Interstellar Gas in the Galactic Halo

GHFST - Scott D. Tremaine (MIT)
The Extent of a Hot Gaseous Galactic Halo

GHGBS - Blair D. Savage (Wisconsin)
The Galactic Distribution of Halo Gas

GHGDY - Donald G. York (Chicago)
Very Low H I Column Densities in the Halo

GHGFB - Frederick C. Bruhweiler (Catholic University)
An Ultraviolet Search for High Velocity Gas Toward the South Galactic Pole

GHGLH - Lewis M. Hobbs (Chicago)
The Distrubution of Interrstelar Gas in the Galactic Halo

GHHBS - Blair D. Savage (Wisconsin)
Investigations of Motions in the Gaseous Galactic Halo

GHHDY - Donald G. York (Chicago)
IUE Proposal for 1985-1986 Observing Year CIV in Galactic Halos

GHIBS - Blair D. Savage (Wisconsin)
Motions of High Latitude Halo Gas

GHICW - Chi-Chao Wu (CSC)
Galactic Absorption From Low Dispersion Spectra of Active Galaxies

GHIDY - Donald York (University of Chicago)
IUE Proposals for 1986-1987 Observing Year CIV in Galactic Halos

GHJAS - Andrew Smith (NASA/GSFC)
Observations of Resonance Scattering in Galactic Coronae

GHKBS - Blair D. Savage (Wisconsin)
Halo Gas Toward Three Very Distant Stars

GHKLD - Laura Danly (STScI)
Outflowing Gas Toward SGP

GHLLD - Laura Danly (STScI)
IUE Observations of Clouds in the Milky Way Halo

GHNBS - Blair D. Savage (U Wisconsin - Madison)
Galactic Radial Inflow/Outflow of Highly Ionized Gas

GHNJC - Jason A. Cardelli (U Wisconsin - Madison)
Characteristics of Extinction in the Disk and Halo Gas

GHOJD - John S. Drilling (Louisiana State University)
UV Spectroscopy of Very Hot Stars in the Galactic Halo

GHPJD - John S. Drilling (Louisiana State University)
UV Spectroscopy of Very Hot Stars in the Galactic Halo

GHPKS - Kenneth R. Sembach (MIT)
Searching for the Base of the Galactic Halo

GHQKS - Kenneth Sembach (Massachusetts Institue of Technology)
IUE Observations of High Ionized Gas in Interarm Regions at the Base of the Galactic Halo

GI004 - D. J. Stickland (RGO)
The Eclipse of Epsilon Aurigae

GI007 - Nussbaumer (Zurich)
The Protoplanetary Nebula V1016 CYG

GI013 - H. Nussbaumer (Zurich)
The Symbiotic Star HBV 475

GI031 - Keith Horne (CAmbridge)
IUE Observations of Eclipsing Cataclysmic Variables

GI041 - Mason (Mullard)
IUE Observations of High-Inclination Close Binary Systems

GI042 - Howarth (London)
Changing Physical Conditions in the X-Ray Binary HZ HER/HER X-1

GI074 - L. Bianchi (Torino)
Phase Resolved Spectra of LMC X-1

GI110 - Elia Leibowitz (Tel Aviv)
Simultaneous IUE-Ground Base Observations in Symbiotic Stars

GI147 - Angelo Cassatella (Vilspa)
UV Observations of Classical Novae

GI155 - Hill (St. Andrews)
The Eclipsing Cataclysmic Variables V2051 OPH and PG1012-029

GI156 - H. Drechsel (Bamberg)
Interacting Binaries

GI172 - B Kohoutek (Hamburg)
An Ultraviolet Study of Two Bipolar Planetary Nebulae

GI178 - Hassall (Vilspa)
Phase-Resolved Observations of UV Superhumps During Dwarf Nova Superoutbursts

GI184 - A. J. Willis (London)
Electron Scattering and Photoionisation Variations in Sco X-1

GI215 - Bonnet-Bidaud (Meudon)
Ultraviolet Observations of Newly Discovered X-Ray Sources

GI224 - L. Maraschi (Milano)
Coordinated X-Ray and UV Observations of Magnetic White Dwarfs in Binaries

GI233 - V. D. Woerd (Utrecht)
The 67-Min Period in EX HYA

GI234 - Heise (Utrecht)
Dwarf Novae in Outburst, Simultaneously with Exosat

GI235 - Heise (Utrecht)
AM HER Revisited, Simultaneous with Exosat

GIJBS - Blair D. Savage (Wisconsin)
Infalling Gas Toward the NGP

GITOO - ( )
Interactions Studies in Hot Objects Observed as Too (Novae...)

GK570 - G. Klare (Heidelberg)

Orbital Phase Dependent UV Spectroscopy of Cataclysmic Varia

GKJBS - B.D. Savage (Wisconsin-Madison)
Kinematics of Galactic Halo Gas

GKJTS - Theodore Simon (NASA/GSFC)
Chromospheric Activity in the Pleiades Cluster

GKOJW - J. Craig Wheeler (U Texas - Austin)
Synoptic Observations of GK Persei

GLOBC - (ESA)
UV Observations of Globular Clusters in Galaxies Members of the Local Group

GM015 - Bates (Belfast)
High Velocity Gas Associated with Galactic Radio Loops

GM021 - Schmutz (Zurich)
The Neighbourhood of the Wolf-Rayet Star Ez Cma

GM036 - W. Somerville (London)
Interstellar Matter in Ob Associations

GM037 - W. Somerville (London)
Interstellar Molecular Lines

GM040 - Innes (London)
Investigation of the Remnant Shell of the North Polar Spur Supernova

GM045 - M. Gerbaldi (France)
UV Observation of AP Stars

GM045 - Nandy (Edinburgh)
Interstellar Extinction and a Study of Early Type Supergiants in the SMC

GM081 - R. M. West (Manchester)
A Large Scale Survey of Interstellar Absorption in the Galactic Halo

GM097 - J. Koppen (Heidelberg)
High Dispersion Observations of Planetary Nebulae

GM106 - Harris (Vilspa)
Studies of Near-Halo Gas

GM115 - Clegg (London)
Observations of Halo Planetary Nebulae

GM116 - Clegg (London)
Profiles of Resonance Lines in Planetary Nebulae Produced By Scattering and By Velocity Fields

GM138 - Mundt (Heidelberg)
Formation of UV Continua and Faint Emission Lines in Herbig-Haro Objects

GM148 - E. H. Geyer (Bonn)
Intervening Gas Investigations by IUE Observations of the UV-Bright Central Object in NGC 2018 and Other Young Globular

GM163 - Van Der Hucht (Utrecht)
Search for Circumstellar UV Extinction Towards Stars with Cool Circumstellar Dust

GM180 - L. Prevot (Marseille)
A Far UV Extinction of Heavily Reddened Stars in the LMC

GM183 - M. Grewing (Tubingen)
Three Dimensional Mapping of the Nearby Interstellar Medium By Combined Ultraviolet and Optical Spectroscopy

GM190 - Gry (Vilspa)
Study of the Physical Conditions of the Interstellar Matter Between The Sun and Sirius

GM195 - M. Grewing (Tubingen)
Observations of IC 4406, NGC 6326, NGC 6629, and NGC 6833

GM207 - M. Pettini (RGO)
Expanding Shells of Interstellar Gas Around Ob Associations

GM208 - M. Pettini (RGO)
Distances of 21 Centimeter High Velocity (OORT) Clouds

GM236 - Boer (Tubingen)
Diffuse Light Near Zeta Orionis

GM248 - Molaro (Trieste)
Study of the Local Interstellar Medium Through MG II Absorptions

GM261 - S. R. Pottasch (Groningen)
Observations of Planetary Nebulae with Anomalously High Neon Abundance

GMTOO - ( )
Interstellar Studies Observed as Too

GP036 - G. C. Perola (Milano)
Galaxies in the Clusters Coma, Hercules and A 2199

GP117 - G. C. Perola (Milano)
Emission Line Galaxies

GP613 - U. Palumbo (Bologna)
UV Emission from Normal Bright Spiral Galaxies

GPHPH - Paul W. Hodge (Washington)
UV Observations of NGC 205

GPJCM - D. Christopher Martin (Columbia University)
Anomalous Ultraviolet Extinction

GPTLP - Thornton Page (Johnson Space Center)
Galaxy Population and Intergalactic Gas

GQ017 - H. Norgaard (Copenhagen)
Diffuse Lyman Alpha Emission from Dominant Galaxies

GQ052 - M. H. Ulrich (Munchen)
Observations of 2 Variable Seyfert Nuclei

GQ058 - P. M. Gondhalekar (RAL)
UV Spectrophotometry of Quasar Q1011 + 25 (TON 490)

GQ060 - P. M. Gondhalekar (RAL)
UV Spectrophptometry of Compact Radio Nuclei of Nearby Galaxies

GQ064 - Kollatschny (Gottingen)
The UV Line Spectrum of the Seyfert I Galaxy ESO 438-G9

GQ068 - Kollatschny (Gottingen)
Multiple Nucleus Seyfert Galaxies

GQ113 - J. Bergeron (Paris)
Existence of a Nearby LY Alpha Forest Absorber?

GQ114 - J. Bergeron (Paris)
Degree of Excitation of the Sharp Absorption Line Systems of Lower Redshift Observed in Quasar Spectra

GQ127 - Jean Clavel (Meudon)
Simultaneous UV, X-Ray and Optical Observations of NGC 4593

GQ158 - J. Christopher Blades (Baltimore)
UV Spectroscopy of Emission Line Gas in the Central Galaxies of X-Ray Luminous Clusters

GQ175 - A. C. Fabian (Cambridge)
Observations of Cooling Flow Galaxies

GQ185 - Tadhunter (RGO)
Ultraviolet Observations of the Radio Galaxy 2152-69

GQ186 - Tadhunter (RGO)
Ultraviolet Observations of the Radio Galaxy NGC 1052

GQ202 - Lawrence (RGO)
UV Observations of Liners with Known IR and X-Ray Excesses

GQ203 - Boisson (Meudon)
UV Observations of a Complete X-Ray Selected Sample of Active Galaxies

GQ205 - Michael V. Penston (RGO)
Continued Monitoring of NGC 4151

GQ225 - E. G. Tanzi (Milano)
Coordinated UV and Optical Observations of Bl Lac Objects

GQ226 - A. Treves (Milano)
Coordinated UV and X-Ray Observations of Seyfert Galaxies and Qsos

GQ229 - McMahon (Cambridge)
Lyman Continuum Observations of Broad Absorption Line Qsos

GQ260 - D. Kunth (Paris)
Extrinsic Absorption Systems in QSO PKS 1327-206

GQJBO - Beverley J. Oke (California Institute of Technology)
Ultraviolet Spectroscopy of Peculiar Galaxies

GQJRG - Richard F. Green (KPNO)
Quasars in Rich Clusters of Galaxies

GQTOO - ( )
Extragalactic Objects Observed as Too (AGN,QSO,...)

GS048 - J. L. Bertaux (Verrieres)
The Stability of the IO Torus

GS050 - J. L. Bertaux (Verrieres)
Deuterium in the Upper Atmosphere of Venus + Monitoring of SO2 in Upper Atmosphere

GS054 - K. H. Fricke (Bonn)
The Long-Term Variability of the Lyman Alpha Emission From Jupiter, Saturn, and Uranus

GS104 - Combes (Meudon)
Search for H2 Aurora and Acetylene on Uranus and Neptune

GS188 - Richard L. Moore (London)
Spatially Resolved Observations of Saturn and Jupiter at 1700-1900 A and 2100-2600 A

GS227 - M. Wallis (Cardiff)
Periodic and New Comets

GS258 - C. Festou (Paris)
Variability Time Scale of Lyman Alpha from Uranus

GS264 - A. Evans (Keele)
Ultraviolet Extinction Properties of Cometary Dust

GSNAB - Alexander Brown (Colorado - JILA)
A Magnitude-Limited Survey of Single Non-Variable G Supergiants

GV111 - G. Vauclair (Meudon)

High Gravity Stars

GV308 - G. Vettolani (Bologna)
UV Study of Two New Emission-Line Galaxies: UGC 3829 and NGC 1106

GV346 - G. Vauclair (Meudon)
Chemical Composition and Diffusion in Hot High-Gravity Stars

GV555 - G. Vauclair (Paris)
Chemical Composition and Diffusion in High Gravity Stars

GXIJS - John T. Stocke (Colorado - CASA)
Anomalous X-Ray Selected Stars

Germa - W. Eichendorf (Germany)
Classical Cepheids

HA023 - G. Vauclair (Toulouse)
Blue Edge of the ZZ Ceti Instability Strip

HA024 - K. H. Fricke (Gottingen)
UV Observations of a Soft X-Ray Emitting White Dwarf

HA047 - V. Doazan (Paris)
Far UV Changes Associated with the Visual Variability Pattern of BE Stars

HA048 - V. Doazan (Paris)
Far UV Study of Non-Radially Pulsating B Stars

HA053 - Michael Barylak (Vilspa)
The P CYG Star AG Carinae

HA061 - Nancy D. Morrison (St Andrews)
The Hydrogen-Deficient Star LSSI922

HA084 - Tjin A Djie (Amsterdam)
Observation of Chromospheric and Transition Region Line Profiles in the Spectrum of the Herbig AE Stars HR 5999 A BN OR

HA085 - The (Amsterdam)
Ultraviolet Studies of the Shells of Herbig Ae and Be Stars

HA102 - R. Freire (Strasbourg)
Search for Delimitations of the LY Alpha and Chromospheric Emission Between A and F Stars

HA108 - B. Westerlund (Uppsala)
A Search for Signs of Self-Propagating Star Formation in the Large Magellanic Cloud

HA124 - R. P. Kudritzki (Munchen)
Non-Lte Analysis of the Central Stars of Planetary Nebula

HA146 - D. Schoenberner (Kiel)
Spectral Photometry of Blue Stragglers

HA158 - Heber (Kiel)
The Evolution of Early-Type Bub-Dwarf and Blue Horizontal Branch Stars

HA164 - K. Nandy (Edinburgh)
A Study of Galactic Very Low Excitation (VLE) Compact Nebulae

HA168 - A. E. Lynas-Gray (UCL)
A New Distance Determination for the RR Lyrae Star X Arietis

HA169 - Prinja (UCL)
Short-Time Variations in the Stellar Winds of Luminous Early Type Stars

HA172 - A. J. Willis (UCL)
Rapid UV Variability in WR Stars Evidence for Pulsations?

HA173 - A. J. Willis (UCL)
Short Period Photospheric & Wind Variations in HD 45166

HA174 - A. J. Willis (Willis)
The Extreme O-Star AZ 232 in the SMC

HA175 - A. J. Willis (UCL)
The Physical & Chemical Nature of the WN-C Star HD 62910

HA181 - Wolf (Heidelberg)
OFPE/WN 9 Stars in the LMC

HA182 - A. Heck (Strasbourg)
UV Observations of V348 SGR

HA184 - Faraggiana (Trieste)
Search of BEII in CP and Early F Stars Showing Large LI Abundance

HA191 - M. Hack (Trieste)
Hydrogen-Poor Binary Systems

HA193 - Harris (Vilspa)
Absolute Spectrophotometry of Faint Blue Stars for Calibration of the Space Telescope

HA194 - Van Der Hucht (Utrecht)
The Ir-Variable WR Stars HD 192641: Is the Temporary CS Dust Condensation Caused by Stellar Wind Variations

HA196 - Angelo Cassatella (Vilspa)
Hot Superluminous Stars Near the Instability Limit

HA199 - H. J. Lamers (Utrecht)
Probing the Wind of P Cygni by Studying its Variable Shells

HA240 - Catala (Meudon)
Search for NV in the Herbig Star AB AUR

HA246 - F. Praderie (Meudon)
Correlated Short Term Spectral Variability in the Herbig Star AB Aur

HALSS - Steven N. Shore (NMIT)
The Wind of the Herbig AE/BE Star HD 37806

HAMAB - Alexander Brown (Colorado)
HI-RES IUE Observations of HD 104237, The Brightest Herbig AE STA R

HAMTS - Theodore Simon (Hawaii)
Activity Cycle of the Herbig AE Star AB Aurigae

HATOO - ( )
Hot Stars (A and Hotter) Observed as Too

HBCAC - Authur D. Code (Wisconsin)
UV Studies of Horizontal Branch Stars in Globular Clusters of the Milky Way

HBHYK - Yoji Kondo (NASA/GSFC)
Investigation of the Peculiar Secondary Eclipse of the Interacting Binary R Arae

HBJAP - A. G. Davis Phillip (Inst. Sp Obs.)
UV Observations of FHB Stars

HBOAB - Alexander Brown (Colorado - JILA)
Origin of Hydrogen Balmer Emission from Stellar Flares on M Dwarfs

HBOAP - A. G. Davis Philip (Institute for Space Obs.)
Ultraviolet Observations of Field Horizontal-Branch Stars

HC004 - D. Dravins (Lund)
Stellat Activity Cycle in Beta Hydri

HC005 - V. Weidemann (Kiel)
UV Spectroscopy of White Dwarfs

HC009 - L. Bianchi (Torino)
UV and Optical Observations of Active Late Type Stars (Newly Identified X-Ray Emitters)

HC010 - L. Bianchi (Torino)
UV Observations of FK Comae Stars with Simultaneous Optical Photometry

HC016 - Rodono (Catania)
Doppler Imaging of the Chromospheres of AR Lac Components

HC017 - Egret (Strasbourg)
UV Stellar Classification of Pecuuliar Stars

HC018 - D. Reimers (Hamburg)
Chromosphere and Wind of the Metal Deficient Giant HD 6833

HC020 - D. Reimers (Hamburg)
Mass Loss of Red Giants with Hot Companions

HC021 - D. Reimers (Hamburg)
A Long Look at Zeta Aurigae During Total Eclipse

HC030 - Bues (Bamberg)
Atmospheric Abundances of White Dwarfs in Binary and SuspectED Binary Systems

HC031 - Reza (RIO)
Simultaneous Ground Based and UV Observations of Pre Main Sequence Stars

HC036 - Figueroa (Madrid)
Activity in Late Type Stars

HC052 - C. Jordan (Oxford)
The Chromosphere, Corona and Wind of Alpha TRA (k 4 ii)

HC055 - D. Reimers (Hamburg)
Chromospheric Eclipse of the G Supergiant 22 Vul

HC057 - Eriksson (Uppsala)
The Unique Eclipsing Binary System TZ Fornacis

HC058 - C. Jordan (Oxford)
The Mild BA Star Beta UMI (k 4iii)

HC059 - C. Jordan (Oxford)
High Resolution Spectroscopy and Atmospheric Modelling of Low Gravity Cool Stars

HC060 - C. Jordan (Oxford)
Chromospheric Activity and Spin-Down in the Hertzprung Gap

HC062 - Lago (Porto)
UV Variability of the T Tauri Star RU Lupi

HC071 - White (ESOC)
Simultaneous IUE and Exosat Observations of RS CVN Binaries

HC078 - C. J. Butler (Armagh)
Coordinated IUE, Optical, Exosat & Radio Observations of DME Stars

HC086 - Osmi Vilhu (Helsi)
Effects of Binarity and Age on the Chromospheric Activity of Rapidly Rotating Very Late-Type Stars

HC087 - Lindroos (Stockholm)
UV Investigation of Post-T Tauri Stars

HC088 - C. Jordan (Oxford)
Ultraviolet Observations of Infra-Red Sources in the Iras Mini-Survey

HC090 - C. Jordan (Oxford)
High Resolution Spectroscopy of the PMS Star T Tauri

HC096 - M. Hack (Trieste)
The Symbiotic Star CH Cygni

HC106 - Heintze (Utrecht)
Evolutionary Stages of Some Selected Algols

HC126 - Andersen (Oslo)
Stellar Flare Continua and Emission Mechanisms

HC131 - O. Engvold (Oslo)
A Deep SWP Echelle Exposure of a Red Dwarf Flare Star: At Microscopii

HC135 - J. E. Beckman (Tenerife)
And Active Late-Type Dwarfs

HC141 - Deasy (Dublin)
Mass Loss fron Cepheid Variables

HC161 - Schrijver (Utrecht)
Structural Changes in the Chromospheres of M Dwarfs

HC202 - Querci (Toulouse)
LWP-High Resolution Spectra of the Carbon Star Tw Hor

HC203 - M. Querci (Toulouse)
The Carbon Proto-Planetary Nebula HD 59643

HC204 - Lago (Porto)
UV Observations of T Tauri Stars

HC229 - A. Greve (Iram)
Solar Flux Soectra at 2000-3000 Angstrom, High and Low Resolution

HC230 - Gilmozzi (Vilspa)
UV Behaviour of the Shock Propagation in Mira Variables

HC241 - A. Evans (Keele)
Ultraviolet Observations of RCB Stars

HC248 - Byrne (Armagh)
Study of the Chromosphere/Corona

HCEEB - Erika Bohm-Vitense (Washington)
Search for & Study of Hot Companions of Cepheids

HCEHB - Howard E. Bond (Louisiana State)
A Search for White-Dwarf Companions of Subgiant CH Stars

HCETA - Thomas B. Ake (CSC)
Observations of Cool Giants & Supergiants with Hot Companions

HCFEB - Erica Bohm-Vitense (University of Washington)
Cepheid Companions and Masses

HCFHB - Howard E. Bond (Louisiana State)
A Search for White-Dwarf Companions of Subgiant CH Stars

HCFSP - Sidney B. Parsons (NASA/GSFC)
Mass Ratios of Binary Stars with Luminous Cool Primaries and Hot Secondaries

HCGBC - Bruce W. Carney (North Carolina)
Ultraviolet Observations of Blue Stragglers and Halo K Dwarfs

HCGTA - Thomas B. Ake (CSC)
Observations of Cool Giants and Supergiants with Hot Companions

HCGTT - Trinh X. Thuan (Virginia)
Stellar Populations in Galaxies with Active Star Formation

HCHBB - Bernard W. Bopp (Toledo)
Interacting F + BE Binary Stars

HCHDL - David L. Lambert (Texas)
A Search for White Dwarf Companions of Asymptotic Giant Branch Stars

HCIFF - Francis C. Fekel (Vanderrbilt)
Search for White Dwarf Companions of Chromospherically Active Giants

HCJSK - Scott J. Kenyon (CFA SAO)
Accretion in SY Fornacis

HCJTA - Thomas B. Ake (CSC)
Hot Companions to S and MS Stars

HCKEB - Erika Bohm-Vitense (Washington)
Blue Companions of Supergiants

HCKTA - Thomas B. Ake (CSC ST)
WD Companions to TC-Deficient Peculiar Red Giants

HCLSP - Sidney B. Parsons (CSC)
Cool Giants and Supergiants with Hot Companions

HCMMJ - Michael A. Jura (UCLA)
In Search of Possible Companions to Three Anomalous Carbon Stars

HCPSP - Sidney B. Parsons (CSC - STScI)
Affirmative Data for Cool + Hot Binary Systems

HCTOO - ( )
Cool (Cooler than A) Stars Observed as Too

HD527 - H. Drechsel (Bamberg)
Interacting Contact Binaries

HDIMP - Mirek J. Plavec (CAL LA)
The Hydrogen-Deficient Binary Upsilon Sagittarii

HDOMP - Miriam Pena (UNAM - Mexico)
High Dispersion Study of BB1

HDPJH - Jay B. Holberg (U Arizona)
IUE Echelle Spectra of an EUV Selected Sample of Hot DA White Dwarfs

HE027 - Loose (Gottingen)
Star Formation Bursts in Blue Compact Dwarf Galaxies

HE077 - Israel (Leiden)
UV Investigation of Very Strong Starburst in Irregular Galaxy NGC 1569

HE081 - N. Panagia (Baltimore)
UV Observation of Supernovae

HE098 - C. Cacciari (Baltimore)
Integrated Spectra of Globular Clusters in M 31

HE100 - Joseph (London)
Ultraviolet Observations of Ultraluminous Merging Galaxies

HE109 - H. Norgaard (Copenhagen)
Diffuse Lyman Alpha Emission from Dominant Galaxies

HE129 - C. Cacciari (Baltimore)
The Nucleuc of NGC 1705

HE134 - F. Bertola (Padova)
UV Observations of NGC 205

HE171 - O'Brien (UCL)
Distant Blue Galaxies

HE189 - Sparks (Sussex)
The Relation Between Ultraviolet Excess and the Interstellar Medium in Elliptical Galaxies

HE201 - Angelo Cassatella (Vilspa)
The Stellar Content of Young Globular Clusters in the Magellanic Clouds

HE208 - Heydari (Meudon)
High Extitation Blobs of the Magellanic Clouds and Their Environment

HEEAH - Albert V. Holm (CSC)
IUE Observations of High Luminosity Helium Pulsational Variables

HEEES - Edward M. Sion (Villanova)
High Resolution Ultraviolet Studies of Hot Helium Rich White Dwarfs

HEEGW - Gary A. Wegner (Penn State)
Ultraviolet Study of Helium (DB) White Dwarfs

HEESS - Steven N. Shore (Case Western Reserve)
Spectroscopy & Zeeman Polarimetry of Helium Rich Magnetospheres & Winds

HEFDB - Douglas N. Brown (Washington)
Mass Loss and Photospheric Structure in Early-Type Spectrum Variables

HEFES - Edward Sion (Villanova)
Ultraviolet Studies of the Hot, Pulsating Helium-Rich Degenerate Stars

HEFSS - Steven N. Shore (Case Western Reserve)
Spectrophotometry of Helium Peculiar Stars

HEGJL - James W. Liebert (Arizona)
A High Dispersion Spectrum of the Hot Pulsating White Dwarf PG1159-035

HEJES - Edward M. Sion (Villanova)
Echelle Studies of Helium-Rich White Dwarfs

HEJSS - Steven N. Shore (New Mexico Tech)
The Sn Stars

HEKJD - John S. Drilling (Louisiana State)
UV Spectroscopy of Hot Extreme Helium Stars

HELES - Edward M. Sion (Villanova)
IUE Echelle Studies of Physical Processes in Helium-Rich White Dwarfs

HELGP - Geraldine Peters (University of Southern California)
Multiwavelength Observations of Equator-On "Rapid Variable" Be Stars

HEOCB - C. Stuart Bowyer (UC Berkeley)
Heavy Elements Abundances in Hot DA White Dwarfs: C, N, Si, and Fe

HEPFB - Frederick C. Bruhweiler (Catholic University)
The Physics in Circumstellar Envelopes and Disks Around Herbig Ae/Be Stars

HERAH - Albert V. Holm (CSC - Astronomy Programs)
High Luminosity Helium Pulsational Variables

HERJH - Jay B. Holberg (U Arizona)
High Signal-to-Noise Echelle Spectra of Two He-rich Degenerates

HERJS - Jeffrey M. S. Silvis (Catholic University)
Accretion onto Close Binary Herbig Ae/Be Stars

HETOO - ( )
Extragalactic Objects Observed as Too

HFOEB - Erika H. Bohm-Vitense (U Washington)

Transition Layers of Hyades F Stars

HGHBS - Blair D. Savage (Wisconsin)
Halo Gas High Galactic Latitude

HGIBS - Blair D. Savage (Wisconsin)
Ultraviolet and Radio Studies of Halo Gas

HGLBS - Blair D. Savage (Wisconsin)
Halo Gas Toward Several Distant Stars

HHCKB - Karl-Heinz Bohm (Washington)
IUE Observations of Herbig-Haro Objects

HHDCI - Catherine L. Imhoff (Arizona)
UV Observations of Pre-Main Sequence Emission-Line Stars

HHDKB - K.H. Bohm (Washington)
Herbig-Haro Objects

HHEJS - J. Michael Shull (Colorado)
IUE Observations of the Brightest Herbig-Haro Objects

HHEKB - Karl Heinz Bohm (Washington)
IUE Observations of Herbig-Haro & Related Objects

HHERS - Richard D. Schwartz (Missouri)
UV Observations of Low Excitation HH Objects.

HHFJS - J. Michael Shull (Colorado - JILA)
IUE Observations of Herbig-Haro Objects

HHFRS - Richard D. Schwartz (Missouri)
Ultraviolet Observations of Low Excitation Herbig-Haro Objects

HHGJS - J. Michael Shull (Colorado-Lasp)
IUE Observations of Herbig-Haro Objects

HHGKB - Karl-Heinz Bohm (Washington)
Formation of UV Continua and Faint Lines in Herbig-Haro Objects

HHGRS - Richard D. Schwartz (Missouri)
Low-Excitation Herbig-Haro Objects and Interstellar Extinction

HHGTS - Theodore Simon (Hawaii)
IUE Observations of Flows and Jets in HH Objects

HHHJS - J. Michael Shull (Colorado-Lasp)
IUE Observations of Herbig-Haro Objects

HHHKB - Karl-Heinz Bohm (Washington)
Ultraviolet Study of the Unusual Hergib-Haro Objects H-H 24 and H-H 32

HHIJR - John C. Raymond (CFA)
Bright Knots in HH-1 and HH-2

HHJKB - Karl-Heinz Bohm (Washington)
H2 Continua in Ultraviolet Spectra of Herbig-Haro Objects

HHKEB - Edward W. Brugel (Colorado - CASA)
New and Unique HH-Objects 80 and 81: High Excatation is Shocks

HHKKB - Karl-Heinz Bohm (Washington)
H2 Emission in Low To Moderate Excitation Herbig-Haro Objects

HHLEB - Edward W. Brugel (Colorado - CASA)
High Velocity Interstellar Shocks: Herbig-Haro Objects in Cepheus A, and HH-34

HHLFY - Farhad Yusef-Zadeh (Northwestern)
A Unique Herbig Hard Object

HHLKB - Karl-Heinz Bohm (Washington)
Ultraviolet Continuum Emission in the Peculiar Herbig-Haro Object 24A

HHMKB - Karl-Heinz Bohm (Washington)
Variability and Shock Instabilities in Herbig-Haro Objects

HHNKB - Karl-Heinz Bohm (U Washington)
The Physical Structure of the Complex Herbig-Haro Object HH2

HHOFY - Farhad Yusef-Zadeh (Northwestern University)
Observations of Bright HH Objects in M42

HI022 - Keith Horne (Cambridge)
Mass Accretion Rates for Eclipsing Cataclysmic Variables

HI041 - Frontera (Bologna)
Ultraviolet Observation and Monitoring of the Optical Counterpart of 4U1700+24 (=HD 154791)

HI042 - J. E. Pringle (Cambridg)
The Accretion Discs and White Dwarfs in the Extreme Period Dwarf Novae OY Car, Z CHA & BV CEN

HI054 - D. Reimers (Hamburg)
A Deep Look at the Newly Discovered Companion of the M Giant 4 Dra

HI069 - T. Snijders (R.G.O.)
UV Observations of Classical Novae

HI079 - V. D. Woerd (Utrecht)
The Rise of Dwarf-Nova Outbursts: BV CEN

HI103 - J. Krautter (ESO)
UV Spectroscopy of Nova Muscae 1983 During the Late Stages

HI104 - Krautter (ESO)
Observations of the Eclipse of EX HYA With High Time Resolution

HI110 - Howarth (UCL)
Coordinated EXOSAT/IUE Observations of the of Binary HD 153919

HI112 - A. Treves (Milano)
UV Observations of the Black Hole Candidate LMC X-3

HI115 - L. Maraschi (Milano)
Coordinated UV, X-Ray and Optical Observations of Magnetic White Dwarfs in Binaries

HI136 - H. Nussbaumer (Zurich)
The Symbiotic Star HBV 475

HI151 - Bonnet-Bidaud (Saclay)
Ultraviolet Observations of Newly Identified X-Ray Sources

HI160 - Watts (Tubingen)
Photometry of the Eclipsing Cataclysmic Variable V SGE

HI177 - Howarth (UCL)
Target of Opportunity Observations of A0538-66 in Outburst

HI179 - Howarth (UCL)
On the Off State of A0538-66: Activity and Parameters in Quiescence

HI180 - Howarth (UCL)
High Resolution Spectroscopy of the X-Ray Binary HZ HER

HI185 - R. Viotti (Frascati)
The Outburst of Z Andromedae

HI190 - Smith (UCL)
IUE Observations of Variability in the WR + Compact Candidate HD 96548

HI197 - Angelo Cassatella (Vilspa)
The UV Activity of the Recurrent Nova T CR B

HI210 - Juan Echevarria (Unam)
International Search Program of Dwarf Novae During the First Day of Outburst

HI215 - F. Giovannelli (Frascati)
Multifrequency Behaviour of A0535+26/HDE 245770 System in Quiescence and in Outburst

HI224 - Bonnet-Bidaud (Saclay)
Ultraviolet Study of the Pulsar Period in 2A0526-328 (TV COL)

HITOO - ( )
Interactions Studies in Hot Objects Observed as Too (Novae...)

HK416 - H. Keller (Lindau)
Ultraviolet Observation of Comets

HL048 - H. J. Lamers (Utrecht)
Short Time Variability of Early-Type Supergiants

HL593 - H. J. Lamers (Utrecht)
The Nature and Origin of OBN and OBC Stars

HLEPM - Philip Massey (United Kingdom)
Super W-R Stars in M33

HLESS - Steven N. Shore (Case Western Reserve)
Luminous, Extended Atmosphere Stars in the Local Group

HM001 - I. J. Danzinger (ESO)
Oxygen-Rich Young SMC SNR

HM021 - H. M. Maitzen (Bochum)
Peculiar A-Stars

HM029 - Molaro (Trieste)
Study of Interstellar C IV and SI IV in the Local Medium (<200 PC)

HM043 - H. Mauder (Tubingen)
Observations of T Tauri Stars and OB Supergiants

HM068 - M. Pettini (R.G.O.)
Distances of 21 Centimeter High Velocity (OORT) Clouds

HM080 - Boer (Tubingen)
Anticenter Interstellar Gas Densities From MG II Lines in Fast Rotating a Stars

HM083 - Mattila (Helsinki)
The Interstellar 2175 a Extinction Bump for Highly Reddened Stars

HM097 - Molaro (Trieste)
Study of the Local Interstellar Medium Through MG II Absorptions

HM121 - S. R. Pottasch (Groningen)
Observations of Planetary Nebulae with Anomalously High Ne Abundance

HM122 - R. M. West (Manchester)
A Large Scale Survey of Interstellar Absorption in the Galactic Halo

HM125 - Liseau (Stockholm)
The Ultraviolet Continua of Herbig Haro Objects

HM133 - Vidal-Madjar (Paris)
Local Interstellar Hydrogen and Deuterium

HM137 - Harris (Vilspa)
Observations of Nearly-Aligned Early-Typr Stars in the Dics/Halo Interface Region

HM142 - Boer (Tubingen)
Dynamics of Gas in LMC Constellation III

HM143 - Boer (Tubingen)
Investigations of Motions in the Gaseous Galactic Halo

HM147 - S. d'odorico (ESO)
The Chemical Abundance in LMC Supernova Remnants: A Probe of Star Formation History

HM153 - L. Prevot (Marseille)
Far UV Extinction Law and Gas-To-Dust Ratio as a Function of Galactocentric Distances

HM159 - J. Koppen (Heidelberg)
High Dispersion Observations of Planetary Nebulae

HM162 - K. Nandy (Edinburgh)
Interstellar Extinction in the Small Magellanic Cloud

HM166 - W. Somerville (UCL)
Interstellar Molecular Lines

HM188 - R. Freire (Strasbourg)

HM206 - H. M. Maitzen (Vienna)
AP Stars

HM209 - Patriarchi (Arcetri)
Variations in Grain Properties

HM221 - J. Christopher Blades (Vilspa)
C IV in Galactic Halo

HM225 - Vidal-Madjar (Paris)
Interstellar or Circumstellar Matter Toward Beta Pic?

HM247 - Solf (Heidelberg)
Ultraviolet Study of the Unusual Herbig-Haro Objects H-H 24 and H-H 32

HM328 - H. M. Maitzen (Vienna)
Silicon Autoionization Features and Spectral Variability in AP Stars

HM334 - H. Mauder (Tubingen)
Mass Exchange in Contact Binaries

HM585 - H. M. Maitzen (Wien)
Silicon Autoionization Features and Spectral Variability in AP-Stars

HMLDL - David S. Leckrone (NASA/GSFC)
Ultraviolet Spectral Energy Distributions of Mercury-Manganese Stars

HMTOO - ( )
Interstellar Studies Observed as Too

HN122 - H. Nussbaumer (Zurich)
V 1016 CYG and HM SGE

HN353 - H. Nussbaumer (Zurich)
Proto Planetary Nebulae

HN405 - H. Norgaard-Nielsen (Copenhagen)
UV Spectra of Normal Elliptical Galaxies and Globular Clusters

HN530 - H. Nussbaumer (Zurich)
Galactic Wolf-Rayet Stars

HN568 - Noorgaard-Nielson Copenhagen (Copenhagen)
UV Spectra of Elliptical Galaxies

HN600 - H. Nussbaumer (Zurich)
Proto Planetary Nebulae

HPTG2 - ( )
Commissioning Period Program

HPTG5 - ( )
Commissioning Period Program

HQ002 - Jean Clavel (Vilspa)
Simultaneous UV, X-Ray and Optical Monitoring of NGC 4593

HQ014 - P. M. Gondhalekar (R.A.L.)
Gas in Cosmic Voids

HQ038 - M. H. Ulrich (E.S.O.)
The Nature of the Continuum Radiation in the UV and X-Ray Ranges in F9

HQ063 - Diaz (R.G.O.)
Star Formation in Active Galactic Nuclei

HQ064 - Wall (R.G.O.)
UV Observations of the Very Bright BL Lac Object PKS 2005-489

HQ065 - M. Pettini (R.G.O.)
The UV Spectrum of the Low-Redshift Bal Qso Pg 1700+518

HQ067 - Michael V. Penston (R.G.O.)
Monitoring of NGC 3516

HQ070 - Micheal V. Penston (R.G.O.)
Continued Monitoring of NGC 4151

HQ076 - Barr (ESOC)
UV Observations of Soft X-Ray Selected AGN'S

HQ092 - Pollock (Birmingham)
Variability Time Scales in OJ287

HQ111 - A. Treves (Milano)
Repeated Multifrequency Observations of the Variable Quasar PG 1351+64

HQ117 - Willem Wamsteker (Vilspa)
Probing Seyfert I Nuclei Over a Large Wavelength Interval

HQ123 - P. M. Gondhalekar (RAL)
Ultraviolet Spectroscopy of Quasars Around Z=2

HQ220 - Willem Wamsteker (Vilspa)
Intergalactic Lyman Alpha Systems

HQ226 - E. G. Tanzi (Milano)
Coordinated Optical

HQ233 - McMahon (Cambridge)
UV Observations of a Bright Quasar at Redshift 3.7

HQ234 - G. E. Bromage (RAL)
Coordinated Study of Variability of MKN 421

HQ235 - D. Alloin (Meudon)
Active Galactic Nuceli: Along the Way from A Seyfert 2 to A Seyfert 1 State

HQTOO - ( )
Extragalatic Objects Observed as Too (AGN, QSO...)

HR406 - H. Ritter (Garching)
Ultraviolet Observations of Shock-Ionized Gas

HR579 - H. Ritter (Garching)
Ultraviolet Spectroscopy of HZ Her Near X-Ray Eclipse

HRDAK - Daniel A. Klinglesmith (NASA/GSFC)
Helium Rich Stars

HRDPB - D. Paul Parker (Western Ontario)
Simultaneous UV and Optical Spectroscopy and Zeeman D Polarimetry of Helium-Rich Magnetospheres and Wind

HROES - Edward M. Sion (Villanova University)
IUE High Resolution Study of a Newly Discovered PG1159 Star

HROMP - Manuel Peimbert (UNAM - Mexico)
The Carbon Abundance in the Galactic H II Region M17

HROPH - Paul W. Hodge (U Washington)
The HR Diagram of HGC 1770

HS051 - J. Rahe (Bamberg)
Comet Giacobini-Zinner and the Ice Mission

HS139 - Fricke (Bonn)
The Long-Term Variability of the Lyman Alpha Emission From Jupiter, Saturn, and Uranus

HS144 - J. L. Bertaux (Verrieres)
Deuterium in the Upper Atmosphere of Venus + Monitoring of SO2 in Upper Atmosphere

HS145 - J. L. Bertaux (Verrieres)
The Stability and Homogeneity of the IO Torus

HS171 - H. Schmidt (Munich)
Massive X-Ray Binaries

HS212 - K. H. Fricke (Bonn)
A Search for Acetylene and Aurorae in the Atmosphere of Neptune

HS223 - Richard L. Moore (London)
Spatially Resolved Observations of Jupiter and Saturn

HS231 - C. Festou (Paris)
Observations of Comets P/Halley and P/Giacobini-Zinner

HS302 - H. Schleicher (Gottingen)
UV Spectroscopy of Very Bright Suspected BL Lac Objects

HS419 - H. Scheicher (Gottingen)
Intermediate Emission Line Galaxies

HS599 - H. J. Staude (Heidelberg)
HD 190073 and Other Peculiar Shell Stars

HSBJL - John B. Lester (Toronto)
Ultraviolet Spectroscopy of OBN-OBC Stars

HSBPC - Peter S. Conti (Colorado)
The Relationship Among O, OF and WR Stars

HSCAD - Andrea K. Dupree (CFA)
UV and X-Ray Observations of OB Supergiants

HSCAU - Anne B. Underhill (NASA/GSFC)
The Effective Temperatures of Stars of Types 03, 04, and 05

HSCBW - B. E. Woodgate (NASA/GSFC)
IUE Measurements of Hot Stars Near the Ecliptic Plane, etc

HSCJD - John S. Drilling (Louisiana State)
Ultraviolet Spectroscopy of OB+ Stars

HSCLC - L. Carrasco (Mexico)
Comparative UV Spectrophotometry of High and Low Velocity O-Type Stars

HSCPC - Peter S. Conti (Colorado - JILA)
The Relationship Among O, OF, and WR Stars

HSCSP - Sidney B. Parsons (Texas)
Abundance Effects on Mass Loss in O and Early B Type Stars

HSDBS - Blair D. Savage (Wisconsin)
A Study of R136 and Related Objects

HSDJD - John S. Drilling (Louisiana State)
Ultraviolet Spectroscopy of OB+ Stars

HSDRH - R. M. Humphreys (Univ. of Minnesota)
Ultraviolet Spectroscopy of the Brightest Supergiants in M31 and M33

HSDRP - Robert J. Panek (CSC)
The Orion Nebula Star Cluster

HSDSA - Saul J. Adelman (The Citadel)
Abundances of the Elements in Sharp-Lined Normal Late B Type Stars

HSDTS - Theodore P. Snow (Colorado)
Stellar Wind Variability in Ob Stars

HSEJD - John S. Drilling (Louisiana State)
UV Spectroscopy of Subluminous O Stars

HSEPH - Paul W. Hodge (Washington)
Evolution of Mass Loss in Stars of Magellanic Cloud Clusters

HSETS - Theodore P. Snow (Colorado)
UV & X-Ray Variability in Hot Stars

HSFBM - Bruce Margon (Washington)
The Nature of the UV Excess Objects with Missing H-Alpha

HSFBS - Blair D. Savage (Wisconsin)
An Investigation of Global Spectral Peculiarities in the NGC 6231 Main Sequence B Stars

HSFCC - Charles R. Cowley (Michagan)
Superficially Normal Early B Stars with Sharp Spectral Lines

HSFCW - Chi-Chao Wu (CSC)
Photometric Standards for Space Telescope Instruments

HSFES - Edward M. Sion (Villanova)
High Resolution Ultraviolet Observations of Hot Subdwarf B Stars

HSFGD - George A. Doschek (NRL)
The Best Possible UV Line List from RR TEL

HSFJD - John S. Drilling (Louisiana State)
Ultraviolet Spectroscopy of Subluminous O Stars

HSFJH - Jay B. Holberg (USC)
Combined Voyager and IUE Energy Distributions for Hot Degenerate Stars

HSFSA - Saul J. Adelman (The Citadel)
Elemental Abundances in Sharp-Lined Late B and Early A Stars

HSFTS - Theodore P. Snow (Lab for Atmospheric & Space Physics)
A Study of Moderate Ionization in Be Star Winds

HSGAP - Phillip Davis (Wesleyan University)
Ultraviolet Observations of "High Mass" Field Horizontal A Stars

HSGAT - Ana V. Torres (Colorado)
Continuum Energy Distribution of O-Type Stars

HSGBM - Bruce Margon (Washington)
The Nature of the UV Excess Objects with Missing H-Alpha

HSGBS - Blair D. Savage (Wisconsin)
A Study of the Most Luminous Supergiants in the LMC

HSGCG - Carol A. Grady (CSC)
Ultraviolet Continua of B and Be Stars

HSGCW - Chi-Chao Wu (CSC)
Photometric Standards for Space Telescope Instruments

HSGDB - Douglas N. Brown (Washington)
Helium-Weak Photospheres and Stellar Winds

HSGFW - Francois Wesemael (Montreal)
Low-Resolution Ultraviolet Observations of Hot B Subdwarfs

HSGGS - George Sonneborn (CSC)
Ultraviolet Spectral Classification of B Stars Using IUE Archive Data

HSGJD - John S. Drilling (Louisiana State)
Ultraviolet Spectroscopy of Subluminous O Stars

HSGSA - Saul J. Adelman (The Citadel)
Elemental Abundances of Mercury-Manganese Stars

HSGWF - Walter A. Feibelman (NASA/GSFC)
High Dispersion Observations of the Central Star of NGC 7293

HSGWW - Wayne L. Waldron (A. R. Corp.)
Variability of Ultraviolet Line Ratios in Early Type Stars

HSHGS - George Sonneborn (CSC)
Ultraviolet Flux Distributions in Later-Type B and Be Stars

HSHJH - Joy Heckathorn (STScI)
Narrow Absorption Components in Early-Type Stars

HSHRD - Ronald A. Downes (A. R. Corp.)
The Nature of the UV Excuss Objects with Missing H Alpha

HSHRP - Ronald S. Polidan (Arizona)
C IV Emission in Be Stars

HSICG - Carol A. Grady (CSC)
Survey of Stellar Winds in Be Stars

HSIDM - Derck Massa (A. R. Corp.)
A Study of Photospheric Silicon and Carbon Lines in Early B Stars

HSIGP - Geraldine J. Peters (USC)
Abundances in Four Sharp-Lined, Early B-Type Stars

HSIJD - John S. Drilling (Louisiana State)
UV Spectroscopy of Very Hot Subdwarf O Stars

HSINM - Nancy D. Morrison (Toledo)
Winds in Hot Main-Sequence Stars

HSIRB - Ralph C. Bohlin (STScI)
UV Spectrophotometry of Blue Stars in the Landolt Standard Areas for HST Calibration

HSJEF - Edward L. Fitzpatrick (Colorado - CASA)
Low-Dispersion Observations of Bright Stars

HSJGP - Geraldine J. Peters (USC)
Multifrequency Observations of the Rapid Variable Be Stars

HSKCB - C. Thomas Bolton (Canada)
The Wind Variability of Zeta OPH and Zeta PUP

HSKCG - Catharine D. Garmany (Colorado - CASA)
The Nature of the Luminous Blue Variables

HSKJN - Joy Nichols-Bohlin (CSC IUE)
High Resolution Observations of the Early-Type Halo Star PHl1580

HSLHB - Howard E. Bond (STScI)
Ultraviolet Monitoring of Irregulary Variable Planetary Nuclei

HSLPM - Philip Massey (KPNO)
Stellar Winds in the Hot Stars of Nearby Galaxies

HSMKB - Karen S. Bjorkman (Wisconsin)
IUE Observations of Selected Hot Stars Coordinated with Wuppe

HSRSP - Sidney B. Parsons (CSC - Astronomy Programs)
Confirming Detections of Hot Secondary Stars

HSSRH - Sara R. Heap (NASA/GSFC)
Hot Subluminous Stars

HSTOO - ( )
Solar System Observed as Too

HT535 - H. R. Tjin a Djie (Amsterdam)
Ultraviolet Studies of the Shells of Herbig Ae and Be Stars

HWDAK - Daniel A. Klinglesmith (NASA/GSFC)
Helium Weak Stars

HWGDB - Douglas N. Brown (Washington)
Helium-Weak Photospheres and Stellar Winds, II: Analysis of Archival Data

HWPSS - Steven N. Shore (CSC - GHRS)
Magnetically Controlled Circumstellar Matter Among the Helium Weak Stars

HXPSV - Saeqa Dil Vrtilek (Harvard CFA - SAO)
Multiwavelength Observations of Her X-1

HYGJL - Jeffrey L. Linsky (Colorado - JILA)
High Dispersion Wavelength-Calibrated Spectra of Hybrid-Chromosphere Stars

HYGLH - Lee W. Hartmann (CFA)
High-Velocity Winds from Hybrid Stars

HZ335 - H. Zelk (Heidelberg)
Low-Dispersion Observations of Absolutely Very Bright Supergiants of Intermediate Spectral Class (F,G)

HZDAB - Albert Boggess (NASA/GSFC)
Observation of the Resonance Lines of Neutral & Ionized Helium in a High Redshift Quasar

HZFAB - Albert Boggess (NASA/GSFC)
An Attempt to Detect Intergalactic Helium in a High-Z Quasar Spectrum

HZFRG - Richard F. Green (Arizona)
High Redshift Quarars

HZHMM - Matthew A. Malkan (UCLA)
Long Exposures of High-Redshift Quasars

HZIGM - Gordon M. MacAlpine (Michigan)
A New, Bright High-Redshift BAL Quasar

HZIJH - John P. Huchra (CFA)
Very High Redshift Quasars

IA016 - Prinja (London)
Remarkable Broad Low Velocity Absorption Components in the Winds of Four-Early Type Stars

IA020 - Seggewiss (Daun)
Search for Chromospheric MG II Emission in Ap-Type Stars

IA025 - M. Hack (Trieste)
Hydrogen-Poor Binary Systems

IA026 - A. J. Willis (London)
A Search for Short-Period UV Variations in HD 192163 (WN6)

IA028 - Wolf (Heidelberg)
OFPE/WN 9 Stars in the LMC

IA045 - L. Bianchi (Torino)
Temperature and Bolometric Luminosity of WR-TYPE PN Nuclei

IA050 - Schmutz (Kiel)
Observations of Galactic Single Wn Stars

IA051 - Boer (RGO)
UV Bright Stars in Globular Clusters and Their Evolutionary State

IA052 - Heber (Kiel)
NLTE Analysis of SDO Stars in the Jaidee and Lynga Survry

IA069 - F. Praderie (Meudon)
Short Term Temporal Changes in the Wind of the AE Star HD 163296

IA071 - H. R. Tjin (Amsterdam)
UV Studies of the Extended Atmospheres Around Herbig Ae/Be Stars

IA072 - D. J. Stickland (RAL)
Probing the Winds of WR Stars

IA073 - Van Der Hucht (Utrecht)
The Ir-X-Radio Variable WR Star HD 193793: Is the Temporary CS Dust Condensation Caused by Stellar Wind (density) Variat

IA075 - Dworetsky (UCL)
Ultraviolet Spectroscopy of the Extreme Metal-Poor A Star HR 4049

IA076 - Howarth (UCL)
A Subdwarf's Unique Stellar Wind

IA080 - V. Doazan (Paris)
The Association Between Short Term and Long-Term Variations in BE Stars

IA081 - V. Doazan (Paris)
Radiative Energy Flux and Distributton of BE Phases

IA083 - Lennon (Belfast)
Evolutionary Status of the Peculiar B3ia Supergiant HD 157038

IA090 - Harris (Vilspa)
Absolute Spectrophotometry of Faint Blue Satrs for Calibration of the Space Telescope

IA091 - Antonio talavera (Vilspa)
Variations in the Envelope Structure and Stellar Winds of A-Type Supergiants

IA092 - Barylak (Vilspa)
The P Cygni Star AG CAR: Its Rapid Evolution Towards O Stars

IA099 - H. J. Lamers (Utrecht)
Probing the Wind of P Cygni by Studying its Variable Shells

IA108 - V. Caloi (Frascati)
Extreme Horizontal Branch Stars in NGC 6752 and M13

IA113 - Pettersson (Uppsala)
Mass-Loss and Evolution of the Intrinsically Extremely Blue O Stars in NGC 6611

IA117 - Viton (Marseille)
Spectrophotometry of UV Objects Detected by the Very-Wide-Field Camera on Spacelab 1

IA135 - Jeffery (Saint Andrews)
High Resolution of UV Spectro-Scopy of Extreme Helium Stars

IA147 - M. Grewing (Tubingen)
Saerch for the Ionisation Source of the P.N. Abell 35 and Study of the Ionisation Structure of the Nebulae

IA173 - F. Giovannelli (Frascati)
Multifrequency (UV, Optical, IR) Observations of Z Canis Maioris

IA186 - Leitherer (Heidelberg)
IUE Spectroscopy of the Massive Of-Type Binary HD 167971

IA188 - H. F. Henrichs (Colorado - JILA)
Stellar Wind Variability in 3 O Stars: Simultaneous UV and High S/N Optical Spectroscopy

IBEGM - George E. McCluskey (Lehigh)
IUE Spectroscopy of the Extraordinary Interacting Binary R Arae

IBEMP - Mirek J. Plavec (CAL LA)
Interacting Close Binary Stars of Longer Period

IBFEB - Edward W. Brugel (Colorado-Lasp)
Analysis of the Symbiotic Stars V1016 CYG, HM SGE and V1329 CYG

IBFGM - George E. McCluskey (Lehigh University)
IUE Spectroscopy of the Interacting Binary U Sagittae

IBFSP - Sidney B. Parsons (NASA/GSFC)
HD 207739 and Other Strange F + B Binary Stars

IBGBB - Bernard W. Bopp (Toledo)
Interacting F + BE Binary Stars

IBGGM - George E. McCluskey (Lehigh University)
Accretional Heating and Gas Flow in Interacting Binaries

IBGGP - Geraldine J. Peters (USC)
IUE & Voyager Observations of the Early Type Contact Systems SX AUR, BF AUR and SV CEN

IBGMP - Mirek J. Plavec (UCLA)
Interacting Binaries with Thick Circumstellar Shells

IBGPS - Paula Szkody (Washington)
Disk Developement in U Gem from One Outburst to the Next

IBGTA - Thomas B. Ake (CSC)
The Interacting S Star Binary HD 35155

IBHAM - Andrew G. Michalitsianos (NASA/GSFC)
Temporal UV-Line Profile Variations in the Peculiar Object RX Puppis

IBHGM - George E. McCluskey (Lehigh University)
IUE Spectroscopy of the Strongly Interacting Binary TX Ursae Majoris

IBHJE - Joel A. Eaton (Indiana University)
Interacting Binaries That are Just Beginning to Initiate Mass Transfer

IBHJH - Johannes Hardorp (Stony Brook)
A Study of Mass-Exchange in Algol-Type Binaries

IBHMP - Mirek J. Plavec (UCLA)
Eclipses of Interacting Binaries: An IUE/Voyager Project

IBHRP - Ronald S. Polidan (Arizona)
500-3000 A Flux Distributions of Nova-Like Variables

IBHSK - Scott J. Kenyon (CFA)
UV Spectra of Symbiotic Stars Detected by the VLA

IBIAL - Albert P. Linnell (Michigan)
Spectrophotometric Synthesis Study of MR Cygni

IBIFW - Fredrick Walter (University of Colorado)
Detailed Study of the UZ Librae System at UV and Optical Wavelengths

IBIJE - Joel Eaton (Indiana University)
Interacting Binaries that are Just Beginning to Initiate Mass Transfer: Future Observations

IBIRW - Richard A. Wade (Arizona)
Uniform Modelling of IUE Data for Cataclysmic Variables

IBJBB - Bernard W. Bopp (Toledo)
Interacting F + BE Binaries

IBJBH - Bruce J. Hrivnak (Valparaiso)
Ultraviolet Observations of the Unique Contact Binary VZ Piscium

IBJDW - Donald E. Winget (Texas)
Coordinated UV/Optical Observations of IBWD Stars

IBJJE - Jeol A. Eaton (Indiana University)
Interacting Binaries Containing Cool Giants

IBKJN - James E. Neff (Colorado - JILA)
The Intrinsic H I Lyman Alpha Profiles of Ty Pyxis

IBLEG - Edward F. Guinan (Villanova)
Stalking the Migrating Spots, Plages, and Transition-Regions on VW Cephei

IBLGP - Geraldine J. Peters (USC)
The Gas Stream in the Algol Binaries TT Hydrae and V393 Scorpii

IBLJE - Joel A. Eaton (Indiana University)
Long-Term Observations of 31 Cygni

IBLJS - J. Scott Shaw (Georgia)
V1010 Ophiuchi

IBLRK - Robert H. Koch (Pennsylvania)
Hot, Massive Binaries

IBLRP - Ronald S. Polidan (Arizona)
Accretion Driven Outflows in the Interacting Binary V356 Sagittarii

IBMBB - Bernard W. Bopp (U Toledo)
UV Observations of Interacting F + B(E) Binary Star Systems

IBMGP - Geraldine J. Peters (USC)
Mass and Angular Momentum Loss in the Interacting Binary Au monocerotis

IBMJE - Joel A. Eaton (Tennessee State)
Long-Term Observations of 31 Cygni

IBMRP - Ronald S. Polidan (NASA/GSFC)
CNO Processing in Massive Algol Binaries

IBMRW - Richard A. Wade (KPNO)
Characterization of Three Short-Period Binary Stars Using IUE

IBNJE - Joel A. Eaton (Tennessee State)
Long-Term Observations of 31 Cygni

IBNRP - Ronald S. Polidan (NASA/GSFC)

Pseudo-Luminous Stars in Binary Systems

IBOMP - Mirek J. Plavec (UCLA)
Eclipses of Three Interacting Binaries

IC002 - S. R. Pottasch (Groningen)
IUE Observations of High Galactic Latitude F Supergiants HD 161796 and 163075

IC006 - M. Fracassini (Milano)
Evolution Problems in Dwarf Cepheids of Population I and II

IC015 - D. Dravins (Lund)
Stellar Activity Cycle in Beta Hydri

IC021 - Bues (Bamberg)
Atmospheric Structure of White Dwarfs in Binary and Suspected Binary Systems

IC033 - D. Reimers (Hamburg)
Mass Loss of Red Giants with Hot Companions

IC034 - D. Reimers (Hamburg)
Mass Loss from Metal Deficient Giant Stars

IC038 - F. Giovannelli (Frascati)
Multifrequency Monitoring of RU Lupi

IC048 - L. Bianchi (Torino)
Search for Long Term Variations of the MG II Lines in FK Comae Stars

IC049 - L. Bianchi (Torino)
Detailed Study of the UZ Librae System at UV and Optical Wave-Lengths

IC053 - V. Weidemann (Kiel)
UV Spectroscopy of White Dwarfs

IC056 - A. Evans (Keele)
Ultraviolet Observations of RCB Stars

IC070 - Tjin A. Djie (Amsterdam)
Observation of Chromospheric and Transition Region Emission Lines in the Spectra of the Herbig Foe Stars BN ORI A NGC 2

IC093 - Gilmozzi (Vilspa)
UV Behaviour of the Shock Propagation in Mira Variables

IC100 - Angelo Cassatella (Vilspa)
Ascending Giant Branch to Planetary Nebula Phase: Two Candidates

IC102 - E. H. Geyer (Bonn)
Stelar Activity of G-Type Stars in Galactic Clusters of Different Ages

IC104 - F. Querci (Toulouse)
The Carbon Proto-Planetary Nebula HD 59643

IC112 - Cornide (Madrid)
A Test of the Binarity Hypothesis for BA II Stars from IUE Spectra

IC129 - Lago (Porto)
Search for UV Emission from Selected X-Ray Emitting PMS Stars in the RHO OPH Cloud

IC141 - Lago (Porto)
Ultraviolet Observations and Modelling of T Tauri Stars

IC146 - C. Cacciari (Baltimore)
Population II Reference Stars

IC157 - Osmi Vilhu (Colorado - JILA)
Doppler-Imaging of HD 199178 An FK Comae Type Star

IC158 - Osmi Vilhu (Vilhu)
CM Draconis

IC159 - Osmi Vilhu (Colorado - JILA)
Lyman Alpha in Contact Binaries VW Cep, 44 Boo and AW Uma

IC160 - Doyle (Armagh)
IUE Observations of Surface Structures on II PEG

IC161 - S. Catalano (Catan)
Study of Active Regions of the K Component Stars of RS CVN and HD 5303 During Secondary Eclipse

IC162 - S. Catalano (Catania)
Search for Delimitation of the Lyman Alpha and Chromospheric Emission Between A and F Stars

IC163 - Byrne (Armagh)
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IC164 - Byrne (Armagh)
Deep Hires Study of UV Line Profiles in the RS CVN Star II Peg

IC166 - C. Jordan (Oxford)
Structure of Main Sequence Star Transition Tegions and Coronae

IC171 - J. E. Beckman (Canarias)
Chromospheric Modelling of Late-Type Active and Quiescent Dwarfs

IC187 - K. Eriksson (Uppsala Astronomical Observatory)
The Unique Eclipsing Binary System TZ Fornacis

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The Unique Eclipsing Binary System TZ Fornacis

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CII Line Electron Density Diagnostics in Late-Type Stars

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Circumstellar Envelopes Around Late-Type Binary Systems

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Deep SWP Echelle Exposures of the Solar-Twin Alpha CentauriaA (G2 V) and Its Companion Alpha Centauri B (K1 V)

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A Deep High-Dispersion, Doppler Compensated SWP Exposure of The Primary of the HR 1099 System

IC215 - Rodono (Catania)
Coordinated X-Rays, UV, Optical, IR, and Radio Observations of Stellar Flares

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High Resolution Observations of Solar Analog Candidates

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Edges of Clouds

ICJHB - J. H. Black (Harvard-CFA)
Investigation of Interstellar Carbon

ICJJH - John A. Hackwell (Aerospace Corporation)
Ultraviolet Extinction and Infrared Cirrus

ICKAD - Andrea K. Dupree (CFA SAO)
CO Clouds in the Local Interstellar Medium

ICKDY - Donald G. York (Chicago)
Structures of the Edges of Interstellar Clouds

ICPDW - Daniel E. Welty (U Chicago)
UV Studies of Translucent Interstellar Clouds

IDHTS - Theodore P. Snow (University of Colorado)
Interstellar Depletions in Diffuse Cloud Cores

IDIJC - Jason A. Cardelli (Wisconsin)
Characteristics of 2175 a Extinction

IDKEB - Erika Bohm-Vitense (Washington)
Variable Bump Extinction in NGC6530

IDKJC - Jason A. Cardelli (Wisconsin)
Characteristics of Weak 2175 a Extinction

IDKWL - Wayne Landsman (ST Systems Corporation)
Deuterium Observations Toward Early-Type Stars

IE009 - N. Panagia (Baltimore)
UV Observations of Supernovae

IE063 - P. M. Gondhalekar (RAL)
Variable Blue Compact Galaxy Tolodo 1924-416

IE087 - Sanz (Inta)
Star Formation and Extinction in Giant HII Regions in M33

IE095 - Angelo Cassatella (Vilspa)
The Stellar Content of the Young Clusters of the Magellanic Clouds

IE103 - Israel (Leiden)
UV Investigation of Peculiar Stellar Objects in Starburst Galaxy NGC 1569

IE126 - Colina (Gottingen)
UV Diagnostics for the Inter-Acting Galaxy Pair ESO 296-IG11

IE182 - D. Kunth (IAP)
The Ultraviolet Stellar Spectrum of Blue Compact Galaxies

IE185 - K. H. Fricke (Gottingen)
Star Formation Bursts in Blue Conpact Dwarf Galaxies

IE204 - H. Norgaard-Nielsen (Copenhagen)
Diffuse Lyman Alpha Emission from Dominant Galaxies

IEBAC - Authur D. Code (Wisconsin)
Ultraviolet Extinction Studies in Large Magellanic Cloud

IEBTS - Theodore P. Snow (Colorado)
Studies of Structure in the Ultraviolet Interstellar Extinction Law with the IUE

IECBS - Blair D. Savage (Wisconsin)
A Search for Variable UV Extinction in Hot Stars with Circumstellar Dust Shells

IECTS - Theodore P. Snow (Colorado)
Ultraviolet Extinction in Dark Clouds

IEDBS - Blair D. Savage (Wisconsin)
An Investigation of Stars with Peculiar UV Extinction

IEDTS - Theodore P. Snow (Colorado)
Observations of Grains in the Interstellar Medium

IEEBS - Blair D. Savage (Wisconsin)
Extinction & Continua of Stars in HII Regions

IEEGC - Geoffrey C. Clayton (Toronto)
The Nature of Dust in the LMC

IEETS - Theodore P. Snow (Colorado)
Observations of Grains in the Interstellar Medium

IEFAC - Authur D. Code (Wisconsin)
A Study of Reddening in Galactic Symbiotic Stars

IEFBS - Blair D. Savage (Wisconsin)
A Study of Extinction in the Large Magellanic Cloud

IEGAW - Adolf N. Witt (Toledo)
Far-UV Extinction and the Size Distribution of Interstellar Grains

IEGBS - Blair D. Savage (Wisconsin)
A Study of the Nature of Dust in the Open Cluster Trumpler 37

IEGCG - Catharine D. Garmany (Colorado)
Interstellar Reddening in the Small Magellanic Cloud

IEGCW - Charles E. Woodward (Rochester)
Hot Dust and the 3.3 Micron Feature: Are 10A Grains the Solution

IEGEB - Erika Bohm-Vitense (Washington)
Interstellar Gas and Dust Absorptions Near NGC 6530

IEGJS - J. Michael Shull (Colorado-Lasp)
Interstellar Studies with IUE Archives

IEIEF - Edward L. Fitzpatrick (Colorado - JILA)
The Properties of Ultraviolet Extinction Curves

IEJDM - Derck L. Massa (Applied Research Corp.)
Far UV Extinction and the 2175 Angstrom Bump

IEJTS - Theodore P. Snow (Colorado - CASA)
Depletions in 2200 a Scattering Regions

IEKEB - Erika Bohm-Vitense (Washington)
Ultraviolet Extinction in the Outer Galaxy

IEKGC - Geoffrey C. Clayton (Wisconsin)
A Connection Between Visual and UV Extinction

IGBAD - A. Dalgarno (Smithsonian)
Interstellar Matter Near X-Ray Sources

IGBAW - A. B. Walker (Stanford University)
Determination of Interstellar Abundance by Correlated X-Ray and Ultraviolet Observations

IGBDY - Donald G. York (Princeton)
Velocity Distribution of Interstellar Clouds in Distant Spiral Arms and in the Magellanic Clouds

IGBHM - H. Warren Moos (Johns Hopkins University)
Hydrogen and Deuterium Lyman Alpha Absorption in the Local Interstellar Medium and the Far Ultraviolet Emission L Spect

IGBJH - James E. Hesser (Dominion Astrophysical Observatory)
Interstellar Lines in the ETA Carina Nebula

IGBJS - J. Michael Shull (Colorado)
Atomic Intersystem Lines in Interstellar Gas and Stellar Winds

IGBMJ - Michael Jura (UCLA)
Observations of Interstellar Zinc

IGBPF - Priscalla C. Frisch (Chicago)
IUE Observations of Interstellar Lines In Stars Near the North Polar Spur

IGBTS - Theodore P. Stecher (NASA/GSFC)
The Physical State and Distribution of Gas in Our Galaxy, II

IGBWS - Wallace L. Sargent (CIT)
IUE Observing Time and Support of Research on Interstellar Lines in the Galactic Halo

IGCAU - Anne B. Underhill (NASA/GSFC)
Interstellar Lines From High Ions

IGCAW - A. Wolfe (Pittsburgh)
IUE Studies of QSO Absorption Line Gas

IGCBS - Blair D. Savage (Wisconsin)
Ultraviolet Observations of Gas in Galactic Halos

IGCDY - Donald G. York (Princeton)
Extent of a Gaseous Galactic Halo

IGCFB - Frederick C. Bruhweiler (CSC)
The Origins of Interstellar C IV and SI IV

IGCJS - J. Michael Shull (Colorado)
IUE Spectroscopic Studies of Interstellar Matter and Stellar Mass Loss

IGCLC - L. Cowie (Princeton University)
Absorption Measures of Galactic Halo Gas

IGCTS - Theodore P. Snow (Colorado)
A Search for Interstellar Si O

IGDAD - Andrea K. Dupree (Center of Astrophysics)
Study of the Local Interstellar Medium

IGDDY - Donald G. York (Princeton University)
The Extent of a Hot Gaseous Galactic Halo

IGDHW - H. Weaver (UC Berkeley)
IUE Observations of High Velocity Clouds

IGDJS - J. Michael Shull (Colorado)
IUE Spectroscopic Studies of Interstellar Matter and Stellar Mass Loss

IGDLC - L. Cowie (MIT)
Absorption Line Studies of Giant Shells in the Galactic Disk

IGDWC - Webster C. Cash (Colorado)
IUE Study of the Cygnus Superbubble

IGEJS - J. Michael Shull (University of Colorado at Boulder)
IUE Interstellar Observations of Bright OB-Stars

IGELH - Lewis M. Hobbs (Chicago)
IUE Observations of Interstellar Carbon

IGFBS - Blair D. Savage (Wisconsin)
The Galactic Distribution of Highly Ionized Gas

IGFGB - Gibor S. Basri (UC Berkeley)
An Absorption Line Study of High Latitude Diffuse Clouds

IGFJH - Joy Nichols-Bohlin (CSC)
High Velocity Components of UV Interstellar Lines in the Carina Nebula

IGFJR - John C. Raymond (CFA)
White Dwarfs and the Interstellar Medium

IGFJS - J. Michael Shull (Colorado - JILA)
IUE Interstellar Observations

IGFLH - Lewis M. Hobbs (Chicago)
IUE Observations of Interstellar Carbon

IGGBS - Blair D. Savage (Wisconsin)
A Study of Interstellar Gas Kinematics in the Large Magellanic Cloud

IGGCB - C. Stuart Bowyer (Berkeley)
Distribution of the Neutral Interstellar Hydrogen Toward The South Galactic Pole

IGGDL - David J. Lien (Michigan State)
Interstellar Atomic and Molecular Observations of Stars Toward Reflection Nebulae

IGGDY - Donald York (The University of Chicago)
Distances of 21cm High Velocity (Oort) Clouds

IGGFB - Frederick C. Bruhweiler (Catholic University)
Planetary Nebulae and Sharp-Lined Displaced Features in White Dwarfs

IGGJH - Joy Nichols-Bohlin (CSC)
Investigation of High-Velocity Interstellar Gas Toward HD 50896

IGGJR - John C. Raymond (CFA)
Soft X-Ray Ionization of Interstellar Gas

IGGJS - J. Michael Shull (Colorado-Lasp)
IUE Interstellar Observations

IGGRF - Robert A. Fesen (Colorado-LASP)
UV Absorption Line Invest. in the Line-Of-Sight Direction To the SNR Puppis A

IGIJN - Joy Nichols-Bohlin (STScI)
Investigation of High-Velocity Interstellar Gnterstellar Gas in Line-Of-Sight to Two Wolf-Rayet Stars

IGJJS - J. Michael Shull (Colorado - CASA)
UV Observations of Intergalactic Gas in the Coma Void

IGJTS - Theodore P. Snow (Colorado - CASA)
Extinction Properties of Cool-Star Circumstellar Grains

IGKDM - Derck L. Massa (ARC)
A Study of the Cep OB3 Cloud

IGKFB - Frederick C. Bruhweiler (Catholic University)
The Interstellar Environment of Supernova 1987A

IGKJN - Joy Nichols-Bohlin (CSC IUE)
High-Velocity Interstellar Gas in the Lines-Of-Sight to Wolf-Rayet Stars

IGKJS - J. Michael Shull (Colorado - CASA)
IUE Observations of Intergalactic Gas in the Coma Void

IGKSL - Susan A. Lamb (Illinois)
UV Spectroscopy of Young Stellar Populations in Interacting Galaxies

IGLBS - Blair D. Savage (Wisconsin)
A Study of the Origin of Highly Ionized Interstellar Gas

IGLRD - Reginald J. Dufour (Rice University)
The Carbon Abundance in Thesuper Metal Poorgalaxy GR 8

IGMJN - Joy Nichols-Bohlin (CSC - Astronomy Programs)
Investigation of High-Velocity Gas Toward Wolf-Rayet Stars

IGMJS - J. Michael Shull (Colorado - CASA)
High-Velocity Gas Along the SW Edge of the Monoceros Loop

IGMLD - Laura Danly (STScI)
IUE Observations of a Galactic Loop

IGNLD - Laura Danly (STScI)
IUE Observations of the Intermediate Velocity Arch

IGNTH - Timothy M. Heckman (Johns Hopkins University)
The Far-Ultraviolet Spectra of Powerful Far-Infrared Galaxies

IGPJC - Jason A. Cardelli (U Wisconsin - Madison)
Limits on Grain Surface Chemistry

IGPLD - Laura Danly (STScI)
Infalling Gas in the Southern Galactic Hemisphere

IGPRB - Richard H. Buss (Johns Hopkins University)
Determining Gas Densities and Grain Compositions

II003 - Bath (Oxford)
Monitoring the Quiescent Behaviour of a Long Period Dwarf Nova

II004 - J. E. Pringle (Cambridge)
A Study of Accretion Discs and White Dwarfs in Eclipsing Dwarf Nova: HT Cas and Ip Peg

II013 - M. Hack (Trieste)
The Symbiotic Star CH Cygni

II014 - H. Nussbaumer (Zurich)
The Symbiotic Star HBV 475

II023 - Verbunt (Munich)
The Structure of Cataclysmic Variables Winds

II027 - Charles (Oxford)
Development of the Superoutburst and Superhump Phenomenon in the Eclipsing SU UMA Systems

II031 - D. Reimers (Hamburg)
Phase-Covering Observations of the Cataclysmic Variable Type Companion of the M Giant 4 Dra

II037 - F. Giovannelli (Frascati)
Multifrequency Behaviour of the X-Ray/Be System A0535+26/HDE 245770

II040 - F. Giovannelli (Frascati)
Accretion Behaviour in SS Cygni

II047 - L. Bianchi (Torino)
UV Observations of Recently Identified X-Ray Binaries

II059 - A. Evans (Evans)
RS Ophiuchi

II068 - C. Kindl (Zurich)
The Symbiotic Star HM SGE

II079 - V. Doazan (Paris)
Coordinated Far UV and Visual Observations of AX Mon

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Quiescent State of the Unique Dwarf Nova WZ SGE

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The Nature of the Accreting Object in T CR B

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Ultraviolet and X-Ray Observations of Raquarii and its Jet

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The Symbiotic Star V 1016 CYG

II192 - Strupat (Bamberg)
UV Spectroscopy of W Ser and Related Objects

II199 - Bonnet-Bidaud (Saclay)
Ultraviolet Study of the Pulsar Period in 2A0526-328 (TV COL)

IM007 - Boer (RGO)
Dynamics of High Velocity Halo Gas

IM022 - J. Koppen (Heidelberg)
High Dispersion Observations of Planetary Nebulae

IM035 - L. Prevot (Marseille)
Far-UV Extinction Law and Gas To Dust Ratio in Distant Regions of the Galaxy

IM046 - L. Bianchi (Torino)
Mass Loss Rates From PN Nuclei and Their Correlation with Nebular Ionization and Dynamical Structure

IM061 - J. Krautter (Heidelberg)
IUE Spectroscopy of the Bipolar Jet System TH 28

IM085 - Harris Harris (Vilspa)
Observations of Nearly-Aligned Early-Type Stars in the Disc/ Halo Interface Region

IM116 - L. Prevot (Marseille)
Study of Abnormal Extinction Curves in the Cygnus Rift

IM118 - Liseau (Stockholm)
UV-Observations of Shocked Interstellar Gas in the L 1551 Outflow: HH 29

IM119 - Liseau (Stockholm)
The Ultraviolet Continua of Herbig-Haro Objects

IM139 - J. Christopher Blades (Baltimore)
C IV in Galactic Halos

IM149 - M. Pettini (RGO)
Expanding Shells of Interstellar Gas Around Ob Associations

IM170 - Molaro (Trieste)
Study of Interstellar C IV and SI IV in the Local Interstellar Medium (D<200 PC)

IM177 - Freire Ferre (Strasbourg)
Late B and A Stars as Probes of the Hot Component of the Local Interstellar Medium

IM180 - Vladilo (Trieste)
Distribution of Interstellar MGII Towards Cool Supergiants in the Galactic Longitude Range 180

IM181 - Cameron (UCL)
Shocks and Flows in Herbig-Hars Objects 7 and 11

IM190 - M. Barlow (UCL)
Ultraviolet Spectrophotometry of Low Heavy Element Abundance Magellanic Cloud Planetary Nebulae

IM191 - M. Barlow (UCL)
Ultraviolet Spectrophotometry of HST GTO Target Magellanic Cloud Planetary Nebulae

IM200 - Molaro (Trieste)
Late B Fast Rotators to Probe the Local Interstellar Medium (D<100 PC)

IM211 - Vidal-Madjar (IAP)
Local Interstellar Hydrogen and Deuterium

IM212 - Vidal-Madjar (IAP)
The Circumstellar Disk Around Beta Pictoris

IM2MS - Maarten Schmidt (Cal Tech)
Ultraviolet Observations of Quasistellar Objects and the Intergalactic Medium

IMBAB - Ralph C. Bohlin (NASA/GSFC)
Absorption and Reddening by Interstellar Gas and Dust Using the IUE

IMBBS - Blair D. Savage (Wisconsin)
Ultraviolet Studies of Interstellar Matter in the Milky Way and Large Magellanic Clouds

IMBDD - B. D. Donn (NASA/GSFC)
The Search for Spectra of Interstellar Molecules Against Hot Stars

IMBKD - Klaus S. DeBoer (Wisconsin)
Interstellar Extinction and Interstellar Lines in Two Close Stars Near Orion B

IMCPF - Priscilla C. Frisch (Chicago)
Highly Obscured Interstellar Clouds

IMDFB - Frederick C. Bruhweiler (CSC)
The Interstellar Medium Within 50PC of the Sun Through Observations of White Dwarfs

IMDGB - G. N. Blair (Electro-Magnetic Application)
Ultraviolet Spectroscopy of Young Compact Regions in Dense Molecular Clouds

IMDJR - John C. Raymond (CFA)
Elemental Abundances & Interstellar Dust in Supernova Remnants

IMDTS - Theodore P. Snow (Colorado)
Interstellar Si Iv & Civ Abundances in the Lines of Sight Towards A Stars

IMEJR - John C. Raymond (CFA)
Grain Destruction & Elemental Abundances in Interstellar Shocks

IMFJS - J. Michael Shull (Colorado - JILA)
Stellar and Interstellar Studies with IUE Archives

IMFKB - Karl-Heinz Bohm (Washington)
Interstellar Absorption and Extinction

IMFRP - Robert Panek (Computer Sciences Corporation)
UV Study of Gas and Dust in Orion

IMFTS - Theodore P. Snow (Lab for Atomospheric & Space Physics)
Interstellar Lines and Ultraviolet Extinction in Dark Clouds

IMGJS - J. Michael Shull (Colorado-Lasp)
Stellar Wind-Shocked H II Regions

IMGRF - Robert A. Fesen (Colorado-LASP)
Identification of Extremely Evolved Supernova Remnabts

IMGRH - Richard Henry (Johns Hopkins University)
Local Interstellar Medium

IMGTS - Theodore P. Snow (University of Colorado)
Interstellar Lines and Ultraviolet Extinction in Dark Clouds

IMHCI - Catherine L. Imhoff (CSC)
Ultraviolet Extinction in the Taurus Dark Clouds

IMHDY - Donald G. York (Chicago)
Distances of 21CM High Velocity (OORT) Clouds

IMHJS - J. Michael Shull (Colorado-Lasp)
Interstellar Studies with IUE Archives

IMHRH - Richard Henry (Johns Hopkins University)
Local Interstellar Hydrogen and Deuterium

IMIJS - J. Michael Shull (Colorado - CASA)
Interstellar Studies with IUE Archives

IMITS - Theodore P. Snow (Colorado - CASA)
Depletion in Dense Diffuse Clouds

IMLAW - Adolf N. Witt (Toledo)
Molecular Hydrogen Dissociation Fronts and Red Dust Emission in Reflection Nebulae

IMLDM - David M. Meyer (Northwestern)
Small-Scale Structure in the Diffuse Interstellar Medium

IMLLH - Lewis M. Hobbs (Chicago)
The Pressure of the Interstellar Medium

IMLPF - Priscilla C. Frisch (Chicago)
Local Interstellar Gas. IV

IMLTS - Theodore P. Snow (Colorado - CASA)
Interstellar Depletions and Ultraviolet Extinction in Dense Clouds

IMMAW - Adolf N. Witt (Toledo)
Scattering in the 2175 Angstrom Interstellar Extinction Feature

IMMCI - Catherine L. Imhoff (CSC - IUE Observatory)
The 2200A Extinction Feature in the Taurus Dark Clouds

IMMDM - Derck L. Massa (ARC)
A Survey of Interstellar Gas Inside the 3 KPC Arm

IMMDW - Daniel E. Welty (Chicago)
UV Extinction in High Latitude Clouds

IMMEB - Erika Bohm-Vitense (Washington)
UV Extinction Law and CIV, SIIV Column Densities in NGC 6530

IMMJC - Jason A. Cardelli (Wisconsin)
Low Density Extinction in the Disk and Halo

IMMJS - J. Micheals Shull (Colorado - CASA)
UV Fluorescent Background from Interstellar IONS and H2

IMMPF - Priscilla C. Frisch (Chicago)
Small Scale Structure in the Interstellar Matter Towards Zeta Oph

IMNCI - Catherine L. Imhoff (CSC - Astronomy Programs)
The 2200 A Extinction Feature in the Taurus Dark Clouds - II

IMOJC - Jason A. Cardelli (U Wisconsin - Madison)
Structure of Interstellar Medium Along Low Density Galactic Sight Lines

IMPCU - C. Megan Urry (STScI)
Intensive Multiwavelength Monitoring of PKS 2155-304

IMPIG - Ian M. George (USRA)
Intensive Monitoring of Spectral Evolution in 0716+714

IMPRE - Richard A. Edelson (NASA/GSFC)
International AGN Watch: Continuous Monitoring of NGC 4151

IMPVB - Paul A. Vanden Bout (Texas)
Observations of Interstellar Molecules

INOTA - Thomas B. Ake (CSC - GHRS)
Collaborative Observations of HDE 332077

IONMM - Melissa A. McGrath (Johns Hopkins University)
IO and the Plasma Torus

IOOMM - Melissa A. McGrath (Johns Hopkins University)
Ultraviolet Variability in the Io Plama Torus

IOPDH - Doyle T. Hall (Johns Hopkins University)
The Temperature of Io Plasma Torus Electrons

IOPSS - S. Alan Stern (Southwest Research Institute)
IUE Studies: A Galileo-Precursor Search for New Species in IO's Atmosphere

IPJGB - Graham Berriman (University of Arizona)
The Nature of the Pulsed Light in Intermediate Polars

IPJRP - Ronald S. Polidan (Arizona)
Anomalously Weak C IV Absorption in Interacting Binaries

IPOKH - Keith Horne (STScI)
Phase-Dependent Observations of Intermediate Polars

IPOTA - Thomas B. Ake (CSC - GHRS)
Coordinated Observations of Interacting Peculiar Red Giant Binaries II

IPPKH - Keith Horne (STScI)
Phase-Dependent Observations of Intermediate Polars

IQ019 - Courvoisier (ST/ECF)
Observations of a UV Flare in the Quasar 3C 273

IQ024 - M. H. Ulrich (ESO/Munich)
Variations of the Absorption Lines in NGC 3516

IQ067 - Boisson (Meudon)
UV Observations of a Complete X-Ray Selected Sample of AGN

IQ074 - Barr (Exosat)
UV Studies of the Unusual Seyfert Galaxy Markarian 766

IQ128 - T. Snijders (RGO)
Continued Monitoring of NGC 4151

IQ131 - G. E. Bromage (RAL)
Observations of the X-Ray Bright BL LAC Object 1H0414+009

IQ138 - Willem Wamsteker (Vilspa)
Multi-Wavelength Study of Seyfert I Galaxies

IQ140 - Willem Wamsteker (Vilspa)
Intergalactic Lyman-Alpha Systems

IQ144 - E. G. Tanzi (Milano)
Coordinated UV and Optical Observations of Variable Active Galactic Nuclei

IQ148 - Wall (RGO)
UV Observations of the Very Bright BL Lac Object PKS 2005-489

IQ194 - Shafer (Exosat)
IUE Observations of Iras Selected Seyfert 1's

IRMBW - Beverley J. Wills (Texas - Austin)
Polarization, Hot Dust and Broad Absorption Lines in Iras Qso's

IRNJH - John A. Hackwell (Aerospace Corporation)
The Link Between UV Extinction and IR Cirrus

IRORC - Ross D. Cohen (UC San Diego)
The X-Ray to IR Continuum of PG 1522+101

IS115 - Fricke (K.H. Bonn)
A Search for Acetylene and Aurorae at Neptune

IS196 - C. Festou (Besancon)
Observations of Comet P/Halley

IS205 - K. Fricke (Bonn)
The Long-Term Variability of the Lyman Alpha Emission From Jupiter, Saturn and Uranus

IS208 - M. Wallis (Cardiff)
Periodic and New Comets

IS220 - J. L. Bertaux (Verrieres)
Deuterium in the Upper Atmosphere of Venus + Monitoring of SO2 in

ISHBS - Blair D. Savage (Wisconsin)
A Search for Variability of the 2175A Extinction Bump

ISHDY - Donald G. York (Chicago)
How Far Will We See at 500A

ISHEF - Edward L. Fitzpatrick (Colorado - JILA)
A Further Investigation of Extinction in the Large Magellanic Cloud

ISHFB - Frederick C. Bruhweiler (Catholic University)
The Interstellar Wind and the Ionization of the Local Cloud

ISHJS - J. Michael Shull (Colorado-Lasp)
Interstellar Metal Abundances Survey

ISHPF - Priscilla C. Frisch (Chicago)
Interstellar Clouds Near the Sun

ISIJS - J. Michael Shull (Colorado - CASA)
Investigation of the Anti-Center Supershell

ISILH - Lewis M. Hobbs (Chicago)
A High-Sensitivity Search for New Interstellar Molecules, atOMS, and IONS

ISIPF - Priscilla C. Frisch (Chicago)
Interstellar Clouds Near the Sun. II.

ISIWL - Wayne B. Landsman (NASA/GSFC)
New Probes of Local Interstellar Deuterium and Hydrogen

ISJGS - George Sonneborn (CSC)
Small-Scale Structure of the Ism in Orion OB1

ISJJN - Joy Nichols-Bohlin (CSC)
High-Velocity Gas Toward the WR Stars HD 96548 and HD 97152

ISJPF - Priscilla C. Frisch (Chicago)
Interstellar Clouds Near the Sun, III

ISKBS - Blair D. Savage (Wisconsin)
Gas Associated with Heavily Modified Dust

ISKJS - J. Michael Shull (Colorado - CASA)
IUE Extinction and Abundance Studies of Interstellar Gas

ISKRH - Richard C. Henry (Johns Hopkins University)
Local Interstellar Hydrogen and Deuterium

ISKSS - Steven Shore (New Mexico Institute Mining & Technology)
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ISLJH - Jay B. Holberg (Arizona)
An IUE Determination of Interstellar Hydrogen Columns to He-Rich Degenerates

ISLPF - Priscilla C. Frisch (Chicago)
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ISMAC - Adeline Caulet (NASA/GSFC)
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ISMAM - A. M. Magalhaes (Wisconsin)
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ISMDB - Douglas N. Brown (Washington)
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ISMDM - David M. Meyer (Northwestern)
Small-Scale Structure in the Interstellar Medium

ISMFB - Frederick C. Bruhweiler (Catholic University)
Probing the Local Interstellar Void and the Future of EUV Astronomy

ISMTS - Theodore P. Snow (Colorado - CASA)
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ISNDM - David M. Meyer (Northwestern University)
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ISNTS - Theodore P. Snow (Colorado - CASA)
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ISPJG - James C. Green (Colorado - CASA)
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ISPTS - Theodore P. Snow (Colorado - CASA)
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KDPCA - Carol W. Ambruster (Villanova University)
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KE190 - Danziger (Garching)
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KM201 - Vladilo (Trieste)
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KM205 - M. Grewing (Tuebingen)
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KNPFB - Frederick C. Bruhweiler (Catholic University)
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KQ003 - O'Brien (UCL London)
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KQ053 - M. H. Ulrich (Muenchen)
Intrinsic Absorption Lines in 4 Seyfert 1 Galaxies and Quasars

KQ054 - M. H. Ulrich (Muenchen)
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KQ085 - Wamsteker (Vilspa)
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KQ120 - Courvoisier (Muenchen)
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KQ175 - George (Leicester)
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KQ176 - George (Leicester)
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KRUEG - Vernon Krueger (NASA/GSFC)
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KS010 - Bertaux (Paris)
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KS064 - Wallis (Cardiff)
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KS093 - Brosch (Tel Aviv)
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KS094 - Brosch (Tel Aviv)
The UV Albedo of Triton

KS117 - K. J. Fricke ( )
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KS126 - Festou (Besancon)
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KS148 - Besancon ( )
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KS173 - K. J. Fricke (Fricke% KH)
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KS317 - K. Seidensticker (Bochum)
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LA001 - Barstow (Leicester)
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LA002 - Barstow (Leicester)
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LA015 - Henrichs (Amsterdam)
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LA020 - Vogel (Zurich)
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LA023 - V. Doazan (Paris)
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LA026 - S. Vauclair (Toulouse)
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LA030 - S. Vauclair (Toulouse)
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LA032 - M. Grewing (Tubingen)
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LA033 - M. Grewing (Tubingen)
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LA042 - Michael Barylak (Vilspa)
The P Cygni Star AG Car: Its Rapid Evolution Towards O Stars

LA043 - Brocato (Garching)
Post Asymptotic Giant Branch Stars in NGN 6528

LA044 - Lamers (Utrecht)
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LA313 - L. Angeletti (Roma)
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LA565 - L. Angeletti (Rome)
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LABDS - Blair D. Savage (Wisconsin)
Interstellar Lyman-Alpha Observations

LANAK - Anne L. Kinney (STScI)
Intermediate Redshift Counterparts to High Redshift Lyman Alpha Galaxies

LANDT - David A. Turnshek (U Pittsburgh)
Damped Lyman-alpha Absorption From Low to Moderate Redshift Galaxies

LANJC - John T. Clarke (U Michigan)
H Lyman Alpha Emission Line Profile Studies of Jupiter and Saturn

LAODT - David A. Turnshek (U Pittsburgh)
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LAPJB - Jay A. Bookbinder (Harvard CFA - SAO)
Lyman Alpha Observations of High Velocity Dwarfs

LAPWL - Wayne B. Landsman (Hughes - STX)
Further Studies of Stellar Lyman Alpha Emission

LB304 - L. Bianchi (Vilspa)
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The Binary System X Persei

LBFAS - Arne Slettebak (Ohio State)
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LBLSS - Steven N. Shore (NM Inst. Tech)
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LBMBA - Bruce M. Altner (CSC - GHRS)
Spatially Resolved Spectroscopy of AG Carina

LBMJS - J. Scott Shaw (Georgia)
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LBMKD - Kris Davidson (Minnesota)
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Monitoring the Most Massive Stars

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Monitoring the Most Massive Stars

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LC017 - Doyle (Armagh)
Flares on RS CVn Stars

LC035 - M. Rodono (Catania)
Fourth Epoch Doppler-Imaging Observations of AR Lacertae

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Cool Star Flux Spectra for Population Studies in Galaxies

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Mass Loss Determination in the M Giant Companion of BF Cyg

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High Velocity MgII Wings in II Peg

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Chromospheres of Naked Carbon Stars

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Chromospheres/Transition Regions of DM(e) Stars

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Transition Zone Dynamics in Yellow Giants and Supergiants

LC117 - Montesinos (Oxford)
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LC120 - C. Jordan (Oxford)
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LC123 - Munday (Oxford)
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LC124 - Reza (Rio Janeiro)
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Rotational Modulation and Surface Imaging Study of HD 32918

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Ultraviolet Observations of RCB Stars

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Search for Blue Companion Among Cepheids and Other Yellow Supergiants

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LC176 - Angelo Cassatella (Vilspa)
Search for Hot Component Companions to Late Type Supergiants

LDEDS - David R. Soderblom (CFA)
Spectra of Late-F Dwarfs & Their Relation to Rotation

LDEJL - Jeffrey L. Linsky (Colorado)
A Correlative Study of the Variability of XI BOO A

LDEKH - Kenneth L. Hallam (NASA/GSFC)
Stellar Differential Rotation & Chromospheric Surface Distribution

LDERN - Robert W. Noyes (CFA)
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LDFDS - David R. Soderblom (CFA)
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LDFJL - Jeffrey L. Linsky (Colorado - JILA)
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Capella HL

LDGDS - David R. Soderblom (CFA)
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LDGJL - Jeffrey L. Linsky (Colorado - JILA)
Ultraviolet Study of the Chamaeleon T-Association

LDHBH - Bernhard M. Haisch (Lockheed)
Continuation of a Comparative Study of Solar-Type Stars

LDHDD - Douglas K. Duncan (Cal Tech-MT. Wilson)
Structural Changes in the Chromospheres of M Dwarfs

LDHFW - Frederick M. Walter (Colorado-Lasp)
Ultraviolet Tomography of the Transition Region of V471 Tauri

LDHMG - Mark S. Giampapa (Noao)
Profiles of the MG II H and K Lines in Selected Red Dwarfs

LDIDB - David Burstein (Arizona State)
K Giant Spectra for Stellar Population Models

LDIJL - Jeffrey L. Linksy (Colordao)
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UV Chromospheric Activity Cycles

LDJDB - David Burstein (Arizona State)
Dwarf Star Spectra for Stellar Population Models

LDJDD - Douglas K. Duncan (STScI)
Rapidly Rotating Cool Dwarfs

LDKCA - Carol Ambruster (Carol W. Ambruster)
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LDKDB - David Burstein (Arizona State)
Dwarf Star Spectra for Stellar Population Models

LDKSB - Sallie L. Baliunas (CFA SAO)
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LDLCA - (Carol W. Ambruster)
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LDMGB - Gibor S. Basri (UC Berkeley)
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LDMTS - Theodore Simon (Hawaii)
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LDNJL - Jeffrey L. Linsky (Colorado - JILA)
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LEGCS - Christopher Sneden (Texas)
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LEGTS - Theodore Simon (Hawaii)
Chromospheres and Light Element Abundances

LEORP - Ronald S. Polidan (NASA/GSFC)
Multiwavelength Study of 17 Leporis

LFBSW - Simon P. Worden (Air Force Geophysics Laboratory)
MG II and FE II Resonance Line Studies in Extremely Luminous F Stars

LGDRS - Robert E. Stencel (Colorado)
An Emission Measure Analysis of the High Dispersion SWP Spectra

LGDTS - Theodore Simon (Hawaii)
A Study of Transition Region Properties in Yellow Giants

LGEEB - Erika Bohm-Vitense (Washington)
Chromospheres & White Dwarf Companions of Peculiar Abundance Stars

LGESB - Sallie L. Baliunas (CFA)
Activity in the Hyades Giants

LGETS - Theodore Simon (Hawaii)
Ultraviolet Observations of Young Giant Stars

LGFDM - Dermott J. Mullan (Delaware)
Statistics of Mass Loss Fluctuations in Cool Giants

LGFEB - Erika Bohm-Vitense (U Washington)
White Dwarf Companions and Chromospheres of Stars with Peculiar Element Abundances

LGFJL - Jeffrey L. Linsky (Colorado - JILA)
High Dispersion Study of Luminous Cool Stars

LGFRH - R. Kent Honeycutt (Indiana University)
Chromospheric Activity TIO Strength and Spectral Types in M Giants

LGFSB - Sallie L. Baliunas (CFA)
Vertical Structure of the Atmospheres of Active G-Giant Stars

LGFTA - Thomas R. Ayres (Colorado-Lasp)
High-Dispersion Observations of Alpha Bootis

LGGDD - Dennis W. Dawson (F & M College)
The Envelopes of RV Tauri and Semi-Reg Dwarf Variables Durind the Rise to Maximum Light

LGGEB - Erika Bohm-Vitense (U Washington)
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LGGIL - Irene Little-Marenin (Wellesley College)
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LGGJL - Jeffrey L. Linsky (Colorado - JILA)
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LGGRC - Robert D. Chapman (NASA/GSFC)
Empirical Model of the Atmosphere of the K Supergiant in Zeta Aurigae

LGGTS - Theodore Simon (Hawaii)
Active Regions in Yellow Giant Stars

LGHAD - Andrea Dupree (Smithsonian Astrophysical Observatory)
The Incidence of Winds From Metal Deficient Giant Stars

LGHBP - Benjamin F. Peery (Howard University)
A Search for Hot Degenerate Companions of Late-Type Giants with Heavy-Element Excesses

LGHHJ - Hollis R. Johnson (Indiana)
Upper Atmospheres of Late M Stars

LGHJL - Jeffrey L. Linsky (Colorado - JILA)
Variability of the Winds, Chromospheres and Transition Regions of Hybrid Stars

LGHSB - Sallie L. Baliunas (CFA)
Activity Cycles in the Hyades and Praesepe

LGIHJ - Hollis R. Johnson (Indiana)
Upper Atmospheres of Late M Stars

LGISB - Sallie Baliunas (Smithsonian Astrophysical Observatory)
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LGJHJ - Hollis R. Johnson (Indiana)
The Upper Atmospheres of Late M Stars

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Intrinsic Lyman Alpha Profile of a High Radial Velocity G Giant

LGKMJ - Michael Jura (UCLA)
Search for a Close Companion to V Hya, a Rotating Carbon Star

LGKTA - Thomas R. Ayres (Colorado - CASA)
The Age of the Hyades

LGLHJ - Hollis R. Johnson (Indiana)
Companions to CH Stars

LGLKC - Kenneth G. Carpenter (NASA/GSFC)
Short Timescale Variations in the Outer Atmosphere of Gamma Crucis

LGLMS - Myron A. Smith (CSC)
Periodic Ultraviolet Variations in Two Red Supergiants

LGLSD - Stephen A. Drake (ST Systems)
An IUE Study of F Giants

LGLTA - Thomas R. Ayres (Colorado - CASA)
Cool-Star Betathon

LGMDL - Donald G. Luttermoser (Colorado - JILA)
Fluorescent Clues to the Atmospheric Shock Structure of Cool, Variable Stars

LGMMK - Margarita Karovska (Harvard SAO - CFA)
Coordinated IUE and Speckle Observations of the Mira AB System

LGMMS - Myron A. Smith (CSC - Astronomy Programs)
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LGMPJ - Philip G. Judge (Colorado - JILA)
The Mira/Semi-Regular Connection

LGMTA - Thomas B. Ake (CSC - GHRS)
The Binary Hypothesis for Peculiar Red Giant Formation

LGMTS - Theodore Simon (Hawaii)
IUE Observations of Rapidly Rotating Giants

LGNDL - Donald G. Luttermoser (Iowa State University)
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LH006 - L. Houziaux (Universite De Mons)
Study of Luminosity Effects in the Spectrum of B-Type Stars

LHA07 - L. Houziaux (Universite De Mons)
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LHB07 - L. Houziaux (Universite De Mons)
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LI004 - Hassall (Cambridge)
Comparison of Early Rise Stages of Normal and Superoutbursts of the Dwarf Nova Z Cha

LI005 - Hassall (Cambridge)
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LI045 - Gonzalez (Vilspa)
Rayleigh Scattering in Symbiotic Stars

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LI047 - P. L. Selvelli (Trieste)
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LI048 - P. L. Selvelli (Trieste)
The Imminent Outburst of the Recurrent Nova T Pyx

LI049 - Angelo Cassatella (Vilspa)
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LI052 - Gonzalez (Vilspa)
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LI062 - Andreae (Bamberg)
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LI064 - Gimenez (Granada)
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LI074 - Bonnet-Bidaud (Saclay)
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LI139 - Drew (Oxford)
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LI143 - Penninx (Amsterdam)
Simultaneous X-Ray and Ultraviolet Observations of Sco X-1

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LI155 - D. J. Stickland (RAL)
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LI158 - Giovannelli (Frascati)
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LI164 - Nussbaumer (Zurich)
The Symbiotic Star V1016 Cyg

LI172 - Czerny (Warsaw)
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LIOGR - Gail A. Reichert (USRA)
UV and Optical Observations of Liners

LM009 - Boer (Bonn)
Distance to HVC Complex C Using Newly Calibrated Stars

LM011 - Molaro (Trieste)
UV/Optical Observations of ISM in the Field of SN 1987A

LM072 - Stars (Lagrange)
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LM078 - Rao (Bangalore)
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LM166 - Solf (Heidelberg)
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LM344 - L. Maraschi (Milano)
Observation of X-Ray Emitting Qsos and BL LAC Objects

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LMPPH - Paul W. Hodge (U Washington)
An HR Diagram for LH 72

LNOSS - Sumner G. Starrfield (Arizona State University)
UV Observations of Novae During the Late States of Their Outbursts

LOPSS - Sumner G. Starrfield (Arizona State University)
Multiwavelength Observations of Nova Cygni 1992 and Nova Pup 1991 During Late Outburst Stage

LP147 - L. Prevot (Marseille)
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LQ068 - Mason (Surrey)
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LQ069 - Branduardi (Surrey)
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LQ070 - Hansen (Copenhagen)
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LQ087 - O'Brien (London)
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LQ100 - Miley (Leiden)
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LSJAD - Andrea K. Dupree (CFA SAO)
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LSJJB - Jay A. Bookbinder (Colorado - CASA)
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LSJSB - Sallie L. Baliunas (CFA SAO)
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LSJTA - Thomas R. Ayres (Colorado - CASA)
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LSKAD - Andrea K. Dupree (CFA SAO)
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LSKKC - Kenneth G. Carpenter (Colorado - CASA)
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LSMAD - Andrea K. Dupree (Harvard SAO - CFA)
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LSNAD - Andrea K. Dupree (Harvard CFA - SAO)
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MA090 - Vogel (Zurich)
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MA094 - Stahl (Heidelberg)
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MA095 - Wolf (Heidelberg)
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MA100 - Cuypers (Brussel)
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MA158 - Megessier (Meudon)
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MA172 - Antonio Talavera (Vilspa)
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MA173 - Antonio Talavera (Vilspa)
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MA501 - M. Auvergne (Nice)
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MAPFF - Francis C. Fekel (CEIS - Tennessee State University)
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MBMMC - Michael F. Corcoran (NASA/GSFC)
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MC006 - North (Lausanne)
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MCHJH - John B. Hutchings (DAO)
Star Formation in the Magellanic Clouds

MCJBB - Bruce Bohannan (Colorado - CASA)
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MCKEB - Erika Bohm-Vitense (Washington)
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MCLNE - Nancy Remage Evans (Canada)
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MCMAM - Andrew G. Michalitsianos (NASA/GSFC)
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MCMPH - Paul W. Hodge (Washington)
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MCNAM - Antonio M. Magalhaes (U Wisconsin - Madison)
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MCOMR - Melodi Rodrigue (U Nevada - Reno)
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MCRBW - Bart P. Wakker (U Illinois)
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MD123 - M. Dennefeld (ESA)
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ME169 - Brosch (Tel Aviv)
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MF412 - M. Friedjung (Paris)
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MF415 - M. Friedjung (Paris)
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MFGEB - Edward W. Brugel (Colorado-LASP)
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MG012 - M. Golay (Observatoire De Geneve)
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MG124 - M. Grewing (Tubingen)
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MG126 - M. Grewing (Tubingen)
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MG338 - M. Gerbaldi (Paris)
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MG340 - M. Grewing (Tubingen)
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MG574 - M. Grewing (Tubingen)
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MG604 - M. Grewing (Tubingen)
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MGCTS - Theodore Simon (Colorado)
MGII Observations of the Young Cluster NGC 2264

MGDDM - Dermott J. Mullan (Delaware)
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MGFLH - Lee W. Hartmann (CFA)
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MGGJW - J. H. Waite (NASA/GSFC)
MG+ Observations of Earth

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MG II Emission from Mira Variables

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The Winds of High Luminosity K and M Stars

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MH011 - M. C. Huber (Zurich)
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MH155 - M. Hack (Trieste)
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MI177 - Angelo Cassatella (Vilspa)
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MLBFS - Fred Sanner (Texas)
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MLBJC - Cassinelli (Wisconsin)
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MLCDM - Dermott J. Mullan (Delaware)
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MLCHJ - Hollis R. Johnson (Lockheed)
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MLCJH - John B. Hutchings (Herzberg)
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MLCJL - Jeffrey L. Linsky (Colorado)
A Critical Test of the Coronae/Winds Division Among Late-Type Stars

MLCNM - Nancy D. Morrison (Toledo)
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MLCSL - S. A. Lamb (Missouri)
Mass Loss from F-Type Supergiants

MLCTG - Theodore R. Gull (NASA/GSFC)
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MLDGM - George E. McCluskey (Lehigh University)
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MLERH - Ryuko Hirata (University of Kyoto)
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MLFCD - Charles A. Dean (S. M. Systems)
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Mass Loss Rates from Archive O-Star Images

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Hot Stars in Nearby Galaxies

MLJBH - J. B. Hutchings (Dominion Astrophysiacl Observatory)
Evidence for Mass Loss in the Ultraviolet Spectra of Early-Type Supergiants

MLJCG - Catharine D. Garmany (Colorado - CASA)
UV Observations of Three O Giants

MLJEB - Erika Bohm-Vitense (University of Washington)
Mass Loss in Population I Cepheids

MLJFB - Frederick C. Bruhweiler (Catholic University)
Unusual Mass Loss/Accretion Phenomena of the O Subdwarf HD 128220B

MLJPM - Philip L. Massey (Noao KPNO)
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MLJRS - Robert Stencel (University of Colorado)
UV Observations of the Southern Star HR 3126

MLKCG - Catharine Garmany (University of Colorado)
Stellar Winds in the Magellanic Clouds

MLKJN - Joy Nichols-Bohlin (CSC IUE)
Stellar Wind Variability of O Stars

MLKPM - Philip Massey (KPNO)
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MLNEB - Erika H. Bohm-Vitense (U Washington)
Mass Loss of B3 to B6 Main Sequence Stars

MLOAB - Alexander Brown (Colorado - JILA)
Completion of a Magnitude-Limited Survey of Single Non-Variable G Supergiants

MM004 - Lagrange (ESO (D))
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MM057 - M. Barlow (UCL)
The Carbon Abundance in Planetary Nebulae Near the Galactic Centre

MM058 - Clegg (RGO)
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MM061 - M. Barlow (UCL)
Nebular and Central Star Parameters for Five Galactic Planetary Nebulae

MM071 - Dennefeld (IAP)
Where is the Interstellar Matter Towards the LMC ?

MM142 - Adamson (Lancashire)
Interstellar Extinction Law in the Taurus Dark Cloud

MM147 - Vidal-Madjar (IAP)
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MM152 - Liseau (Frascati)
Time Variable Interstellar Shocks: Herbig Haro Objects

MM165 - Solf (Heidelberg)
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MM167 - Boulanger (Paris)
Small Particles in Molecular Clouds

MM176 - K. S. De Boer (Bonn)
The Interstellar Medium at High Galactic Latitudes

MMNSB - Sallie L. Baliunas (Harvard CFA - SAO)
The Maunder-Minimum Phase of Solar-Type Stars in the Ultraviolet

MMOCU - C. Megan Urry (STScI)
Intensive Multiwavelength Monitoring of the Blazar 3C279

MMOSB - Sallie L. Baliunas (Harvard CFA - SAO)
The Maunder-Minimum Phase of Old K-Dwarf Stars in the Ultraviolet

MMPSA - Saul J. Adelman (The Citadel)
Elemental Abundances of Mercury-Manganese Stars

MOPMC - Michael R. Combi (U Michigan)
Variation of the Solar Lyman-Alpha Line Profile with Solar Activity

MOPNM - Nancy D. Morrison (U Toledo)
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MP028 - M. Perinotto (Arcetri)
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MP029 - M. Perinotto (Arcetri)
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MP130 - Michael Penston (Vilspa)
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MP203 - M. Perinotto (Firenze)
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MP345 - M. Perinotto (Florence)
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MP348 - M. Perinotto (Florence)
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MP398 - Michael Penston (Vilspa)
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MPJAM - Andrew G. Michalitsianos (NASA/GSFC)
Hires IUE Observations of the Peculiar Stars RX Puppis and R Aquarii

MQ005 - Durret (IAP)
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MQ023 - Mason (Mullard UCL)
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MQ036 - Buson (Padova)
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MQ043 - M. H. Ulrich (ESO Garchin)
Observations of the Seyfert 1 Nucleus of NGC 4151

MQ044 - M. H. Ulrich (ESO Garchin)
UV Variability of the Quasar 3C 273

MQ045 - M. H. Ulrich (ESO Garchin)
IUE Observations of the Bright Variable Quasar 1821+64

MQ046 - M. H. Ulrich (ESO Garchin)
IUE Observations of Quasars Simultaneous with Rosat Pointed Observations

MQ049 - Willem Wamsteker (Vilspa)
Variability Probing of the Inner Parts of the Broad Line Regions in Seyfert I Nuclei

MQ092 - Courvoisier (Geneve)
Extended UV Activity in M82

MQ117 - Wagner (Heidelberg)
Co-Ordinated Optical UV Observations of Microvariability in QSO 0716+71

MQ126 - M. Ward (Cambridge)
Coordinated HST and IUE Observations of 2 Agn

MQ133 - L. Maraschi (Milano)
IUE Observations of Blazars Coordinated with Rosat Pointed Observations

MQ175 - D. Reimers (Hamburg)
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MR003 - M. Rego (Madrid)
Chromospheric Activity in Dwarf Stars

MR179 - M. Rodono (Catania)
By Dra Stars

MR205 - M. Rego (Madrid)
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MR321 - M. Rego (Madrid)
Chromospheric Activity in Dwarf Stars

MR355 - M. Rosa (Heidelberg)
UV Spectra of Giant Extragalactic HII Regions

MR379 - M. Rodono (Catania)
Solar-Type Stellar Activity in By Dra Flare

MR381 - M. Rodono (Catania)
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MR503 - M. Rosa (Heidelberg)
The Exciting Stars of Extragalactic HII Regions

MR531 - M. Rodono (Catania)
Studies of the Quiet and Plage Component of the Active Stars in RS CVN Binary Systems

MRITA - Thomas R. Ayres (Colorado - CASA)
Long-Term Cycles in the Magnetic Active Regions of Cool Stars

MS010 - K. H. Fricke (Bonn)
The Long Term Variability of the Lyman Alpha Emission From Jupiter, Saturn and Uranus

MS017 - C. Festou (Besancon)
IUE Studies of Faint Planetary Satellites

MS018 - C. Festou (Besancon)
IUE Observations of IO'S Atomsphere and Torus

MS039 - Ballester (Oxford)
Coordinated UV and IR Observations of the Jovian Aurora

MS146 - K. H. Fricke (Bonn)
UV Variability of the Sun, Uranus, and Neptune

MSINE - Nancy Remage Evans (CSC)
Fluxes, Temperatures, and Radii of Satrs Defining the Zams

MSJDW - J. D. Wray (Texas)
Spectrometry of Selected Early-Type Stars, Magellanic Wolf-Rayet Stars and Galactic Nucleii

MSJLW - Lee Anne Willson (Iowa)
A Stars in the Pleiades

MSJRP - Ronald E. Pitts (CSC)
Fluxes, Temperatures, and Radii of Stars Defining the Zams

MSLHJ - Hollis R. Johnson (Indiana)
Ultraviolet Spectra and Chromospheres of S and Ms Stars

MT384 - M. Tarenghi (ESA)
UV Observations of Double Active Galaxies

MU009 - M. H. Ulrich (France)
Observations of Nuclei of Two Seyfert Galaxies and A Qso

MU120 - M. H. Ulrich (ESA)
NGC 4151

MU373 - M. H. Ulrich (ESA)
Monitoring of the Continuum and Line Strengths of Seyfert Galaxy NGC 4151

MU595 - M. H. Ulrich (Garching)
UV and Optical Observations of Active Nuclei: A Study of Non-Stellar Continous Radiation

MU597 - M. H. Ulrich (MU)
Continuation of the Monitoring of the Continuum and Line Strengths of the Seyfert Galaxy NGC 4151

MVDSL - David S. Leckrone (NASA/GSFC)
Spectroscopy of the EP, AP and Magnetic Variable Stars at Ultraviolet Wavelengths

MWOJL - Jeffrey L. Linsky (Colorado - JILA)
A Multiwavelength Campaign of Active Stars w/Intermediate Rotation Rates

NA004 - Howarth (UCL London)
Spectrophotometry of Magellanic Cloud B Main Sequence Stars

NA009 - Schonberner (Kiel)
UV Study of the Closest Central Star of a Planetary Nebula (S216)

NA013 - de Boer (Bonn)
Physical Parameters of Subdwarfs of Type SdOB and SdO

NA023 - Willis (UCL London)
High Resolution Spectroscopy of Magellanic Cloud WR Stars

NA024 - Willis (UCL London)
Multi-Wavelength Studies of HD 50896 (WN5+?) - Origin of its Stellar Wind Variability

NA026 - Monier (Vilspa)
Probing the Atmospheric Structure of 52 Her Through a Complete Phase Coverage in the Ultraviolet

NA030 - Prinja (UCL London)
Stellar Wind Variability in Mid-B Supergiants

NA032 - Weidemann (Kiel)
UV Spectroscopy of Selected White Dwarfs

NA035 - Fernley (Vilspa)
Radii and Bolometric Luminosities of Pleiades Main Sequence Stars

NA038 - Seggewiss (Daun)
Study of the Spectroscopic Magnetic Binary Alpha Dra

NA040 - Wolf (Heidelberg)
Chemical Abundances from B Stars in the Magellanic Clouds

NA041 - Wolf (Heidelberg)
B[e] Supergiants of the Magellanic Clouds

NA044 - Henrichs (Muenchen)
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NA046 - Henrichs (Muenchen)
UV and Optical Covariability of O Star Winds

NA048 - Krautter (Heidelberg)
Late Stages in the Outburst of Classical Novae

NA050 - Evans (Keele)
Ultraviolet Observations of PMS Stars in the Orion Region

NA064 - Heber (Kiel)
UV Spectrophotometry of Peculiar Hot Stars Discovered by the Hamburg Schmidt Survey

NA081 - Cacciari (Bologna)
UV-Bright Stars in M3

NA087 - Barstow (Leicester)
IUE Observations of DAB White Dwarfs

NA088 - Barstow (Leicester)
Time Resolved High Spectral Resolution Observations of a Rare DA + DM Binary System Which Also A Bright EUV Source

NA093 - Faraggiana (Trieste)
Search for Lambda Boo Stars

NA094 - Pottasch (Groningen)
IUE Observations of New Proto- Planetary Nebulae from IRAS Survey

NA098 - Faraggiana (Trieste)
The Chemical Composition of the Lambda Boo Stars

NA101 - Tjin A Djie (Amsterdam)
Evolution of the Envelopes of Herbig Ae/Be Stars

NA106 - Solheim (Tromso)
Two Phase Ultraviolet Spectrometry of Pulsating White Dwarf Stars

NA108 - Pottasch (Groningen)
IUE Observations of Post AGB Stars Which Show Spectrum Variation

NA118 - Vogel (Zurich)
Atmospheres of the Hot Components in Symbiotic Systems

NA128 - Heber (Kiel)
High Resolution UV Spectroscopy of 3 Metal Weak Lined SdO Stars

NA132 - Tweedy (Leicester)
A Scan Across the Planetary Nebula NGC 4361

NA141 - Willis (UCL London)
The Colliding Winds and Shocked Gas in Gamma Velorum (WC8+091)

NA154 - Bianchi (Torino)
Continuum and UV Extinction of OB Stars in M33 And M31

NA155 - Bianchi (Torino)
Study of Planetary Nebulae and Their Central Stars with IUE

NA157 - Bianchi (Torino)
Observations of Novae and Related Objects with IUE, ROSAT and Optical Telescopes

NA165 - Doazan (Paris)
The New Be Phase of Pleione

NA170 - Van der Hucht (Utrecht)
Colliding Winds and Dust Formation in the Variable WC7 Stars HD 192641 HD 193793 a Continuation Proposal

NA175 - Cassatella (Vilspa)
Verification of the IUE Flux Scale Through Observations of Two Hot DA White Dwarfs

NA186 - Talavera (Vilspa)
Stellar Winds and Mass Loss in A-type Supergiants

NA187 - Stahl (Heidelberg)
Multifrequency Observations of the Outburst Phase of the dLMC - LBV R127

NA188 - Catala (Meudon)
Cyclic Acitivity in PMS Herbig Ae Stars

NA192 - Parthasarathy (Bangalore)
Ultraviolet Spectrum of Extremely Metal Poor Post AGB Star HD 52961

NA193 - de Boer (Bonn)
Sorting Out Binarity in Hot Subdwarf Stars

NA201 - Koubsky (Ondrejov)
UV Spectra of the Cyclic Variable Shell Star HD 183656

NA202 - Megessier (Meudon)
Rotational and Short Time Scale Variations of the Magnetic Pulsating Ap Star And Alpha Cir

NA205 - Krautter (Heidelberg)
IUE Observations of the X-Ray Nova Muscae GRS 1121-68

NABJH - J. Patrick Harrington (Maryland)
An Investigation of Chemical Abundances in Low-Extitation Planetary Nebulae

NAERD - Reginald J. Dufour (Rice University)
Abundances of C, SI, & MG in Galactic H II Regions

NAESM - Stephen P. Maran (NASA/GSFC)
A Abundance in Planetary Nebula of Fornax Galaxy

NAGWF - Walter A. Feibelman (NASA/GSFC)
Atlas of Low and High Dispersion IUE Spectrograms of Planetary Nebulae and Related Objects

NASA- - Walter A. Feibelman (NASA/GSFC)
Hi-Res Study of PN-Nuclei of Extremely High Temperature & Low Luminosity

NASAY - George Sonneborn (NASA/GSFC)
Puppis SNR

NB108 - N. Bel (Meudon)
X-Ray Globular Clusters

NB423 - N. Bel (Paris)

A Very Rapidly Expanding Gas in the Core of the Globular Cluster NGC 6624

NBIRD - Reginald J. Dufour (Rice University)
IUE Observations of Nebulosity Around AG CArinae

NBJHB - Howard E. Bond (STScI)
The Close-Binary Nucleus of the Planetary Nebula HFG 1

NBKWF - Walter A. Feibelman (NASA/GSFC)
A Study of Bipolar Nebulae and Protoplanetary Objects

NBNSS - Sumner G. Starrfield (Arizona State University)
Coordinated Multiwavelength Observations of Classical and Recurrent Novae in Outburst

NC001 - Doyle (Armagh)
Short Period Oscillations in Dwarf M Stars

NC002 - Doyle (Armagh)
The Nature of M Dwarfs with a Zero H Alpha Flux

NC006 - Byrne (Armagh)
Transition Region Densities in Active Late_Type Stars

NC007 - Elgaroy (Oslo)
Deviation from the Wilson-Bappu Relationship in Faint Red Dwarf Stars

NC008 - Doyle (Armagh)
Multiwavelength Observations of Stellar Flares

NC011 - Reimers (Hamburg)
Mass Loss of Alpha Her a from CS Lines in the Spectrum of Alpha Her B

NC027 - Bues (Bamberg)
Atmospheric Structure and Abundances of White Dwarfs in Binary Systems

NC036 - Mathioudakis (Armagh)
Circumstellar Material in the RS CVn System SZ Psc

NC049 - Evans (Keele)
Ultraviolet Observations of RCB Stars

NC078 - Rodono (Catania)
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NC083 - Waelkens (Leuven)
UV Monitoring of Post-AGB Stars with Variable Extinction

NC091 - Hunsch (Hamburg)
Exploring the Onset of Cool Winds in K-Type Giants of Luminosity Class III

NC111 - Fernandez (Oxford)
Chromospheric Modelling of the Barium Star Cap (G4Ib)

NC112 - Rowe (Oxford)
Mg II H and K Lines as an Indicator of Magnetic Activity

NC114 - Jordan (Oxford)
A Magnitude-limited Survey of Single, Non-variable G Supergiants

NC115 - Harper (Oxford)
Active Regions, Or Changes in the Chromospheric Structure of "Hybrid" Bright Giants?

NC117 - Vogel (Zurich)
Empirical Velocity Laws for Cool Giants

NC121 - Pye (Leicester)
Coordinated UV, XUV and X-Ray Observations of the DMe Flare Star UV Ceti

NC134 - Pye (Leicester)
Determination of the Nature of the Bright EUV Source KW Aurigae

NC137 - Montesinos (Oxford)
Flux-Flux and Flux-Rotation Relations in G-Type Stars

NC138 - Montesinos (Oxford)
IUE Monitoring of the Post- Asymptotic Giant Branch Star FG Sge

NC140 - Joras (Oslo)
Rapid Flux and Velocity Variations in Alpha Ori

NC151 - Viotti (Frascati)
Study of the UV Spectrum of the VV Cep Binary KQ Puppis

NC156 - Bianchi (Torino)
IUE Survey of X-Ray Selected Late- Type M.s. and Evolved Stars

NC168 - Stickland (RAL)
Al Velorum, a New Zeta Aurigae-Type Binary

NC176 - Cassatella (VILSPA)
Search for Hot Component Companions To Late Type Supergiants

NC182 - Querci, M. (Midi Pyrenees)
MgII Emission from Shock Waves in Carbon Miras

NC184 - Querci, F. (Midi-Pyrenees)
Carbon Star Shell Extension and Past Mass-loss Deduced from the 2200 a Feature

NC190 - Catalano (Catania)
Search for Delimitation of the Lyman-alpha and Chromospheric Emission Between a And F Stars

NC195 - Bromage (RAL)
Coordinated IUE/ROSAT and Rotational Mapping of a Short-Period RS-CVn Binary

NC196 - Bromage (RAL)
Time-Resolved Coronal, Transition- Region, Chromospheric and Magnetic Field Study of Stellar Flares

NC198 - Bromage (RAL)
Spatially-Resolved IUE/ROSAT Observations of the Close Double Flare Star

NC199 - Bromage (RAL)
Relationships Between Magnetic Fields and Non-Thermal Emission on the Lower Main Sequence

NCBJH - J. Patrick Harrington (Maryland)
Studies of Suspected High Carbon Abundance Planetary Nebulae

NCHWF - Walter A. Feibelman (NASA/GSFC)
The Eclipsing Nucleus of the Planetary Nebula NGC 2346

NCIRF - Robert A. Fesen (Colorado - CASA)
Peculair Abundances in the Crab Nebula's Filaments

NCIWF - Walter A. Feibelman (NASA/GSFC)
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NCKPH - Paul W. Hodge (Washington)
Carbon Abundance Variations in the SMC

NCKSK - Scott Kenyon (CFA SAO)
PU Vulpeculae

NDBAB - Albert Boggess (NASA/GSFC)
Observations of Galactic H II Regions and Their Exciting Stars

NDBFS - Francis H. Schiffer (CSC)
Observations of the UV Continuum in the Orion Nebula: An Investigation of the Scattering of Starlight by Dust

NDBPP - Peter M. Perry (CSC)
Surface Mapping of Bright Emission Line Extended Objects

NDBRD - Reginald J. Dufour (Rice University)
Observations of the UV Spectra of HII Regions in the Magellanic Clouds and Type I Planetary Nebulae

NDCPP - Peter M. Perry (CSC)
Ultraviolet Observations of Selected Features in the Orion Nebula

NDCRD - Reginald J. Dufour (Rice University)
Observations of the UV Spectra of HII Regions in the Magellanic Clouds

NDCSC - S. J. Czyzak (Ohio State University)
Spectroscopic Investigations of Bright Gaseous Nebulae

NDCVH - H. L. Helfer (College of Arts and Science)
UV Observations of the Continua of Nebula and Their ExcitingStars

NDDHH - H.L. Helfer (Rochester)
UV Observations of the Continua of Nebulae & Their Exciting Stars

NDEKD - Kris Davidson (University of Minesota)
Studies of Material Ejected From ETA Carinae

NDERD - Reginald J. Dufour (Rice University)
High Dispersion IUE Observations of Metal-Poor H II Regions

NDFRD - Reginald J. Dufour (Rice UNiversity)
High Dispersion IUE Observations of Metal-Poor H II Regions

NDGRD - Reginald J. Dufour (Rice University)
High Dispersion IUE Observations of Material Ejected by ETA Carinae

NE033 - Anton (Heidelberg)
UV Spectroscopy of the Central Galaxy of the Cooling-Flow Cluster 2A 0335+096

NE057 - Bertola (Padova)
UV Detection of Ongoing Star Formation in Elliptical Galaxies

NE061 - Panagia (Baltimore)
UV Observations of Supernovae

NE062 - Panagia (Baltimore)
Observations of SN 1987A

NE066 - Fricke (Gottingen)
UV Spectroscopy of Knots in Three Ring Galaxies

NE070 - Wamsteker (Vilspa)
Are the Starburst and Seyfert Phenomena Related? A Case Study of: NGC 1808

NE071 - Wamsteker (Vilspa)
A Study of the Stellar Population in Selected SO Galaxies

NE076 - Cassatella (Vilspa)
The Stellar Content of the Populous Clusters of the Magellanic Clouds

NE077 - E. Terlevich (RGO)
The Carbon Abundance in SBS 0335- 052 and the Time Evolution of C/O

NE099 - Castellani (Pisa)
Massive Stars in the Young SMC Cluster NGC 330

NE126 - Capaccioli (Padova)
An Observational Test of Evolutionary Models for Polar Ring Galaxies

NE127 - Capaccioli (Padova)
The (UV-V, Mg2) Correlation for Early Type Galaxies

NE158 - Maraschi (Milan)
Intensive Multifrequency-Monitoring of PKS 2155-304

NEGRD - Reginald J. Dufour (Rice University)
High Dispersion IUE Observations of Metal-Poor Extragalactic H II Regions -- III

NEGWB - William P. Blair (CFA)
UV Spectra of Evolved Magellanic Cloud Supernova Remnants

NEHJR - John C. Raymond (CFA)
Emission from Nova Shells

NEIRD - Reginald J. Dufour (Rice University)
IUE Observations of Nebulosity Around HD 148937

NEJRD - Reginald J. Dufour (Rice University)
Stellar Enriched and Shocked Gas Associated with NGC 6888

NEKPH - Paul W. Hodge (Washington)
M31 H II Regions

NENPC - Peter S. Conti (Colorado - CASA)
Spatially Integrated Spectroscopy of Nearby Giant HII Regions - How Many O Stars are Predicted?

NENRD - Reginald J. Dufour (Rice University)
Ultraviolet Spectroscopy of the Helix Nebula

NEPIR - ( )
Commissioning Period Program

NEQSS - Sumner Starrfield (Arizona State University)
Multiwavelength Observations of Nova Cygni 1992 and Nova Pup 1992 during Outbursts

NFFJR - John C. Raymond (CFA)
The Transition to Radiative Shocks in the Cygnus Loop

NFGRF - Robert A. Fesen (Colorado-LASP)
UV Emission Line Study of the Elemental Abundances in the Supernova Remnant Puppis A

NGHBZ - Benjamin M. Zuckerman (UCLA)
Model of the Orion Nebula Incorporating IUE Data

NGHMF - Michel Fich (Washington)
Carbon Abundances in Outer Galaxy HII Regions

NGHRD - Reginald J. Dufour (Rice University)
H II Regions in the Magellanic Clouds & The Orion Nebulae

NGIDV - Dave Van Buren (Colorado - CASA)
IUE Tomography of the Rosette Nebula

NH051 - S. Dumont (France)
Emission and Variability in AE-Type Stars

NHJRD - Reginald J. Dufour (Rice University)
IUE Observations of the Trifid and Logoon H II Regions

NI014 - Glz-Riestra (Vilspa)
Monitoring of the Symbiotic Star SY Muscae in Low and High Resolution

NI015 - Glz-Riestra (Vilspa)
BF Cygni in Outburst

NI016 - Naylor (Cambridge)
How Common are UV Modulations in CVs?

NI017 - Naylor (Cambridge)
The Disk and Wind Structure of U Gem in Outburst

NI018 - de Martino (Vilspa)
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NI019 - de Martino (Vilspa)
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NI031 - Schmid (Zurich)
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NI052 - Vauclair (Toulouse)
Evolutionary State of Helium Transfer Cataclysmics

NI074 - Cassatella (Vilspa)
Observations of Faint Classical Novae

NI075 - Cassatella (Vilpsa)
The UV Luminosity and Mass Accretion Rate of Old Novae

NI080 - Stickland (RAL)
Massive Binaries II

NI085 - Evans (Keele)
Multi-Frequency Observations of Symbiotic Stars

NI090 - Ulla (Tromso)
The Interactive Binary White Dwarfs System GP Com

NI107 - Solheim (Tromso)
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NI119 - Vogel (Zurich)
The Symbiotic Nova HM Sge

NI120 - Verbunt (Utrecht)
Structure of Winds from Cataclysmic Variable Accretion Disks

NI122 - Munari (Asiago)
Observations of Six High-ionization Symbiotic Stars

NI136 - Beuermann (Berlin)
Heating of the White Dwarf in AM Herculis

NI153 - Bianchi (Torino)
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NI164 - Andreae (Bamberg)
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NI167 - Friedjung (Paris)
Observation of Old Nova At Similar Time as with the HST

NI169 - Mouchet (Meudon)
Ultraviolet Observations of Magnetic Cataclysmic Candidates

NI172 - Selvelli (Trieste)
The Imminent Outburst of the Recurrent Nova T Pyx

NI173 - Cassatella (Vilspa)
UV Monitoring of the Symbiotic Star Z Andromadae

NI189 - Jasniewicz (Strasbourg)
The Binary Nucleus of the Planetary Nebula Abell 35

NI200 - Bromage (RAL)
Test for Multi-Waveband Correlation and Origin of Radio Emission in Ae Aquarii

NJFAM - Andrew G. Michalitsianos (NASA/GSFC)
Low Dispersion UV Observations of the R Aquarii Jet

NJFCB - C. Stuart Bowyer (Berkeley)
Far UV Spectrosocopy of the Optical Emission Knots in the Inner Jet of CEN A

NJFMK - Minas C. Kafatos (George Mason University)
A High Resolution Study of the Jet in R Aquarii

NJGAM - Andrew G. Michalitsianos (NASA/GSFC)
Temporal Variability: UV Emission from the R Aquarii Jet

NJGMC - Martin Cohen (NASA-AMES Research Center)
Ultraviolet Spectroscopy of an Optical & Radio Jet Associated with a Young Star

NJIMK - Minas C. Kafatos (George Mason University)
Temporal UV Line Emission in the R Aquarii Jet

NJJEB - Edward W. Brugel (Colorado - CASA)
Circumstellar Emission Nebula and Jet Associated with T Tauri

NJJMK - Minas C. Kafatos (George Mason University)
Lores Observations of the R AQR Jet and Nebulosity

NLKJR - John Raymond (Smithsonian Astrophysical)
The Bow Shock Of 0623+71

NLKPS - Paula Szkody (Washington)
Low States of Novalike Systems

NM003 - Bates (Belfast)
Interstellar Gas in the Fields of 4LAC and M22

NM021 - Bomans (Bonn)
Physical State of the LMC High Velocity Gas Near SNR 0525-66.0

NM037 - Solf (Heidelberg)
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NM073 - Patriarchi (Firenze)
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NM079 - Bomans (Bonn)
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NM095 - Beust (Paris)
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NM096 - Vidal-Madjar (IAP Paris)
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NM124 - Vladilo (Trieste)
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NM139 - Dennefeld (IAP Paris)
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NM159 - Barlow (UCL London)
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NOKWB - William P. Blair (Johns Hopkins University)
Oxygen-Rich Supernova Remnants

NOLSS - Sumner Starrfield (Arizona State)
Target of Opportunity Observations of Galactic Novae in Outburst

NOMSB - C. Stuart Bowyer (Berkeley)
A Search for Orbital Modulation in Quiescent Dwarf Novae

NOMSS - Sumner G. Starrfield (Arizona)

Target of Opportunity Observations of Classical and Recurrent Novae

NOMSS - Sumner G. Starrfield (Arizona State)
Target of Opportunity Observations of Galactic Novae in Outburst

NONSS - Sumner G. Starrfield (Arizona State University)
Target of Opportunity Observations of Galactic Novae in Outburst

NOOSS - Sumner G. Starrfield (Arizona State University)
Coordinated Multiwavelength Observations of Classical and Recurrent Novae in Outburst

NOPSS - Sumner G. Starrfield (Arizona State University)
Coordinated Multiwavelength Observations of Classical and Recurrent Novae in Outburst

NOQSS - Sumner Starrfield (Arizona State University)
Multiwavelength Observations of Novae During the Late Stages of Their Outbursts

NORPS - Paula Szkody (U Washington)
Monitoring the Long-Term Changes in NLS

NORSS - Sumner G. Starrfield (Arizona State University)
Multiwavelength Observations of Nova Cygni 1992 and Nova Cas 1993 - Late Stages of Outburst

NP103 - N. Panagia (Bologna)
Supernovae

NP314 - N. Panagia (Bologna)
UV Observations of Supernovae

NP315 - N. Panagia (Bologna)
UV Spectrum of the Nucleus of M100=NGC 4321

NP586 - N. Panagia (Bologna)
UV Observations of Supernovae

NP587 - N. Panagia (Bologna)
UV Mapping of the Nuclear Region of M 100

NPBAB - Albert Boggess (NASA/GSFC)
Observations of Planetary Nebulae

NPBCP - C. R. Purton (York University)
Ultraviolet Observations of Very Young Planetary Nebulae

NPBJL - Julie Lutz (Washington State University)
Observations of Planetary Nebula Shells and Central Stars

NPBLA - Lawrence H. Aller (UCLA)
Ultraviolet Observations of High Excitation Planetaries

NPBRB - Ralph C. Bohlin (NASA/GSFC)
Distribution of Emission Line Intersities in Planetary Nebulae

NPBTB - Timothy Barker (Wheaton College)
UV Spectrophotometry of Planetary Nebulae

NPCAB - Albert Boggess (NASA/GSFC)
Observations of Planetary Nebulae

NPCJL - Julie H. Lutz (Washington State University)
Observations of Peculiar Central Stars of Planetary Nebulae with IUE

NPCLA - Lawrence H. Aller (UCLA)
Ultraviolet Observations of High Excitation Planetary Nebulae

NPDJH - J. Patrick Harrington (Maryland)
Dust in Planetary Nebulae

NPDJK - James B. Kaler (Illinois)
Central Stars of Large Planetary Nebulae

NPDLA - Lawrence H. Aller (California)
Stratification Effects and Diagnostics for Planetart Nebulae

NPDSM - Steohen P Maran (NASA/GSFC)
The Carbon Abundance in High-Excitation Planetary Nebulae in the Magellanic Clouds

NPDTB - Timothy Barker (Wheaton College)
The Ionization Abundance of C, N, & NE in Planetary Nebulae

NPDWF - Walter A. Feibelman (NASA/GSFC)
Observations of Variable & Evolving Planetary or Proto-Planetary Nebulae

NPEGF - Gary J. Ferland (Kentucky)
Carbon in Planetary Nebulae

NPEJH - J. Patrick Harrington (U Maryland)
A Study of the Planetary Nebula IC 2149

NPEJK - James B. Kaler (Illinois)
Central Stars of Large Planetary Nebulae

NPELA - Lawrence H. Aller (CAL LA)
Stratification in & Chemical Compositions of Planetary Nebulae

NPETB - Timothy Barker (Wheaton College)
The Ionization Structure of Planetary Nebulae

NPEWF - Walter A. Feibelman (NASA/GSFC)
Observations of Variable & Proto-Planrtary Nebulae

NPFHB - Howard E. Bond (Louisiana State)
Ultraviolet Observations of Close-Binary and Pulsating Nuclei of Planetary Nebulae

NPFHW - H. Alwyn Wootten (NRAO)
Investigation of Neutral Circumnebular Material in Planetary Nebulae

NPFJK - James B. Kaler (Illinois)
Central Stars of Large Planetary Nebulae

NPFLA - Lawrence H. Aller (UCLA)
Structure of and Abundances in High-Excitation Planetaries

NPFST - Silvia Torres-Peimbert (Mexico)
High Dispersion UV Spectroscopy of the Planetary Nebula NGC 3918

NPFTB - Timothy Barker (Wheaton University)
The Ionization Structure of Planetary Nebulae

NPFWF - Walter A. Feibelman (NASA/GSFC)
Observations of the Bipolar Planetary Nebula NGC 2346

NPGHB - Howard E. Bond (Louisiana State)
Ultraviolet Observations of Close-Binary and Pulsating Nuclei of Planetary Nebulae

NPGJH - J. Patrick Harrington (Maryland)
Effects of Stellar Winds on Planetary Nebulae

NPGJL - Julie H. Lutz (Washington State University)
IUE Studies of Infrared D-Type Symbiotic Stars/Planetary Nebulae

NPGLA - Lawrence Aller (University of California)
'Chemical Compositions, Physical & Structure of High- Excitation Planetary Nebulae'

NPGSM - Stephen P. Maran (NASA/GSFC)
Planetary Nebulae & Their Central Stars in the Magellanic Clouds

NPGTB - Timothy Barker (Wheaton College)
The Ionization Structure of Planetary Nebulae

NPGWF - Walter A. Feibelman (NASA/GSFC)
Observations of Bipolar and/or Protoplanetary Nebulae

NPHSM - Stephen P. Maran (NASA/GSFC)
Completion of Survey of Planetaries in the Magellanic Clouds

NPHWF - Walter Feibelman (NASA/GSFC)
Emission Line Ratios in Planetary Nebulae and Related Objects

NPIJK - James B. Kaler (Illinois)
Southern Planetary Nebulae

NPILA - Lawrence Aller (University of California)
Planetary Nebular C/O Ratios, Morphology, and Evolution

NPITB - Timothy Barker (Wheaton College)
UV Spectra of Peculiar Planetary Nebulae

NPIWF - Walter A. Feibelman (NASA/GSFC)
Bipolar and Evolving Planetary Nebulae and Realted Objects

NPJGF - Gary J. Ferland (Ohio State University)
Spectroscopy of Planetary Nebulae

NPJHD - Harriet L. Dinerstein (Texas)
IUE Observations of NGC 2242

NPJJC - Judith G. Cohen (CIT)
O Star and Planetary Nebula in M22

NPJST - Silvia Torres-Peimbert (Mexico)
Compact Planetary Nebulae. Carbon Abundances

NPJTB - Timothy Barker (Wheaton College)
The Ionization Structure of Planetary Nebulae

NPJWF - Walter A. Feibelman (NASA/GSFC)
Mass Loss From the Nucleus of PN 75 + 35 1

NPKHB - Howard Bond (STScI)
A Search for Binary Nuclei of Planetary Nebulae

NPKHB - Howard E. Bond (STScI)
Search for Binary Nuclei of Planetary Nebulae

NPKJK - James B. Kaler (Illinois)
Winds from Planetary Nebulae Nuclei

NPKJL - James W. Liebert (Arizona)
A Unique Planetary Nebula Ejection from A Hot DA White Dwarf

NPKLA - Lawrence H. Aller (UCLA)
Temperatures of Planetary Nebulae Nuclei, a Comparison of Methods

NPKRD - Reginald J. Dufour (Rice University)
CNO Abundances in Type I Planetary Nebulae

NPKSM - Stephen P. Maran (NASA/GSFC)
Type I Planetaries in Magellanic Clouds

NPKST - Silvia Torres-Peimbert (Mexico)
Research on Plaetary Nebulae

NPKWF - Walter A. Feibelman (NASA/GSFC)
Evolved Nuclei of Two Planetary Nebulae

NPLRD - Reginald J. Dufour (Rice)
CNO Abundance in Type I Planetary Negulae

NPNTB - Timothy Barker (Wheaton College)
IUE Spectra of Peculiar Planetary Nebula

NQ020 - Fabian (Cambridge)
The Far-UV Continuum and Extended Emission Lines as Diagnostics of the Cluster Environment Around Quasars

NQ022 - Clavel (Vilspa)
International AGN Watch: Mapping the Broad-line Region in NGC 3783

NQ055 - Buson (Padova)
A Search for a Line from the Radiative Decay of Dark Matter Tau Neutrinos

NQ063 - Brunner (Tubingen)
Big Blue Bump in Seyfert I Galaxies: Simultaneous IUE/ROSAT Observations

NQ072 - Wamsteker (Vilspa)
Variability Probing of the Inner Parts of the BLR in Various Seyfert I Nuclei

NQ113 - Courvoisier (Geneve)
UV Variability of the Quasar 3C 273

NQ142 - Mason (MSSL)
The Ultraviolet Spectrum of Ultra- Soft X-ray AGN

NQ148 - Ulrich (ESO Garching)
Observations of the Seyfert 1 Nucleus of NGC 4151

NQ149 - Ulrich (ESO Garching)
IUE Observations of Quasars Simultaneous with ROSAT Pointed Observations

NQ152 - Piro (Frascati)
Very Strong Soft X-ray Emission from the Seyfert 1 Galaxy E1615+061 and Its Relationship with the UV Emission

NQ177 - Gondhalekar (RAL)
Simultaneous Ultraviolet and Optical Monitoring of 3C446

NQ191 - Reimers (Hamburg)
UV Spectra of Bright New QSO of the Hamburg Survey

NRBAW - Adolf N. Witt (Toledo)
Phase Function Studies in Reflection Nebulae with IUE

NRDAW - Adolf N. Witt (Toledo)
Illuminating Stars of Reflection Nebulae Observed by ANS TDTD-1

NRHAW - Adolf N. Witt (Toledo)
The Unusual Reflection Nebula CED 201

NRIRF - Robert A. Fesen (Colorado - CASA)
The Nature of the Filamentary Nebula 1723-46

NRITS - Theodore P. Snow (Colorado - CASA)
Depletions in Reflection Nebulae Containing Tiny Grains

NRJWB - William P. Blair (Johns Hopkins)
UV Spectra of PKS 1209-52

NRKAW - Adolf N. Witt (Toledo)
Large-Angle Scattering in Reflection Nebulae and the Grain Size Distribution

NRKWB - William P. Blair (Johns Hopkins University)
UV Observations of N49 and M1

NRRSW - R. S. Wolff (Columbia University)
Search for Ultraviolet Emission by Supernova Remnants

NS058 - Ballester (Oxford)
IO's Atmosphere and Torus: East- West Asymmetries in Their UV Emissions

NS059 - Ballester (Oxford)
Jupiter's Aurora: Correlative Studies of the UV H2 Emissions and the H3 And Hydocarbon Emissions

NS060 - Prange (IAS)
Auroral and Planetary Emissions of Saturn. Origin And Variability

NS092 - Fricke (Bonn)
The Long Term Variability of the Lyman Alpha Emission from Jupiter, Saturn and Uranus

NSBAD - Andrea K. Dupree (Smithsonian)
Ultraviolet Observations of Supernova Remnants

NSBGW - George Wallerstein (Washington)
Kinematics and Physical Conditions in Shocked Clouds in Supernova Remnants

NSBKD - Kris Davidson (University of Minesota)
Emission Lines in the Crab Nebula

NSBRK - Robert Kirshner (Michigan)
Supernova Remnants and Nucleosynthesis

NSBSM - Stephen P. Maran (NASA/GSFC)
Selected Filaments in the Crab Nebula

NSCAD - Andrea K. Dupree (CFA)
Ultraviolet Observations of the Cygnus Loop and Other Shocks

NSCGW - George Wallerstein (Washington)
Kinematics and Physical Conditions in Shocked Clouds in the Monoceros Supernova Remnant

NSCKD - K. Davidson (Minnesota)
Observations of the Crab Nebula

NSDJR - John C. Raymond (CFA)
Ultraviolet Observations of the Cygnus Loop

NSDNT - N. Thonnard (Carnegie Institute of Washington)
Absorption Line Studies of Supernova Remnants in the Large Magellanic Cloud

NSDTG - Theodore R. Gull (NASA/GSFC)
A Very Young Supernova Remnant in the Large Magellanic Cloud

NSEJR - John C. Raymond (CFA)
Ultraviolet Spectra of Non-Radiative Shock Waves

NSERF - Robert Fesen (NASA/GSFC)
A Radial Mapping of the Cygnus Loop's UV Emission

NSEWB - William P. Blair (CFA)
CArbon Abundance in M33 & M31 From Supernova Remnants

NSFCW - Chi-Chao Wu (CSC)
Ultraviolet Observations of the Blue Star Projected in the Remnant of Supernova AD1006

NSFJR - John C. Raymond (CFA)
Deep Exposures on the Cygnus Loop

NSFRF - Robert A. Fesen (NASA/GSFC)
UV Studies of Type I SNRS in the Large Magellanic Cloud

NSFWB - William P. Blair (CFA)
Carbon Abundance in M33 and M31 From Supernova Remnants

NSGJR - John C. Raymond (CFA)
The Cygnus Loop

NSGRF - Robert A. Fesen (Colorado-LASP)
A Study of Grain Destruction in the Cygnus Loop Supernova Remnant

NSGWB - William P. Blair (CFA)
UV Spectra of an O-Rich Supernova Remnant in the SMC

NSHJR - John C. Raymond (CFA)
A Cloud Struck by the Cygnus Loop Blast Wave

NSIKB - Karl-Heinz Bohm (Washington)
A Test of Bow-Shock Models of HH-Objects Using IUE Spectra

NSIPW - P. Frank Winkler (Middlebury)
The Composition of Supernova Ejecta in Puppis A

NSIRF - Robert A. Fesen (Colorado - CASA)
UV Emission-Line Diagnostics for Low-Velocity Shocks

NSJJR - John C. Raymond (CFA SAO)
Non-Thermal Pressure and the Evolution of SNR Shocks

NSJRF - Robert A. Fesen (Colorado - CASA)
Detecting Enriched Ejecta in the Remnant of SN 185 AD

NSJWB - William P. Blair (Johns Hopkins)
A Face-On Shock in the Cygnus Loop

NSKPW - P. Frank Winkler (Middlebury)
The Composition of Supernova Ejecta in Puppis A

NSMJC - Jason A. Cardelli (Wisconsin)
UV Emission-Lines in an "Edge-On" I-Front

NSOLD - Linda L. Dressel (Applied Research Corporation)
Stellar Populations in Early-Type Galaxies with Nuclear Star-Bursts

NSOSS - S. Alan Stern (Southwest Research Institute)
Comparative UV Studies of New Satellite, Ring, & Asteroidal Targets

NVFSM - Stephen P. Maran (NASA/GSFC)
Time Variations in Young Planetary Nebulae of the Magellanic Clouds

NVISS - Sumner G. Starrfield (Arizona State)
Ultraviolet Observations of Nova Vul 1984 No.1 and No.2

OBFBS - Blair D. Savage (Wisconsin)
Continua and Extinction of OB Stars in Clusters

OBFGS - George Sonneborn (CSC)
Rotational Broadening of Photospheric Lines in Main-Sequence B Stars

OBFTS - Theodore Snow (University of Colorado)
Stellar Winds in B and Be Stars

OBGGS - George Sonneborn (CSC)
Rotational Broadening of Ultraviolet Photospheric Lines in Later-Type B Stars

OBGNW - Nolan R. Walborn (NASA/GSFC)
Ultraviolet Spectral Morphology of the O Stars

OBGRK - Robert P. Kirshner (Michigan)
OB Association Contamination in Spectra of SN Evans 1983 in M 83

OBHCG - Catharine D. Garmany (Colorado)
Winds of Hot Stars in the Small Magellanic Cloud

OBHDB - Douglas N. Brown (Washington)
IUE Spectrophotometric Census of the Orion OBI Association B Stars

OBHJS - J. Michael Shull (Colorado-Lasp)
Interstellar Observations of Distant OB Stars

OBHPM - Philip L. Massey (Aura)
Stellar Winds in the Hot Stars of Nearby Galaxies

OBHSS - Steven Shore (STScI)
Luminous Early-Type Emission Line Supergiants in the Galaxy & Comparison with Magellanic Cloud Counterparts

OBIBB - Bruce Bohannan (Colorado - CASA)
Spectrophotometry of H-Alpha Emission-Line Stars in the LMC

OBICG - Catharine D. Garmany (Colorado - JILA)
Continuum Studies of Magellanic Cloud O Stars

OBIDB - Douglas N. Brown (Washington)
IUE Spectrophotometric Cencus of Orion OB1 Association B Stars, II

OBIDF - David B. Friend (Wisconsin)
Stellar Winds From Rapidly Rotating Hot Stars

OBIEB - Erika Bohm-Vitense (Washington)
The Effects of Metallicity on Stellar Winds

OBIEF - Edward L. Fitzpatrick (Colorado - JILA)
Energy Distributions of LMC OB Supergiants

OBJEF - Edward L. Fitzpatrick (Colorado - JILA)
Energy Distributions of B Supergiants in the Small Magellanic Cloud

OBKCG - Catharine D. Garmany (Colorado - CASA)
Magellanic Cloud OB Associations

OBKDB - Douglas N. Brown (Washington)
IUE Spectrophotometric Census of Ori OB1 Association B Stars, III

OBKEB - Erika Bohm-Vitense (Washington)
UV Continua of Cluster OB Stars in the Wing of the SMC

OBKEF - Edward L. Fitzpatrick (Princeton)
Extinction and Continua of Luminous B Stars in NGC 4755

OBLCG - Catharine D. Garmany (Colorado - CASA)
B Supergiants in the Large Magellanic Cloud

OBLDB - Douglas N. Brown (Washington)
IUE Spectrophotometric Census of Scorpius OB2 Association B-Stars

OBLDM - Derck L. Massa (ARC)
The UV Extinction Properties of Carina Nebular Dust

OBLIH - Ian D. Howarth (Colorado - JILA)
Coordinated UV and H-Alpha Observations of Wind Variability in O Stars

OBLJN - Joy Nichols-Bohlin (CSC)
UV and Optical Covariability of O Star Winds

OBLPM - Philip L. Massey (KPN)
The Stellar Winds of the Very Early O-type Stars in NGC 346, the Youngest Cluster in the SMC

OBMCG - Catharine D. Garmany (Colorado - CASA)
B Supergiants in the Large Magellanic Cloud

OBMJN - Joy Nichols-Bohlin (CSC - Astronomy Programs)
UV and Optical Covariability of O Star Winds

OBMMC - Michael F. Corcoran (NASA/GSFC)
Coordinated UV and X-Ray Monitoring of O Star Winds II

OBMTS - Theodore P. Snow (Colorado - CASA)
IUE Observations of a New Outburst Phase in P Cygni

OBNJN - Joy Nichols-Bohlin (CSC - Astronomy Programs)
UV and Optical Covariability of O Star Winds

OBODG - Douglas R. Gies (Georgia State University)
Colliding Winds and Tomography of O-Type Binaries

OBPWB - William G. Bagnuolo (Georgia State University)
Tomography and Colliding Winds of O-Type Binaries

OCODM - Derck L. Massa (Applied Research Corporation)
A High Dispersion Survey of B Supergiants in Open Clusters

OCPWL - Wayne B. Landsman (Hughes - STX)
The UV-Bright Stars of Omega Centauri

OCRWL - Wayne B. Landsman (Hughes - STX)
The UV-Bright Stars of Omega Centauri

OD01K - George Sonneborn (CSC - Astronomy Programs)
February 1983 Outburst of Omega Orionis

OD01Y - Robert Nelson (JPL)
Galilean Satellites

OD01Z - H. Richard Miller (Georgia State University)
Markarian 421

OD02K - Bernard Bopp (Ritter Observatory)
Rotation and Chromospheric Activity of HD 8358

OD02Y - C. Edward Olsen (U Illinois)
U Cephei

OD02Z - W. Dixon (Johns Hopkins University)
UV Bright Star in NGC 1851

OD03K - Catherine Imhoff (CSC - Astronomy Programs)
UV Observations of HH57

OD03Y - Menas Kafatos (George Mason University)
R Aquarius

OD03Z - Ronald S. Polidan (NASA/GSFC)
Lyx Emission in 17 Lep

OD04K - George McCluskey (Lehigh University)
The Interacting Binary Usage

OD04Y - D. Michael Crenshaw (CSC - Astronomy Programs)
3C 390.3

OD04Z - Bruce McCollum (NASA/GSFC)
Observations of Pulsating O Star

OD05K - Paula Szkody (U Washington)
UV Observations of SU UMa and AM Her

OD05Z - Bernard Haisch (Lockheed PARL)
IUE/ROSAT Observations of Proxim Centauri Flares

OD06K - Geraldine Peters (USC)
The Interacting Binary Systems RS Vul and CX Dra

OD06Z - R. Cohen (UC San Diego)
PHL 1377 Rosat Observations

OD07K - Walter A. Feibelman (NASA/GSFC)
The Butterfly Nebula M2-9

OD07Y - Gail A. Reichart (CSC - Astronomy Programs)
3C 373 and NGC 4151

OD07Z - Wayne Landsman (Hughes STX)
UIT Calibration Stars

OD08K - Andrea K. Dupree (Harvard CFA - SAO)
Feige 24 at Elongation

OD08Y - Andrew M. Smith (NASA/GSFC)
LMC Foreground Source

OD08Z - Margarita Karovska (Harvard CFA - SAO)
Directors Discretionary Time - Observation of MIRA

OD09K - Kenneth Hallam (NASA/GSFC)
Rotation of Solar Type Stars

OD09Y - John T. Clarke (U Colorado)
SWP Calibration at 1216 Angstroms

OD09Z - J. Craig Wheeler (U Texas)
Synoptic Observations of GK Per

OD10B - Sabatino Sofia (NASA/GSFC)
The Dwarf Cepheid SX Phoenicis

OD10K - Frederick C. Bruhweiler (Catholic University)
Molecular Absorption in Comet IRAS

OD10Y - George Sonneborn (CSC - Astronomy Programs)
HD 37806

OD10Z - Ronald S. Polidan (NASA/GSFC)
TU Mon

OD11B - Chi-Chao Wu (CSC)
The Transient-X-Ray Source Cen X-4

OD11K - Robert E. Stencel (NASA - HQ)
Mg II Variations in 56 Pegasi

OD11Y - Steven P. Maran (NASA/GSFC)
IRAS 1912+172

OD11Z - Michael Carini (CSC - Astronomy Programs)
Multifrequency Observation of PG1553+11

OD12B - Anne B. Underhill (NASA/GSFC)
SS433

OD12K - Catherine Imhoff (CSC - Astronomy Programs)
Rotation in T Tauri Stars

OD12Y - Thomas Skinner (Colorado - CASA)
Venus

OD12Z - Charles Loomis (NASA/GSFC)
HR Aur Revisited

OD13B - Huggins (New York Universtiy)
BL LAC Objects and Seyferts

OD13K - Menas Kafatos (George Mason University)
The Aqr Jet Near Minimum Light

OD13Y - Osmi Vilhu (Finland)
RST 137 B

OD13Z - Catherine Mansperger (NASA/GSFC)
IUE Observation of Lanning 90

OD14B - Robert Chapman (NASA/GSFC)

1979-80 Eclipse of AU AUR

OD14K - Erika Bohm-Vitense (U Washington)
Lambda Bootis Stars

OD14Y - Robert E. Stencel (U Colorado)
Alpha-Ori Scattered Light

OD14Z - B. McCollum (NASA/GSFC)
Pulsar/Be Star

OD15B - Steve/Andrea Hold/Dupree (Harvard CFA - SAO)
YZ CMI

OD15K - Robert Kirshner (U Michigan)
Supernova in M83

OD15Y - Ralph C. Bohlin (STScI)
HST Standards

OD15Z - Mario Perez (NASA/GSFC)
Herbig Be Star Walker 90

OD16B - John B. Hutchings (Dominion Astrophysical Observatory)
HR DEL

OD16K - Thomas B. Ake (CSC - Astronomy Programs)
Further UV Observations of the S Star HD 35155

OD16Y - Edward F. Guinan (Villanova University)
VW Cep

OD16Z - Catherine Mansperger (NASA/GSFC)
The Dwarf Nova OY Car in Superout Burst

OD17B - Anne B. Underhill (NASA/GSFC)
Early Type Supergiants

OD17K - Timothy Kallman (NASA/GSFC)
Simultaneous UV and X-Ray Observations of LMC X-4

OD17Y - Robert Kirshner (Harvard CFA - SAO)
LMC SN 1987A

OD17Z - Demetrious Kazanas (NASA/GSFC)
Simultaneous EGRET/IUE Observations of PKS 0537-441

OD18B - Albert/Jeffrey Holm/Linsky (Colorado - JILA)
CN LEO

OD18K - Anne Cowley (Arizona State University)
Ultraviolet Observations of BE UMA

OD18Y - Andrew G. Michalitsianos (NASA/GSFC)
R-Aquarii Outbursts

OD18Z - William Blair (Johns Hopkins University)
Variations in the C IV : He II Ratio in the Crab Nebula

OD19B - Chi Chao Wu (CSC - Astronomy Programs)
Hot Stars Behind Comet Bradfield

OD19K - Imad Ad Ahmad (Imad-Ad-Dean)
Zeta Aurigae

OD19Y - C. Megan Urry (MIT)
Markarian 421

OD19Z - James Webb (Florida Intl. University)
Blazar 3C 279 in Outburst

OD1AB - Andrea K. Dupree (Harvard CFA - SAO)
VV Cep

OD20B - Arthur L. Lane (JPL)
Saturn Ring-Plane Crossing

OD20K - C. Megan Urry (NASA/GSFC)
Ultraviolet Spectra of the BL Lac Object 1218+304

OD20Y - Nancy Remage Evans (Toronto)
SU CYG

OD20Z - J. Parker (U Colorado)
UV Study of the LBV R143

OD21B - Menas Kafatos (George Mason University)
TV GEM

OD21K - Robert Chapman (NASA/GSFC)
Further UV Observation of Epsilon Aurigae in Eclipse

OD21Y - Kam-Ching Leung (U Nebraska)
5 CET / PW Pup

OD21Z - George Herbig (Cluster)
Ultraviolet Spectra PF Pre-MS Stars in the Orion Nebula

OD22B - Robert C. Bless (U Wisconsin)
Nova Her 1963

OD22K - John Caldwell (SUNY - Stonybrook)
Occultation of SAO 158913 by Saturn's Rings

OD22Y - Jorge Sahade (Argentina)
Gamma Vel

OD22Z - Catherine Imhoff (CSC - Astronomy Programs)
Multiwavelength Observations of a T Tauri Star

OD23B - Edward F. Guinan (Villanova University)
V471 TAU

OD23K - Andrea K. Dupree (Harvard CFA - SAO)
Alpha Orionis

OD23Y - Andrew M. Smith (NASA/GSFC)
HD 269265

OD23Z - Ronald S. Polidan (NASA/GSFC)
Simultaneous IUE/ROSAT Observation of Active Algol Systems

OD24B - Richard Green (Steward Observatory)
HD 215441

OD24K - Erika Bohm-Vitense (U Washington)
Ap Stars with Short-Period Optical Variability

OD24Y - Edward Jenkins (Princeton University)
SK - 69 202

OD24Z - Theodore P. Snow (U Colorado)
Simultaneous IUE/Voyager Obsevations of P Cygni

OD25B - Giuseppina Fabbiano (Harvard CFA - SAO)
QSO'S

OD25K - Robert H. Koch (U Pennsylvania)
Ultraviolet Light Curve of ETA Orionis

OD25Y - Nancy Oliversen (CSC - Astronomy Programs)
CH Cygni

OD25Z - Michael Carini (CSC - Astronomy Programs)
A Newly Discovered Variable Star

OD26B - S. A. Lamb ( )
AE AQR

OD26K - R. Rudy (U Arizona)
Lyman Alpha Emission in MRK 1018

OD26Y - Jorge Sahade (Argentina)
Lambda Pav

OD26Z - Walter A. Feibelman (NASA/GSFC)
IRAS Source 08005-2356

OD27B - G. Jacoby (KPNO)
ABELL 35

OD27K - Joel Bregman (New York University)
Simultaneuos UV and X-Ray Observations of OJ287 and 1308+326

OD27Y - Terry Teays (CSC - Astronomy Programs)
BETA CAS

OD27Z - Edward F. Guinan (Villanova University)
Hot White Dwarf HD 33959C

OD28B - A. Glassgold (New York University)
Cygnus Loop

OD28K - Frederick C. Bruhweiler (Catholic University)
MU Sagittarri

OD28Y - Kenneth Carpenter (NASA/GSFC)
119 Tau

OD28Z - Andrew G. Michalitsianos (NASA/GSFC)
UV & High Speed FES Photometry of MWC 560

OD29B - Yoji Kondo (NASA/GSFC)
AU SGR

OD29K - George Sonneborn (CSC - Astronomy Programs)
Secular Stability of the UV Light Curve of 56 Ari

OD29Y - Ronald S. Polidan (U Arizona)
IRAS 09358-5323

OD29Z - H. Warren Moos (Johns Hopkins University)
Jupitor Aurora Emissions

OD2AB - Chi- Chao Wu (CSC)
Nova Serpentis 1978

OD30B - J. Beverley Oke (Hale Observatories)
3C 390 3

OD30K - Mirek Plavec (UCLA)
Ry Persei + UX Mon

OD30Y - Jules Halpern (Columbia University)
1H1821+643

OD30Z - Catherine Mansperger (CSC - Astronomy Programs)
VW Hyi in Outburst

OD31B - Jeffrey Linsky (Colorado - JILA)
PROX CEN

OD31K - Mark Giampapa (NOAO - NSO)
Simultaneous IUE, Voyager, and Optical Observation of Epsilon Persei

OD31Y - Walter A. Feibelman (NASA/GSFC)
IW1 and IW2

OD31Z - H. Richard Miller (NASA/GSFC)
Microvariability in Fairall 9

OD32B - Jurgen Rahe (NASA/GSFC)
V603 AQL

OD32K - Scott Kenyon (Harvard CFA - SAO)
SY Muscae at Minimum Light

OD32Y - John T. Clarke (NASA/GSFC)
Jupiter Aurora

OD32Z - Frederick C. Bruhweiler (Catholic University)
Galactic Column Densities Toward PKS2155-304

OD33B - D. Abbott (Washburn Observatory)
CYG OB2 8A=BD+40 4227

OD33K - Nancy R. Evans (CSC - Astronomy Programs)
Radial Velocity Standard Stars

OD33Y - Imad Ad Ahmad (Imad-Ad-Dean)
22 Vul

OD33Z - Bernard Bopp (U Toledo)
EG And in Outburst

OD34B - C. Thomas Bolton (David Dunlob Obs. - Canada)
HD 219150

OD34K - Nancy R. Evans (CSC - Astronomy Programs)
Cepheid Variables

OD34Y - Andrew G. Michalitsianos (NASA/GSFC)
AS 296

OD34Z - Paul Etzel (U Toledo)
Newly Discovered White Dwarf Binary

OD35B - D. Lien (U Illinois)
Interstellar Gas

OD35K - Edward F. Guinan (Villanova University)
Ultraviolet Observations of the Eccentric Close Binary DI Herculis

OD35Y - Robert E. Stencel (Colorado - CASA)
VY Cma

OD35Z - Frederick Walter (SUNY - Stonybrook)
ROSAT/IUE Observations of Naked T Tauri Brook

OD36B - K. Hackney (W Kentucky University)
BL LAC Object

OD36K - Robert E. Stencel (NASA - HQ)
Ultraviolet Observations of 56 Pegasi

OD36Y - Reginald Dufour (Rice University)
NGC 2359

OD36Z - Carol A. Grady (Applied Research Corporation)
BF Ori During Deep Optical Minimum

OD37B - Robert J. Panek (CSC - Astronomy Programs)
HD 36389

OD37K - France Anne Cordova (Los Almos National Obs.)
The Cataclysmic Variable EX Hydrae

OD37Y - Imad Ad Ahmad (Imad-Ad-Dean)
Xeta Aur

OD37Z - Thomas B. Ake (CSC - Astronomy Programs)
The March 1993 Eclipse of Tau Per

OD38B - Francis Fekel (NASA/GSFC)
Mass Determination of Evolved and Early Type Stars

OD38K - Walter A. Feibelman (NASA/GSFC)
The Eclipsing Binary IM Aurigae

OD38Y - Richard/Walter Thomas/Feibelman (U Colorado/NASA/GSFC)
BE Shell of Plieone

OD38Z - Ronald S. Polidan (NASA/GSFC)
Simultaneous IUE/ROSAT Observations of V356 Sge

OD39B - Gary A. Wegner (Penn State University)
Bright DC White Dwarfs

OD39K - Nancy Oliversen (CSC - Astronomy Programs)
Z Andromedae in Outburst

OD39Y - Robert E. Stencel (Colorado - CASA)
Alpha-Ori Shell

OD39Z - George Sonneborn (NASA/GSFC)
Supernova 1993J

OD3AB - Chi Chao Wu (CSC - Astronomy Programs)
SS Cyg

OD40B - J. E. Hesser (Dominion Astrophysical Observatory)
Carina Nebula Stars

OD40K - Hollis Johnson (Indiana University)
Ultraviolet Observation of Carbon Stars

OD40Y - Chris R. Shrader (CSC - Astronomy Programs)
UV Spectra of HO538+608

OD40Z - Catherine Mansperger (CSC - Astronomy Programs)
Simultaneous UV and X-Ray Observations of SS Cyg

OD41B - Anne B. Underhill (NASA/GSFC)
BD + 30 3639

OD41K - Sidney Parsons (CSC - Astronomy Programs)
The Eclipsing Binary 22 Vul

OD41Y - D. Michael Crenshaw (CSC - Astronomy Programs)
Seyfert 1 Galaxies

OD41Z - Andrew G. Michalitisianos (NASA/GSFC)
Gravitational Lens QSO 0957+561

OD42B - K. Nomoto (NASA/GSFC)
IM MON

OD42K - C. Megan Urry (MIT)
IUE-EXOSAT Observations of the BL Lac Object

OD42Y - A. E. Potter (NASA - JSC)
Interstellar Hydrogen

OD42Z - Margarita Karovska (Harvard CFA - SAO)
Simultaneous ROSAT/IUE Observations of Mira

OD43B - Theodore P. Snow (U Colorado - LASP)
A Study of Stellar Wind Variability in O Stars Using IUE

OD43K - Ronald S. Polidan (U Arizona)
The Nova-Like Variable V3885 SGR

OD43Y - Chris R. Shrader (CSC - Astronomy Programs)
X-Ray Nova

OD43Z - Michael Carini (CSC - Astronomy Programs)
A Peculiar New Rapidly Variable Star

OD44B - A. Metzger (JPL)
Simultaneous UV-X-Ray Observations of Jupiter

OD44K - Theodore Simon (U Hawaii)
Mg II Variability in AB Aur

OD44Y - Jay B. Bookbinder (Colorado - CASA)
Binary M-Sec Pulsar

OD44Z - Kwang-Ping Cheng (NASA/GSFC)
Search for New Proto-Planetary Systems

OD45B - John T. Clarke (U Colorado)
Sky Lyman Alpha

OD45K - Anne B. Underhill (NASA/GSFC)
V444 Cyg at Primary Minimum

OD45Y - Robert E. Stencel (Colorado - CASA)
S Per

OD45Z - Chris R. Shrader (NASA/GSFC)
X-Ray Nova J0442+32 in Outburst

OD46B - Robert E. Stencel (Colorado)
32 Cygni

OD46K - Jeffrey Linsky (Colorado - JILA)
Eclipsing Coverage of the RS CVn System AR Lac

OD46Y - C. Megan Urry (STScI)
3C 279

OD46Z - Andrew G. Michalitsianos (NASA/GSFC)
A New Distant Quasar

OD47B - Karen R. H. Hackney (Western Kentucky University)
BL LAC OBJECTS

OD47K - S. Adelman (NASA/GSFC)
High Resolution IUE Spectra of HD 109995

OD47Y - Richard Thomas (France)
BE Shell of Pleione

OD47Z - Bernard Bopp (U Toledo)
CH Cyg in Outburst

OD48B - Robert H. Koch (U Pennsylvania)
Extinction

OD48K - John B. Hutchings (DAO - Canada)
LMC X-1

OD48Y - Elizabeth Park (CSC - Astronomy Programs)
TZ Eri

OD48Z - Frederick C. Bruhweiler (Catholic University)
Simultaneous EUVE, GRO and IUE Observations of 3C 273

OD49B - Jeffrey Linsky (U Colorado)
HR 5110

OD49K - Nancy Morrison (U Toledo)
Eclipsing Observations of Y Cygni

OD49Y - Donald G. York (U Chicago)

1700 +641

OD49Z - Myron Smith (CSC - Astronomy Programs)
Simultaneuos EUVE and IUE Observations of Lambda Eri

OD4AB - Theodore Snow (U Colorado)
The Stellar Wind Phenomena in Early Type Super Giants

OD50B - Y. H. Chu (U California)
Rolf Rayet Star

OD50K - R. Goodrich (U California)
UV Continuum of NGC 4579

OD50Y - Andrea K. Dupree (Harvard CFA - SAO)
Globular CLusters Red Giants

OD50Z - J. Grunsfeld (NASA/GSFC)
Simultaneous IUE and BATSE Observations of HD 245770

OD51B - C. Edward Olson (U Illinois)
Active Mass Transfer Phase of Cephei

OD51K - A. Aikin (NASA/GSFC)
Surface Relectivity and Atmospheric Properties of Mars

OD51Y - T. Kogure (Japan)
Gamma Cas

OD51Z - L. Lu (U Wisconsin)
Measuring the D/H Ratio in Quasar 2206-199

OD52B - Erika Bohm-Vitense (U Washington)
Cepheid Variables

OD52K - John Huchra (Harvard CFA - SAO)
The QSO/Gravitational Lens, QSO 2237+031

OD52Y - Sumner G. Starrfield (Arizona State University)
LMC Novae

OD52Z - Paul Etzel (San Diego State University)
White Dwarf Binary 14 Aur C

OD53B - Albert V. Holm (NASA/GSFC)
RY Sgr at Maximum Light

OD53K - Jorge Sahade (Argentina)
Ultraviolet Observation of Beta Persei

OD53Y - Chris R. Shrader (CSC - Astronomy Programs)
X1821 +643

OD53Z - Bruce McCollum (CSC - Astronomy Programs)
Proto-Planetary Nebula TH4-4

OD54B - Robert Chapman (NASA/GSFC)
E Aurigae

OD54K - Yoji Kondo (NASA/GSFC)
Circumstellar Extinction in Beta Pictoris

OD54Y - George Sonneborn (NASA/GSFC)
Puppis SNR

OD54Z - Andrew G. Michalitsianos (CSC - Astronomy Programs)
IUE Observations of a Possible Gravitational

OD55B - Kenneth Hallam (NASA/GSFC)
Near Solar Type Stars

OD55K - Wendy Hagen Bauer (U New Mexico)
VV Cephei

OD55Y - Stephen Meatheringham (NASA/GSFC)
Planetary Nebula in M22

OD55Z - Steven B. Howell (Planetary Science Institute)
BC UMa in Outburst

OD56B - Frederick C. Bruhweiler (CSC - Astronomy Programs)
Interstellar Medium in the Solar Neighborhood

OD56K - Thomas B. Ake (CSC - Astronomy Programs)
Eclipsing Observations of Tau Persei

OD56Y - Ronald S. Polidan (U Arizona)
UVX CVn

OD56Z - Kwang-Ping Cheng (NASA/GSFC)
Beta Pic Candidate HD 106591

OD57B - Jorge Sahade (Argentina)
Two Cyclic V/R Variables

OD57K - Joel Bregman (NRAO)
Obssevation of 1308 + 326

OD57Y - John B. Hutchings (DAO - Canada)
Star Formation in Magellanic Clouds

OD57Z - Walter A. Feibelman (NASA/GSFC)
Pulsating PN Nucleus K 1-16

OD58B - H. E. Smith (UC San Diego)
QSO 1217 + 023

OD58K - Robert H. Koch (U Pennsylvania)
V Sge

OD58Y - Imad Ad Ahmad (Imad-Ad-Dean)
HR 6902

OD58Z - C. Otani (ISAS)
Simultaneous IUE and ASCA Observations of NGC 4051

OD59B - S. Kwok (NRC - Canada)
Bi-Polar Nebula GL618

OD59K - Howard Bond (STScI)
MWC 560

OD59Y - Joel Bregman (NRAO)
High Velocity Clouds

OD59Z - Andrew G. Michalitsianos (NASA/GSFC)
Gravitational Lensed Quasar B1422+231

OD5AB - R. L. Hackney (W Kentucky University)
Simultaneous UV and X-Ray Observations of the BL LAC Object MKN 501

OD60B - Carol A. Grady (U Colorado)
59 Cygni Winds

OD60K - Robert E. Stencel (NASA/GSFC)
Eg And

OD60Y - Ronald Downes (Applied Research Corporation)
WX Ceti

OD60Z - Bradley Peterson (Ohio State University)
Test Exposures of AGN's

OD61B - T. Herczeg (U Oklahoma at Norman)
U CrB

OD61K - Frederick Walter (U Colorado - LASP)
AR LAC

OD61Y - Yervant Terzian (Cornell University)
Peculiar Stars/Planetary Nebulae

OD61Z - Kwang-Ping Cheng (NASA/GSFC)
A Search for Planetary System Candidates

OD62B - Sidney Parsons (U Texas at Austin)
Composite Stars

OD62K - C. Fu-zhen (PR China)
VII Zwicky 118

OD62Y - Andrew G. Michalitsianos (NASA/GSFC)
PNK 14

OD62Z - Sidney Parsons (CSC - Astronomy Programs)
A Search for Hot Companions to Cool Stars

OD63B - Robert Hobbs (NASA/GSFC)
Lobes of Radio Galaxies

OD63K - N. Evans (NASA/GSFC)
SU Cyg

OD63Y - Andrew Smith (NASA/GSFC)
HD 152497

OD63Z - Walter A. Feibelman (NASA/GSFC)
New Young Planetary Nebula

OD64B - Bernard Haisch (Lockheed PARL)
Solar Type Stars

OD64K - Jean Swank (NASA/GSFC)
II Peg

OD64Y - Mario Perez (CSC)
E Main Sequence Objects

OD64Z - Bruce McCollum (CSC - Astronomy Programs)
Companion to U Cancri

OD65K - Anne B. Underhill (NASA/GSFC)
V444 Cyg

OD65Y - Menas Kafatos (George Mason University)
Berkley 87

OD65Z - H. Richard Miller (Georgia State University)
Blazar 1553+11 During Outburst

OD66B - Erika Bohm-Vitense (U Washington)
HR 8752

OD66K - Ronald Stoner (Bowling Green State University)
Seyfert-I Monitoring

OD66Y - Michael Corcoran (NASA/GSFC)
TU Mus

OD67B - Wood (U Florida)
Zeta Phonetics

OD67K - Edward Brugel (U Colorado - LASP)
HH #1

OD67Y - J. Michael Hollis (NASA/GSFC)

R AQR

OD68B - Walter A. Feibelman (NASA/GSFC)
Anonymous X-Ray Source

OD68K - Erika Bohm-Vitense (U Washington)
W Vir

OD68Y - Wendy Hagen Bauer (Steward Observatory)
VV Cep

OD69B - Robert J. Panek (CSC - Astronomy Programs)
Orion Stars

OD69K - James Kaler (U Illinois)
Planetary Nebulae

OD69Y - Michael A'Hearn (Maryland)
Comet-Like Outgassing From the Asteroid Ceres

OD6AB - Chi Chao Wu (CSC - Astronomy Programs)
Nova Cygni 1978

OD70B - James Liebert (U Arizona)
PG 1550 +191

OD70K - T. Maccacaro (Harvard CFA - SAO)
X-Ray AGN's

OD70Y - Steven Shore (CSC - Astronomy Programs)
HR Aur

OD71B - Menas Kafatos (George Mason University)
R Agr Jet

OD71K - S. Shaw (U Georgia)
BD + 63 deg. 0003

OD71Y - Theodore P. Snow (U Colorado)
P-Cygni

OD72B - John Nousek (Penn State University)
BF Ori

OD72K - K. Jensen (Naval Research Laboratory)
X-Ray Transient

OD72Y - Andrew G. Michalitsianos (NASA/GSFC)
C 560

OD73B - Margon (U Washington)
Halo of NGC 1300

OD73K - Thomas B. Ake (CSC - Astronomy Programs)
S Stars

OD73Y - Sara Heap (NASA/GSFC)
NGC 2392

OD74B - Andrew G. Michalitsianos (NASA/GSFC)
Sy Muscae

OD74K - Andrew G. Michalitsianos (NASA/GSFC)
R Aqr Jet

OD74Y - Ronald Downes (Applied Research Corporation)
EF Eri

OD75B - C. Stuart Bowyer (UC Berkeley)
Interstellar Wind Ly-2

OD75K - Paul Feldman (Johns Hopkins University)
Comet Machholz

OD75Y - Bernard Bopp (U Toledo)
Unusual Emission Line Objects

OD76B - Helfer (U Rochester)
Cordoba 12403

OD76K - Imad Ad Ahmad (Imad-ad-Dean)
22 Vul

OD76Y - C. Megan Urry (STScI)
NGC 5548

OD77B - Robert E. Stencel (U Colorado)
HD4174

OD77K - Michael DeRobertis (USC - Lick Obsv.)
Mrk 607

OD78B - Sidney Parsons (NASA/GSFC)
HD207739

OD78K - J. McClintock (Harvard CFA - SAO)
4U0541+60

OD78Y - Charles Joseph (Princeton University)
O Per

OD79B - Arne Slettebak (Perkins Observatory)
Early A-Type Shell Stars

OD79K - Fuhua Cheng (PR China)
QSO 0916+55

OD79Y - George Sonneborn (NASA/GSFC)
IUE/Voyager Observations of 56 Ari

OD7AB - Albert V. Holm (CSC - Astronomy Programs)
Supernova 1978 in IC 5201

OD80B - Anne Cowley (U Michigan)
AR Pav Eclipse

OD80K - Ralph C. Bohlin (STScI)
HST Standards

OD80Y - Frederick C. Bruhweiler (CSC - Astronomy Programs)
IUE/GHRS Observations of Beta Pictoris

OD81B - John Caldwell (SUNY - Stonybrook)
Jupiter + Saturn

OD81K - Andrew Smith (NASA/GSFC)
HD 32656

OD81Y - Nancy Oliversen (CSC - Astronomy Programs)
CH Cygni

OD82B - Erika Bohm-Vitense (U Washington)
Binary F Stars

OD82K - H. Warren Moos (Johns Hopkins University)
Europa Occultation

OD82Y - John Bahcall (Princeton University)
IUE/HST Observations of 3C273k

OD83B - Theodore P. Snow (U Colorado)
Be Star Variability

OD83K - Theodore Simon (U Massachusetts)
HD 185510

OD83Y - H. Warren Moos (Johns Hopkins University)
Saturn's White Spot

OD84B - Silk (UC Berkeley)
POX 186

OD84K - Jeffrey Linsky (Colorado - JILA)
RY Tau

OD84Y - Joseph Cassinelli (U Wisconsin)
Beta Centauri Observations

OD85B - Albert Boggess (NASA/GSFC)
3C273

OD85K - A. Slettebak (Ohio State University)
Lambda Bootis Stars

OD85Y - Bruce M. Altner (CSC - Astronomy Programs)
NGC 188 Star for HST Calibration

OD86B - J. Micahel Shull (U Colorado)
Variability of H-H Objects

OD86K - Nancy Oliversen (CSC - Astronomy Programs)
Z And

OD86Y - Christopher Mauche (LLNL)
U Gem

OD87B - Ralph C. Bohlin (NASA/GSFC)
Rocket UV Sources

OD87K - Carol A. Grady (CSC - Astronomy Programs)
BE Stars

OD87Y - Edward F. Guinan (Villanova University)
R ARAE

OD88B - Jorge Sahade (Argentina)
V923 Aql

OD88K - Walter A. Feibelman (NASA/GSFC)
AS 201

OD88Y - Paul Hodge (U Washington)
LMC Clusters

OD89B - Robert E. Stencel (NASA/GSFC)
CI Cygni

OD89K - Ralph C. Bohlin (STScI)
Observing the Earth

OD89Y - Theodore Stecher (NASA/GSFC)
UV Bright Stars in Omega Centauri

OD8AB - Albert V. Holm (CSC - Astronomy Programs)
Outburst of WZ SGE and U SCO

OD90B - Nolan Walborn (NASA/GSFC)
SNC OB Supergiants

OD90K - Kenneth Carpenter (Colorado - CASA)
Gamma Crucis

OD90Y - Sidney Parsons (CSC - Astronomy Programs)
Mass Ratio of 22 Vul System

OD91B - Joy Heckathorn (NASA/GSFC)
PN 0259 + 647

OD91K - G. Solivella (Argentina)
HD 153919

OD92B - Barker (U Western Ontario Canada)
Envelope Ejection by Active Be Stars

OD92K - George McClusky (Lehigh University)
U Cep

OD92Y - Carol A. Grady (Catholic University)
AQR

OD93B - J. Michael Hollis (NASA/GSFC)
Radio Sources Near R Aquarii

OD93K - R. McCray (Colorado - JILA)
Vela X1

OD94B - Anne B. Underhill (NASA/GSFC)
TV Gem

OD94K - Robert Humphreys (U Minnesota)
Var C M33

OD94Y - Terry J. Teays (CSC - IUE Observatory)
Short Period Carbon Star Cepheids

OD95B - Francis Fekel (NASA/GSFC)
Hot Companions of Active Stars

OD95K - Steven Shore (NMINT)
Pulsating Ap Stars

OD96B - Tanaka (ISAS - JAPAN)
Vela X-1=HD77581

OD96K - Michael Robertis (York University - CANADA)
IRAS Select Seyferts

OD96Y - Jerry Bonnell (CSC - IUE Observatory)
3C 279

OD97B - Adolf Witt (U Toledo)
Orion Reflection Nebulosity

OD97K - Adela Ringuelet (Argentina)
Beta Mon

OD98K - Jorge Sahade (Argentina)
Shell Stars

OD98Y - J. Michael Hollis (NASA/GSFC)
R Aquarii Outer Nebula

OD99K - Samuel Durrance (Johns Hopkins University)
OH on Mars

OD9AB - Francis H. Schiffer (CSC - Astronomy Programs)
Flare Stars UX ARI and HR 5110 in Active State

OE589 - O. Engvold (Oslo)
An Emission Measure Analysis of the K Giant Beta Ceti and the M Supergiant Alpha Ori

OPHWM - H. Warren Moos (Johns Hopkins University)
Ultraviolet Studies of the Outer Planets

OPONE - Nancy Remage Evans (York University - CRESS)
Evolutionary Studies in Open Clusters

OPOTM - Thomas Meylan (CSC - IUE Observatory)
Bolometric Corrections of Ap(Si) Stars in Open Clusters using Low Dispersion IUE Spectroscop

OSHCG - Catharine D. Garmany (Colorado)
Short-Term Variations in Stellar Winds of Luminous Early-Tpye Stars

OSJCG - Catharine D. Garmany (Colorado - CASA)
Massive Stars in the Magellanic Clouds

OSPSC - Peter S. Conti (Colorado - JILA)
Spectroscopic Observations of O, OF, and Wolf-Rayet Stars

OV598 - Osmi Vilhu (Helsinki)
Period-Activity Relations in Solar Type Close Binaries

OXFOR - Charles (Oxford)
Time Resolved Spectroscopy of Superhumps in Eclipsing SU UMA Systems

PA003 - Monier (VILSPA)
Phase resolved spectrophotometry of Beta CrB (A8p) with the IUE

PA004 - Monier (Vilspa)
Phase Resolved Spectrophotometry and Mode Identifications of Beta Cephei Stars

PA010 - Wolf (Heidelberg)
Chemical Abundances From B Field Stars Around Young Clusters in the Magellanic Clouds

PA027 - Willis (UCL London)
The UV Spectrum of MCA - 1-B: The First Ofp/WN9 Stars Discovered in M33

PA028 - Stahl (Heidelberg)
Multi-Frequency Observations of the Outburst of the Outburst Phase of the LMC-LBV R127

PA044 - Parthasarath (Bangalore)
Ultraviolet (IUE) Spectra of Post AGB Stars

PA047 - Vogel (Zurich)
Atmospheres of the Hot Components in Symbiotic Systems

PA049 - Seggewiss (Bonn)
The Bright Part of the Stellar Population in Region E in LMC 4

PA060 - Wonnacott (RAL)
White Dwarfs as Probes of Pulsating Stellar Atmospheres

PA061 - Wonnacott (RAL)
Delta Cap: Pulsator or Algol

PA064 - Howarth (UCL London)
Time-Series Spectroscopy of Wind Variability in the Wolf-Rayet Star HD 193077

PA067 - Voels (Muenchen)
UV Observations of OB-Stars in Clusters

PA072 - Henrichs (Amsterdam)
Mass Loss/Flux Variations in Large- Amplitude Rapid Variable Be Stars

PA074 - Patriarchi (Firenze)
A Study of Two Hot, Luminous Supergiants in the LMC

PA090 - Bues (Bamberg)
Atmospheric Structure and Abundances of White Dwarfs in Binary Systems

PA096 - Van der Hucht (Utrecht)
Colliding Winds and Dust Formation in the All-Variable Long-Period WC7 Binaries HD 193793 and HD 192641 A Continuation

PA106 - Prinja (UCL London)
Wind Variability in Rapidly Rotating B Supergiants

PA123 - Barstow (Leicester)
Effective Temperatures and Gravities for an EUV Selected Sample of DA White Dwarfs

PA124 - Catala (Meudon)
Cyclic Activity in PMS Herbig Ae Stars

PA126 - Tweedy (Leicester)
The White Dwarf at the Center of the Planetary Nebula DHW5

PA129 - Barstow (Leicester)
High Resolution Observations of a Newly Discovered PG1159 Star

PA130 - Barstow (Leicester)
High Dispersion SWP Spectra of Newly Discovered DA White Dwarfs

PA135 - Faraggiana (Trieste)
Search for Lambda Boo Stars

PA136 - Heber (Kiel)
UV-Spectrophotometry of Peculiar Hot Stars Discovered by the Hamburg Schmidt Survey

PA139 - Artru (Lyon)
Line Variations of Carbon,Nitrogen and Oxygen in Magnetic Ap Stars

PA140 - Theissen (Bonn)
Physical Parameters of Hot and Peculiar Subdwarf Stars

PA141 - Theissen (Bonn)
Classification of PG 0229+064: A main Sequence B Star Behind the HVC-Complex AC III ?

PA142 - Werner (Kiel)
High Resolution UV Spectroscopy of a New PG 1159 Type Central Star

PA143 - Weidemann (Kiel)
UV Spectroscopy of Selected White Dwarfs

PA145 - Lloyd (RAL)
Probing the Structure of Wolf- Rayet Winds

PA148 - Smith (Sussex)
An Ultraviolet and Optical Investigation of the 53 Per

PA160 - Vauclair (Toulouse)
The Boundaries of the ZZ Ceti Instability Strip

PA162 - Doazan (Paris)
Phase Changes in Pleione: Towards a Normal B Phase ?

PA163 - Conlon (Belfast)
Low Resolution Observations of Hot Post-Asymptotic Giant Branch Stars

PA169 - Cassatella (Frascati)
Study of the WN Companion to the Yellow Supergiant HD 155603

PA172 - Barylak (Vilspa)
The Present Activity Phase of the LBV Star AG Carinae

PA174 - Tjin A Djie (Amsterdam)
Detection of Accretion on Herbig Ae Stars

PAKLW - Lee Anne Willson (Iowa)
A Stars in the Pleiades

PARJH - Jules P. Halpern (Columbia University)
Emergence of Double-Peaked Emission Lines in Pictor A

PB030 - M. Perinotto (Osservatorio Astrofisico-Arcet)
UV Interstellar Extinction in the Direction of OB Associations

PB042 - R. Barbon (Osservatorio Astrofisico-Di Asiago)
Optical Counterparts of Galactic X-Ray Sources

PB188 - P. Benvenuti (Vilspa)
Active Nuclei of Spiral Galaxies

PB189 - P. Benvenuti (Vilslpa)
O Stars in Magellanic Clouds

PB190 - P. Benvenuti (Vilspa)
Supernova Remnants

PB192 - P. Bernacca (Asiago)
X Persei

PB324 - P. Benvenuti (Vilspa)
Measurments of the Dust Albedo in the 2200 Angstrom Region

PB394 - P. Benvenuti (Vilspa)
Mass Loss from O Stars in the Magellanic Clouds

PB608 - P. Bruston (Buisson)
The Nearby Interstellar Medium

PB612 - P. Benvenuti (Asiago)
Measurement of the Dust Albedo in the 2200 A Region

PC005 - Monier (Vilspa)
Phase Resolved Spectrophotometry and Mode Identifications For Two Delta Scuti Stars of Spectral Type F

PC016 - Doyle (Armagh)
The Nature of M Dwarfs with a Zero H Alpha Flux

PC018 - Hunsch (Hamburg)
First Observations of the Atmospheric Eclipse of Beta Scuti

PC020 - Jorissen (ESO Muenchen)
Ultraviolet Observations of the Peculiar Star System HD 191589

PC025 - Bianchi (Torino)
IUE Survey of X-Ray Selected Late- Type M.S. and Evolved Stars

PC029 - Jordan (Oxford)
A Magnitude-Limited Survey of Single, Non-Variable G Supergiants

PC035 - Jorissen (ESO Muenchen)
HDE 332077: A Tc-Poor S Star with a Main Sequence Companion?

PC039 - Schroder (Hamburg)
Observations of the Cool Corona of HR 2554 with High Resolution

PC045 - Vogel (Zurich)
Empirical Velocity Laws for the Wind of Cool Giants

PC053 - Butler (Armagh)
The Origine of Balmer Emission from Stellar Flares

PC055 - Gahm (Stockholm)
Two T Tauri Stars Revisited

PC062 - Stickland (RAL)
A Study of New Composite and Zeta Aurigae Binaries

PC079 - Monier (Vilspa)
Phase Dependent Changes in the Star, R Sct

PC081 - Harper (Oxford)
Is HD 129456 Another Hybrid Giant with Mg II h& k S>L Asymmetry ?

PC082 - Montesinos (Oxford)
Flux-Flux and Flux-Rotation in G and K-Type Giants

PC083 - Montesinos (Oxford)
IUE Monitoring of the Post- Asymptotic Giant Branch Star FG Sge

PC085 - Stickland (RAL)
The Interacting Binary HD 43246

PC091 - Engvold (Oslo)
UV Observations of Limb-Crossing of Active Regions on Sigma Geminorum

PC108 - Viotti (Frascati)
Investigation of the UV Spectrum of the VV Cep Binary KQ Puppis

PC122 - Barstow (Leicester)
A Search for White Dwarf Companions to Late Type Stars

PC133 - Gomez de C. (Vilspa)
On the Origin of the UV Excess in PMS Stars

PC147 - Byrne (Armagh)
Transition Regions of dM(e) Stars

PC149 - Catalano (Catania)
Delineating the Spectral Type Boundary for Onset of Chromo- spheric Activity

PC157 - Byrne (Armagh)
Flaring vs Rotational Modulation on the RS CVn Star, IIPeg

PC167 - Hessman (MPI)
Observations of the High State of the FU Orionis Variable Z Canis Majoris

PC170 - Cassatella (Frascati)
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PC177 - Eriksson (Uppsala)
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PC178 - Foing (Verrieres)
Spatially-Resolved Environment and Coordinated Multi-Frequency Observations of HR 1099

PC179 - Elgaroy (Oslo)
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PC192 - Bromage (RAL)
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PC193 - Bromage (RAL)
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PC204 - P. Crane (ESA)
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PC347 - P. Crane (ESA)
Energy Distribution in the Ultraviolet of Normal Giant Elliptical Galaxies

PCNTS - Theodore P. Snow (Colorado - CASA)
UV Optical Study of Variability in the Wind from P Cygni

PCOEB - Edwin S. Barker (U Texas - Austin)
The UV Lightcurve and UV Reflectance of the Pluto-Charon System

PCPAF - Alexander W. Fullerton (U Delaware)
HD 93521: Rosetta Stone for the Photospheric Connection

PCPRT - Richard W. Tweedy (U Arizona)
IUE Spectra of Two New Pre-Cataclysmic Binary Systems

PE001 - Almoznino (Tel Aviv)
Star Formation in Blue Compact Dwarfs in the Virgo Cluster, SWP Spectroscopy

PE059 - Cacciari (Bologna)
The Blue HB Stellar Population in NGC 6752

PE103 - Buson (Padova)
The Stellar Population of Local Group Dwarf Ellipticals

PE115 - Mas-Hesse (LAEFF/Madrid)
Energy Source of Luminous ROSAT/ IRAS Galaxies

PE117 - Bertola (Padova)
The Influence of Stellar Population Differences Among Elliptical Galaxies on Their Estimated Distances

PE144 - Panagia (STScI)
Observations of SN 1987A

PE150 - Calzetti (STScI)
Ultraviolet Spectra of Normal Spiral Galaxies

PE171 - Cassatella (Frascati)
The Stellar Content of the Populous Clusters of the Magellanic Clouds

PEHAM - Andrew G. Michalitsianos (NASA/GSFC)
UV Variability in Two Peculiar Emission Stars in the Magellanic Clouds

PEHGW - Gary A. Wegner (Dartmouth University)
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PG2SS - Stanley Sobieski (NASA/GSFC)
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PGOJS - J. Michael Shull (Colorado - CASA)
Intrinsic C IV Absorption in PG-QSOs and Seyfert Galaxies

PHCAL - ( )
Photometric Calibration Stars

PHSTD - ( )
Calibrations

PI007 - Friedjung (IAP Paris)
Symbiotic Stars Misidentified as as Planetary Nebulae

PI008 - Friedjung (IAP Paris)
Observation of Old Nova at Similar Time as with the HST

PI012 - Reimers (Hamburg)
UV-Orbital Variability of the New Eclipsing CV 1804+6753

PI024 - Bianchi (Torino)
New X-Ray Sources in the LMC Discovered by ROSAT

PI026 - Morgan (Edinburgh)
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PI043 - Giovannelli (Frascati)
Orbital and Rotational Modulations in the UV Emissions From SS Cygni in Quiescence

PI046 - Vogel (Zurich)
The Hottest Symbiotic Nova: HM Sge

PI052 - Nussbaumer (Zurich)
PU Vul: From Supergiant to the Nebular Phase

PI054 - Prinja (UCL London)
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PI063 - Stickland (RAL)
Fundamental Parameters of Massive Binaries

PI084 - Gonzalez (Vilspa)
IUE Monitoring of Symbiotic Stars Experiencing UV Outbursts: BF Cygni and Z Zndromedae

PI086 - de Martino (Vilspa)
UV Orbital Variability in Polars

PI092 - Czerny (Warsaw)
Disk Precession in the Magnetic Old Nova V603 Aql

PI093 - Verbunt (Utrecht)
Phases of Orbital Variation in Lines From Cataclysmic Variable Winds

PI098 - Mouchet (Meudon)
UV Observations of X-Ray Sources Newly Identified with Intermediate Polars

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PI111 - Ulla (LAEFF/Madrid)
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Spectacular Cooling of the White Dwarf and Development of the Quiescent Accretion Disk in a Dwarf Nova

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The Disk and Wind Structure of U Gem in Outburst

PI156 - Krautter (Heidelberg)
Late Stages in the Outburst of Classical Novae

PI164 - Orio (Torino)
Observations of Two Classical Novae with IUE and ROSAT

PI182 - Hammerschlag (Amsterdam)
Coordinated UV and X-Ray Observations of Vela X-1

PI186 - Naylor (Keele)
Line Profiles of High Inclination and High Mass Transfer Cataclysmic Variables

PI188 - Hack (Trieste)
CH Cyg: A Symbiotic Star with Peculiar Spectral Features

PI190 - Cassatella (Frascati)
The UV Luminosity and the Emission Spectrum of Faint Old Novae

PI191 - Selvelli (Trieste)
The Very Near Outburst of the Recurrent Nova T Pyx

PI195 - Volkova (Odessa)
Investigation of Circumstellar Gas in V488 Cygni

PK160 - P. Kjaergaard (Copenhagen)
Elliptical Galaxies

PK161 - P. Kjaergaard (Copenhagen)
Late Type Stars

PLHNE - Nancy Remage Evans (CSC)
New Calibrators for the Cepheid Period-Luminosity Relation

PLORP - Ronald S. Polidan (NASA/GSFC)
The Peculiar Luminous Star BD+14 3887

PLRNE - Nancy Remage Evans (ISTS)
Fluxes, Temperatures and Radii of Stars Defining the Pleiades Zams

PM002 - Patriarchi (Firenze)
Carbon Abundance in Type I Planetary Nebulae

PM014 - Dennefeld (IAP Paris)
Chemical Evolution in the Magellanic Clouds Through Study of Planetary Nebulae and HII Regions

PM015 - Bates (Belfast)
Interstellar Gas in the Fields of Globular Clusters and a High Velocity Stream

PM033 - de Boer (Bonn)
Detection of High-Velocity Halo Clouds

PM034 - Bomans (Bonn)
The Dynamics of the Supershell LMC 4

PM048 - Bomans (Bonn)
LMC Giant Shell N 154 and the Origin of its X-Ray Emission

PM050 - de Boer (Bonn)
New Supernova Remnant Hidden in Luminous HII Region N 159 in LMC

PM051 - de Boer (Bonn)
The Core of 30 Doradus

PM105 - Walton (UCL London)
UV Spectroscopy of SMC Type I Planetary Nebulae

PM121 - Joblin (CPS Paris)
Nature of Interstellar Matter by Absorption and Emission Correlations

PM128 - Tweedy (Leicester)
Understanding Two-Quantum Emission in the Planetary Nebula NGC 7293

PM152 - O'Brien (Lancashire)
UV Spectroscopy of the T PYX and CP PUP Nova Shells

PM159 - Gilmozzi (STScI)
SN 1987A Light Echoes: Direct Determination of UV Shock Breakout Flux

PM181 - Vidal-Madjar (IAP Paris)
Planetary Perturbations in the Disk of Beta Pictoris

PM183 - Deleuil (Marseille)
Ionization Near Beta Pictoris

PMECI - Catherine L. Imhoff (CSC)
Ultraviolet Observations of the Pre-Main Sequence Star FU Orionis

PMEJL - Jeffrey Linsky (University of Colorado)
Post-T Tauri Stars

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PMHGB - Gibor S. Basri (Berkeley)
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PMHSS - Stephen E. Strom (Massachusetts)
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PMHTS - Theodore Simon (Hawaii)
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PMPMP - Mario R. Perez (CSC - IUE Observatory)
The Blueing Effect in Massive Young Stars

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PNHTB - Timothy Barker (Wheaton University)
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PNLSH - Sara R. Heap (NASA/GSFC)
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PNMMP - Miriam Pena (Mexico)
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PNMRD - Reginald J. Dufour (Rice University)
Shell Edges of Nearby Planetary Nebulae

PNMSH - Sara R. Heap (NASA/GSFC)
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High Temperature Planetary Nebulae in the Magellanic Clouds

PNMWF - Walter Fiebelman (NASA/GSFC)
HIgh Resolution Study of PN-Nuclei Extremely High Temperature and Low Luminosity

PNNLA - Lawrence H. Aller (UCLA)
An Intensive Study of the Variable Planetary Nebulae

PNNRR - R. Michael Rich (Columbia University)
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PNNSH - Sara R. Heap (NASA/GSFC)
A Search for Evolutionary Changes in Planetary Nuclei

PNNST - Silvia Torres-Peimbert (UNAM)
Carbon Abundances of Halo Planetary Nebulae

PNNTB - Timothy Barker (Wheaton College)
The Ionization Structure of Planetary Nebulae

PNOBP - Bradley M. Peterson (Ohio State University)
International AGN Watch: Probing the Nuclear Regions of NGC 5548

PNOFB - Frederick C. Bruhweiler (Catholic University)
UV Emission Line Imagery of High Excitation Planetary Nebulae

PNOLA - Lawrence H. Aller (UCLA)
A Study of Two Possibly Variable Planetary Nebulae

PNOSH - Sara R. Heap (NASA/GSFC)
A Search for Evolutionary Changes in Planetary Nuclei - A Continuation

PNPFB - Frederick C. Bruhweiler (Catholic University)
High Dispersion IUE Studies of Hot Central Stars of Planetary Nebula

PNPMP - Miriam Pena (UNAM)
LMC Planetary Nebulae with Wolf Rayet Features

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PNRLA - Lawrence H. Aller (UCLA)
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PNRWF - Walter A. Feibelman (NASA/GSFC)
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PP563 - P. Patriarchi (Madrid)
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PQ078 - Rodriguez (Vilspa)
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PQ094 - Courvoisier (Geneve)
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PQ099 - Walter (MPI Garching)
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PQ104 - Wamsteker (Vilspa)
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PQ107 - O'Brien (UCL London)
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PQ110 - Maraschi (Milan)
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PQ118 - Buson (Padova)
The Evolution of Lyman Forest in Quasars

PQ125 - Ulrich (ESO Garching)
Observations of the Seyfert I Nucleus of NGC 4151

PR404 - P. Rasmussen (Copenhagen)
UV Spectroscopy of Late-Type Stars Covering a Wide Range in the 3 Basic Atmospheric Parameters

PR408 - P. Rafanelli (Padova)
IUE Observations of U Gem Stars

PRJCG - Carol A. Grady (CSC)
Strong Wind Episodes and Non-Radial Pulsation Changes in Be Stars

PRKCG - Carol A. Grady (CSC IUE)
Strong Wind Episodes and Non-Radial Pulsation Changes in Be Stars

PS069 - Festou (Toulouse)
Comparative Ultraviolet Studies of Unexplored Solar System Surfaces

PS097 - Prange (Verrieres)
H Lyman Alpha Dayglow Emission Line Profiles From Saturn and Uranus

PS165 - Festou (Toulouse)
Short-Time-Scale Variabilities of the FUV Emissions of Saturn

PS176 - Zarnecki (Kent)
Observations of Comet Crigg Skjellerup

PS187 - P. L. Selvelli (Vilspa)
Recurrent Novae

PS194 - Bertaux (Verrieres)
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PS576 - P. L. Selvelli (Trieste)
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PS577 - P. L. Selvelli (Trieste)
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PS614 - P. Shaver (Garching)
Jets in Active Galactic Nuclei

PS615 - P. L. Selvelli (Trieste)
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PSA13 - J. B. Swings (Liege)
Peculiar Emission-Line Objects

PSB13 - J. P. Swings (Liege)
Ko and Wr Stars

PSC13 - C. Arpigny (Liege)
Metal-Poor F and G Stars

PSD13 - D. Malaise (Liege)
TDL S2/S68 Selected Stars

PSKJH - Jay B. Holberg (Arizona)
High Dispersion Observations of the Central Star of K1-16

PSMGT - Martin G. Tomasko (Arizona)
Spectrophotometry of Planets, Satellites and Asteroids

PSOJL - Jeffrey L. Linsky (Colorado - JILA)
Radiative and Magnetic Properties of Plages on Solar-Type Dwarfs

PSRKC - Kwang-Ping Cheng (Catholic University)
A Search for New Planetary System Candidates

PSTCO - Toby Owen (New York State)
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PT037 - G. C. Peroal (Milano)
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PT361 - P. The (Amsterdam)
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PW184 - P. Wesselius (Groningen)
Companions of Late Type Stars

Paris - M. Gerbaldi (Paris)
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QAJDT - David A. Tytler (Columbia University)
Qso Lyman Limit Absorbers

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Origin of CIV in QSO Absorption Line Systems

QCEAB - Albert Boggess (NASA/GSFC)
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QCEBW - Beverley J. Wills (Texas)
The Continuum Energy Distributions of Quasars

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QCIMM - Matthew A. Malkan (CAL LA)
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QCIRG - Richard F. Green (Arizona)
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QI124 - ( )

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QSBAD - Arthur F. Davidsen (Johns Hopkins)
Ultraviolet Spectrophotometry of Quasars and Active Galactic Nuclei

QSBBW - Beverley J. Wills (Texas)
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QSBJO - J. Beverly Oke (CIT)
Research on Emission Line Galaxies

QSBMG - Margaret J. Geller (Smithsonian)
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QSBMS - Maarten Schmidt (CIT)
Ultraviolet Observations of Quasistellar Objects and the Intergalactic and Intracluster Medium

QSBWS - Wallace L. Sarge (CIT)
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QSCAG - A. E. Glassgold (New York University)
Lyman Alpha Discontinuity in Low Redshift QSOS

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QSCMG - Margaret J. Geller (Center for Astrophysics)
IUE Observations of Variable X-Ray Seyfert Galaxies

QSCSG - Stephen A. Gregory (Bowling Green State University)
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QSCTS - B. Soifer (Cal Tech)
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QSDAD - Andrea K. Dupree (CFA)
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QSDAG - A. E. Glassgold (New York University)
QSO Emission Lines & Ionizing Radiation

QSDAW - A. S. Wilson (Maryland)
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QSDBS - B. Soifer (CIT)
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QSDDT - David A. Turnshek (Arizona)
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QSDEW - E. J. Wampler (UC Santa Cruz)
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QSDHS - H. E. Smith (UC SD)
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QSDKD - K. Davidson (Minnesota)
IUE Observations of Markarian 359, Particularly to Determine Possible Reddening

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The Efeect of X-Ray & UV Ionizing Radiation on Quasas Emission Lines

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QSEJO - J. Beverly Oke (Cal Tech)
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QSERG - Richard Green (University of Arizona)
Quasars at Redshift 1

QSERH - R. W. Hobbs (NASA/GSFC)
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QSERP - Richard Puetter (University of California, San Diego)
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Coordinated Ultraviolet, Optical & Infrared Observations of High-Redshift Quasars

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QSFAG - A. E. Glassgold (New York University)
Quasar Emission Lines and Ionizing Radiation

QSFBW - Beverley J. Wills (Texas)
The Continuum Energy Distributions of Intermediate Redshift Quasars

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QSFRC - Ross D. Cohen (UC SD)
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QSFRG - Richard F. Green (Arizona)
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QSFRR - Richard J. Rudy (Arizona)
Lyman Alpha Observations of Seyfert 1.8 and 1.9 Galaxies

QSFRS - Ronald E. Stoner (Bowling Green University)
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QSFWS - Wallace L. Sargent (CIT)
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QSGDT - David A. Turnshek (Pittsburgh)
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QSGRG - Richard Green (Steward Univ and Kitt Peak Observatory)
Quasars at Redshift 1

QSGRP - Roger L. Ptak (Bowling Green University)
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QSIMM - Matthew A. Malkan (UCLA)
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QSIRS - Ronald E. Stoner (Bowling Green)
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QSKAK - Anne L. Kinney (STScI)
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QSKBW - Beverley J. Wills (Texas)
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QSNDT - David A. Turnshek (U Pittsburgh)
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R066 - M.H. Ulrich (ESO, Germany)
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RA003 - D.J. Stickland (RAL, UK)
Massive Eclipsing Binaries

RA004 - A.J. Willis (UCL, London, UK)
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RA008 - T. Rauch (Kiel, Germany)
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RA009 - K. Werner (Kiel, Germany)
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RA014 - B. Wolf (Heidelberg, Germany)
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RA021 - M. Gerbaldi (IAP, Paris, France)
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RA024 - P.L. Dufton (Belfast, UK)
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RA037 - C. Cacciari (Bologna, Italy)
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RA038 - D.J. Lennon (Muenchen, Germany)
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RA043 - H.R.E. Tjin A Djie (Amsterdam, Holland)
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RA046 - E. Verdugo (Vilspa, Madrid, Spain)
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RA055 - S. Dreizler (Bamberg, Germany)
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RA067 - S. Jordan (Kiel, Germany)
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RA070 - L. Bianchi (STScI)
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RA076 - A. Theissen (Bonn, Germany)
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RA085 - M.A. Barstow (Leicester, UK)
A Continued Search for Hot White Dwarf Companions to Normal Stars

RA086 - M.A. Barstow (Leicester, UK)
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RA087 - C.S. Jeffery (St. Andrews, UK)
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RA090 - P. Patriarchi (Firenze, Italy)
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RA099 - J.M. Will (Bonn, Germany)
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RGLWK - William C. Keel (Alabama)
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SA028 - E. Verdugo (Vilspa, Spain)
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Ultraviolet Spectrophotometry of the Radially Pulsating Extreme Helium Star V652 Her (BD + 133224)

SA055 - T. Rauch (Kiel, Germany)
UV-Spectrophotometry of the Extremely Hot H-rich Central Star of the Planetary Nebula Lo 17

SA056 - C. Cacciari (Bologna, Italy)
The Nearby BHB Stars as Probes of the Galactic Halo

SA058 - M. Gerbaldi (Paris, France)
Boo Stars in Young Open Clusters

SA060 - R. Viotti (Frascati, Italy)
Multiwavelength Observations of the Shell Phases of Carinae and of its Nebula

SA064 - A. Theissen (Bonn, Germany)
Disentangling Composite Spectra of Hot Subdwarfs with Cool Companions

SA066 - S. Jordan (Kiel, Germany)
Very Hot DA White Dwarfs From the Hamburg-Quasar Survey

SA068 - S. Jordan (Kiel, Germany)
Calibration of Convective Efficiency by UV Observations of a Double Degenerate

SA069 - R. Napiwotzki (Bamberg, Germany)
The Chemical Evolution of Hot Hydrogen-Rich Central Stars of Planetary Nebulae

SA070 - S. Moehler (Heidelberg, Germany)
Analysing UV Bright Stars in Globular Clusters

SA075 - M.A. Barstow (Leicester, UK)
A High Signal-to-Noise Echelle Survey of H-Rich White Dwarfs

SA078 - K.A. Venn (Muenchen, Germany)
UV Flux Distributions and Terminal Velocities in Galactic, Cluster B8-A0 Supergiants

SA081 - M.R. Burleigh (Leicester, UK)
A Continuing Search for Hot White Dwarf Companions to Normal Stars

SA082 - W. Schmutz (Zurich, Switzerland)
Observational Constraints on the Ionization Structure and Velocity Low in Vel

SA085 - H.F. Henrichs (Amsterdam, Holland)
Discrete Absorption Components and the Be Star Phenomenon

SA086 - H.F. Henrichs (Amsterdam, Holland)
Stellar Wind Variability and Magnetic Fields in O Stars

SA087 - H.F. Henrichs (Amsterdam, Holland)
Wind Modulation in Beta Cep Stars

SA089 - R. Monier (Strasbourg, France)
Getting Accurate Model Independent Measures of the A and F Stars (A Multiwavelength Approach)

SA091 - Frederick C Bruhweiler (Catholic University)
The Evolution of Bondary Layers in Herbig Ae/Be Stars

SA093 - Geraldine J Peters (USC)
Short-Term Wind Variability in the Be Star Omega Orionis

SA095 - M. Parthasarathy (Bangalore, India)
IUE Observations of Post-AGB Stars Which Show Spectrum Variations

SA097 - R. Viotti (Frascati, Italy)
Study of the Long Term Spectral Variation of AG Carinae and its Nebula

SA106 - Douglas R Gies (Georgia State University)
Nonradial Pulsation and Mass Loss in Epsilon Persei

SA107 - Francoise Praderie (Observatoire de Paris-Meudon)
Emission, Mass Loss and Chromospheres in Herbig Ae Stars (III)

SA109 - Geraldine J Peters (USC)
Chemical Compositions of Three Fundamental O9-B0 Standards

SA111 - Deane M Peterson (SUNY - Stony Brook)
Duplicity Among A-F Supergiant Clibrators

SA114 - Wayne B Landsman (Hughes STX)
The UV-Bright Stars of Globular Clusters

SA115 - Carol A Grady (Applied Research Corporation)
Probing the Circumstellar Grains in Herbig Ae/Be Star Disks: Coord

SA117 - Gloria Koenigsberger (UNAM)
The Changing Wind Structure and Eruption in the SMC WR System HD 5

SA123 - R. Freire Ferrero (Strasbourg, France)
Do Early A Stars Emit X-Rays?

SA126 - N. Brosch (Tel Aviv, Israel)
Outstanding TAUVEX Sources

SA132 - Davis Philip (ISO)
Ultraviolet Observations of Field Horizontal-Branch Stars V A G

SA133 - Edward F Guinan (Villanova University)
Eclipsing Binaries in the Magellanic Clouds: Laboratories for Stellar Structure and Evolution

SA138 - V. Doazan (Paris, France)
Far UV Monitoring of Pleione

SA140 - A.J. Willis (UCL, London)
Stellar Wind Variability in the WC Star HD192103 (WC8)

SA145 - P.A. Crowther (UCL, London)
Long Term Spectroscopic Monitoring of the LBV HD 5980

SA146 - A.J. Willis (UCL, London)
Stellar Wind Variability in the WN Star HD96548 (WN8)

SA148 - H.R.E. Tjin A Djie (Amsterdam, Holland)
Dissipation of Herbig Ae/Be Envelopes Near the Main Sequence

SA156 - V. Caloi (Frascati, Italy)
An Investigation of the Blue Sequence in the Young LMC Cluster NGC1850

SA158 - P.F.C. Blondel (Amsterdam, Holland)
Detection of Accretion on Herbig Ae/Fe Stars

SABDM - Dennis L. Matson (JPL)
Ultraviolet Reflectance Spectroscopy of Selected Asteroids

SACDM - Dennis L. Matson (JPL)
Ultraviolet Reflectance Spectroscopy of Selected Asteroids

SADDM - Dennis L. Matson (JPL)
Ultraviolet Reflectance Spectroscopy of Selected Asteroids

SAEDM - Dennis L. Matson (JPL)
Ultraviolet Reflectance Spectroscopy of Selected Asteroids

SAITS - Thomas E. Skinner (Colorado)
Outer-Planet Surorae

SAJCW - Chi-Chao Wu (CSC)
Augmentation of IUE Ultraviolet Spectral Atlas

SAKCW - Chi-Chao Wu (CSC)
Augmentation of IUE Ultraviolet Spectral Atlas

SAKTS - Thomas E. Skinner (Colorado LASP)
The Influence of the Solar Wind on Outer Planet Aurorae

SALCW - Chi-Chao Wu (CSC)
Augmentation of the IUE Ultraviolet Spectral Atlas

SAMCW - Chi-Chao Wu (STScI)
Augmentation of the IUE Ultraviolet Spectral Atlas

SAMEG - Edward F. Guinan (Villanova)
Magnetic Activity of the Sun in Time

SAMJC - John T. Clarke (Michigan)
Simultaneous IUE and ROSAT Observations of Jupiter's Aurora

SANCW - Chi-Chao Wu (STScI)
Augmentation of the IUE Ultraviolet Spectral Atlas

SAOCW - Chi-Chao Wu (CSC - STScI)
Augmentation of the IUE Ultraviolet Spectral Atlas

SARFF - Francis C. Fekel (Tennessee State University - CEIS)
Activity in Pop II Stars

SARTL - Timothy A. Livengood (NASA/GSFC)
Equinoctial Observations of Saturnian Aurorae and Seasonal Effects

SBHFF - Francis C. Fekel (Vanderbilt University)
Mass Ratios of Composite Binaries

SBHFW - Francois Wesemael (Montreal)
Continuing High-Resolution Ultraviolet Observations of Hot B Subdwarfs

SBITA - Thomas B. Ake (CSC)
Winds in Supergiant Binaries

SBJCG - Catharine D. Garmany (Colorado - CASA)
Blue Stragglers in Open Clusters

SBKMP - Mirek J. Plavec (UCLA)
Superionized Winds in Semidetached Binaries

SBLKC - K. C. Chambers (STScI)
Minkowski's Object: A Starburst Triggered by a Radio Jet

SBMNE - Nancy Remage Evans (Canada)
Red Giant Binaries In Clusters

SBPJM - Jayant N. Murthy (Johns Hopkins University)
Emission Lines from the Eridanus Superbubble

SC002 - J.G. Doyle (Armagh, N. Ireland)
UV Observations of Selected EUV Late-Type Objects

SC003 - Nancy Remage Evans (York University)
Binaries: How Wide?

SC006 - R. Monier (Strasbourg, France)
Ultraviolet Spectrophotometry of Scuti Star Pup

SC011 - Erica Bohm-Vitense (U Washington)
The Heating Mechanisms of Hyades F Stars

SC015 - R. Monier (Strasbourg, France)
Phase Resolved Multiwavelength Spectrophotometry of RV Tauri Stars

SC025 - Myron A. Smith (CSC - Science Programs)
A Search for the Site of Multiwavelngth Variability in Gamma Cas

SC032 - Frederick M Walter (SUNY - Stony Brook)
Coordinated X-Ray and UV Doppler Imaging Observations of AR Lacert

SC043 - B. Montesinos (LAEFF, Spain)
Flux-Flux and Flux-Rotation Correlations in Late-Type Giants

SC046 - M. Friedjung (Paris, France)
The VV Cep Binary KQ Pup: A Key for Understanding the Physics of Wind Accretion

SC049 - Wendy Hagen Bauer (Wellesley College)
Variations in the Interacting Binary VV Cephei

SC051 - R. de la Reza (Rio de Janeiro, Brasil)
Chromospheres and Li Abundances of Strong Li K Giants

SC072 - B. Montesinos (LAEFF, Spain)
FG SGE, A Unique Case of Post-AGB Evolution

SC083 - I. Bues (Bamberg, Germany)
Long-Term Variability in the Spectra of Single Magnetic White Dwarfs

SC102 - A.I. Gomez de Castro (Madrid, Spain)
Physical and Thermal Structure of the Accretion Flow Onto T Tauri Stars

SC105 - G.E. Bromage (Lancashire, UK)
Flux-Limited Sample and Flare Studies of New EUV-Selected dMe Stars

SC116 - Alexander Brown (Colorado - CASA)
Linking the Impulsive and Gradual Phases of RS CVn Flares: HR 1099

SC124 - G.E. Bromage (Lancashire, UK)
Activity in an EUV-Selected Sample of Fast-Rotating Late-Type Stars

SC125 - O. Engvold (Oslo, Norway)
Mapping of Chrosmospheric Active Regions on UX Ari

SC152 - L. Pastori (Bera-Merate, Italy)
Chromosphere and Transition Region of the X-Ray Sources

SC165 - Robert E Stencel (U Denver)
Nineteenth Episode Monitoring of Long Period Eclipsing Systems

SC166 - Marc Gagne (Colorado - JILA)
Probing Coronal Flare Energetics: IUE, XTE, and EUVE Obs of Nearby

SC202 - S. Catalano (Catania)
RS CVN Binaries

SC380 - S. Catalano (Catania)
Selected RS CVN Binaries

SC537 - S. Catalano (Catania)
Strllar Chromospheres

SCBMA - Michael F. A'Hearn (Maryland)
Ultraviolet Cometary Spectrophotometry

SCBPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

SCBWJ - William M. Jackson (Howard University)
Cometary Observation

SCCMA - Michael F. A'Hearn (U Maryland)
Ultraviolet Cometary Spectrophotometry

SCCPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

SCCWJ - William M. Jackson (Howard University)
Comet Observations with IUE

SCDMA - Michael F. A'Hearn (Maryland)
Ultraviolet Spectrophotometry of Comets

SCDPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with IUE

SCDWJ - William M. Jackson (Howard University)
A Proposal for Cometary Observations with the IUE

SCEMA - Michael F. A'Hearn (Maryland)
Comets as Targets of Opportunity

SCEPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the International Ultraviolet Explorer

SCFMA - Michael F. A'Hearn (Maryland)
Comets as Targets of Opportunity

SCFPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the International Ultraviolet Explorer

SCGJH - Jan Michael Hollis (NASA/GSFC)
Ultraviolet Absorption Studies Toward Comet Comae

SCGMA - Michael F. A'Hearn (Maryland)
Comets as Targets of Opportunity

SCGPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the International Ultraviolet Explorer

SCHJH - Jan Michael Hollis (NASA/GSFC)
Ultraviolet Absorption Studies Toward Comet Comae

SCHMA - Michael F. A'Hearn (U Maryland)
Comet Jacobini-Zinner and the Ice Mission

SCHPF - Paul D. Feldman (Johns Hopkins University)
IUE Observations of Halley's Comet

SCHWJ - William M. Jackson (Howard University)
A Proposal for Observations of Comets, as Targets of Opportunity

SCIMA - Michael F. A'Hearn (Maryland)
Multi-Year Proposal for IUE Observations of Comets as Targets of Opportunity

SCIPF - Paul D. Feldman (Johns Hopkins University)
IUE Observations of Comets as Targets of Opportunity

SCIWJ - William M. Jackson (Cal Davis)
Comets, as Targets of Opportunity

SCJMA - Michael F. A'Hearn (Maryland)
Multi-Year Program to Study Comets as Targets of Opportunity

SCJPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

SCKMA - Michael F. A'Hearn (Maryland)
IUE Observations of Comets

SCKPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

SCLMA - Michael F. A'Hearn ( )
IUE Observations of Comets

SCLPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

SCLTA - Thomas Ake (STScI)
S Stars as Cooler Analogs to BA II Stars-The Question of Binarity

SCMMA - Michael F. A'Hearn (Maryland)
IUE Observations of Comets

SCMPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

SCNMA - Michael F. A'Hearn (U Maryland)
IUE Observations of Comets and Related Bodies

SCNPF - Paul D. Feldman (Johns Hopkins University)
Observations of Comets with the IUE

SCORS - Robert E. Stencel (Colorado - CASA)
Intersystem C II Lines as Shock Diagnositics in Stellar Chromospheres

SCOSS - Steven H. Saar (Harvard CFA - SAO)
UV Spectra of the "Super-Cycle" Star: HD 10780

SCRFG - R. F. Garrison (David Dunlop Observatory)
Spectral Classification with Ultraviolet Spectra

SD393 - S. D'Odorico (Padova)
Active Nuclei of Soiral Galaxies

SD407 - S. D'Odorico (Padova)
Ultraviolet Observations of Shock-Ionized Gas

SD509 - S. D'Odorico (Garching)
Carbon Abundance in the Gaseous Phase of M 33

SD611 - S. D'Odorico (Garching)
Active and Quiescent Nuclei of Spiral Galaxies

SDHFW - Francois Wesemael (Montreal)
Continuing Low-Resolution Ultraviolet Observations of Hot B Subdwarfs

SDIGW - Gary A. Wegner (Dartmouth University)
Ultraviolet Spectra of Subluminous Objects Found in the Kisoschmidt Survey

SDIRB - Roger A. Bell (Maryland)
IUE Observations of Subdwarfs and RR Lyrae Stars

SDITS - Theodore Simon (Hawaii)
Lyman Alpha Spectra of Three Standard Candles

SDJGW - Gary A. Wegner (Dartmouth University)
Spectra of Subluminous Objects Found in the Kiso Schmidt Survey

SDJJL - James W. Liebert (Arizona)
Very Hot Subdwarfs

SDJTS - Theodore Simon (NASA/GSFC)
Eclipse Observations of HD 185510

SDLJD - John S. Drilling (Louisiana State)
UV Spectroscopy of Very Hot sdO Stars

SDLTS - Theodore Simon (Hawaii)
The Mass of the Subdwarf B Star in HD 185510

SDMPT - Peter A. Thejll (Delaware)

Gravities and Space Densities of O Subdwarfs

SDRJD - John S. Drilling (Louisiana State University)
UV Spectroscopy of Very Hot SDO Stars

SE044 - Arlin P S Crotts (Columbia University)
Re-Observing the First Hours of Supernova 1987A: Final Epoch

SE142 - D. Valls-Gabaud (Strasbourg, France)
A Systematic Ly-Study of Metal Poor Starburst Galaxies

SE157 - J.M. Mass Hesse (LAEFF, Spain)
Initial Mass Function and Extinction in Blue Compact Galaxies

SEMSC - Supriya Chakrabarti (UC Berleley)
IUE Observations of Earth's Aurora

SEYFE - (ESA)
Multifrequency Monitoring of Seyfert 1 Galaxies

SFOGC - Geoffrey C. Clayton (Colorado - CASA)
UV Extinction Properties of Dust in a Region of Active Star Formation

SGABU - Anne B. Underhill (NASA/GSFC)
Study of the Ultraviolet Spectra of Early-Type Supergiants

SGEAU - Anne B. Underhill (NASA/GSFC)
Luminous Early-Type Stars

SGEBM - Barry F. Madore (Toronto)
A Search for Companions to Non-Pulsating Yellow Supergiants

SGFAU - Anne B. Underhill (NASA/GSFC)
Spotted Surfaces on Luminous Early-Type Stars

SGHJM - John S. Mathis (Wisconsin)
An Investigation of Broad-Line Regions of Seyfert 1 Galaxies

SGIJN - Joy Nichols-Bohlin (STScI)
Evolutionary Status of the Peculiar B3IA Supergiant HD 157038

SGMFB - Frederick C. Bruhweiler (Catholic University)
Extranuclear Regions in Nearby Seyfert Galaxies

SGNAD - Anthony C. Danks (STX)
The Connection Between Starburst and Seyfert Galaxies, A Case Study: NGC 1808

SGOGS - George Sonneborn (NASA/GSFC)
Anomalous A-Type Supergiants in the Magellanic Clouds

SGPAD - Anthony C. Danks (Hughes - STX)
Star Formation in Gas Rich SO Galaxies

SGPAK - Anne L. Kinney (STScI)
Ultraviolet Spectra of Normal Spiral Galaxies

SGPLD - Linda L. Dressel (Applied Research Corporation)
Star-Burst Rings in S0 Galaxies

SGRMC - Michael T. Carini (CSC - Astronomy Programs)
Further Observations of the Core UV Upturn in Normal Spiral Galaxies

SGSBP - Sidney B. Parsons (Texas)
Ultraviolet Spectroscopy of A, F, and G Supergiants

SHHWJ - Willaim M. Jackson (Howard University)
A Proposal for Observations of Comet P/Halley with the International Ultraviolet Explorer

SHIPF - Paul D. Feldman (Johns Hopkins University)
IUE Observations of Halley's Comet

SHIWJ - William M. Jackson (Cal Davis)
A Proposal for Observations of Comet P/Halley

SHPOS - Oswald H. W. Siegmund (UC Berkeley)
Variability in Gaseous Shells Around A Stars

SHPYC - You-Hua Chu (U Illinois)
The Supergiant Shell LMC3

SHRYC - You-Hua Chu (U Illinois)
SNR Shocks in X-Ray Bright Superbubbles

SI001 - F.A. Ringwald (Keele, UK)
Is BK Lyn (PG 0917+342) The First Nova-Like Below the Period Gap?

SI008 - A. Skopal (Lomnica, Slovakia)
Understanding the Outburst Stage of the Symbiotic System CH Cyg

SI009 - C.B. Pereira (Rio de Janeiro, Brasil)
UV Spectroscopy Study of Symbiotic Stars

SI010 - Donald W. Hoard (U Washington)
Accretion in the SW Sex Stars

SI016 - D.J. Stickland (RAL, UK)
The Most Massive Binaries

SI020 - Paula Szkody (U Washington)
Monitoring the Accretion During the Supercycle of V1159 Ori

SI022 - P. Koubsky (Ondrejov, Czech)
Ultraviolet Study of Non-eclipsing Algol Systems

SI027 - T. Fer (Madrid, Spain)
IUE monitoring of Symbiotic Stars Experiencing Outbursts: Z Andromedae and BF Cygni

SI030 - D. de Martino (Vilspa, Spain)
Variability of the Unique System CQ Dra

SI031 - D. de Martino (Vilspa, Spain)
Multi-Frequency Monitoring of Oe/X-Ray Binary X Per

SI033 - D. de Martino (Vilspa, Spain)
UV Orbital Variations in Intermediate Polars

SI035 - D. de Martino (Vilspa, Spain)
Search of the Nature of Long Term Mass Accretion Variations in Polars

SI047 - R. Viotti (IAS, Frascati, Italy)
The New Activity Phase of the Symbiotic Star AG Dra

SI054 - R. Gonzalez (Vilspa,Spain)
IUE Observations of the Late Stages of Novae in the LMC

SI059 - B.T. Gaensicke (Goettingen, Germany)
UV Spectroscopy of New, ROSAT-Discovered AM Her Systems

SI062 - B.T. Gaensicke (Goettingen, Germany)
The Nature of the Long-Term Variability of AM Herculis

SI063 - Chris R Shrader (USRA)
X-Ray Transients as Targets of Opportunity

SI065 - Miriam Pena (UNAM)
Variability of the Central Star of the PN LMC-N66

SI067 - W. Schmutz (Zurich, Switzerland)
Wind Structure of Red Giants in Symbiotic Systems

SI077 - H. Duerbeck (Muenster, Germany)
A Multi-Wavelength Study of the Quiescent and Flaring Activity of the Algol System RZ Cas

SI079 - T.R. Marsh (Southampton, UK)
Observations of a New Eclipsing Dwarf Nova, HS 1804+6753

SI094 - Geraldine J Peters (USC)
Circumstellar Material in UXMON, a System with Grazing Incidence M

SI100 - C. Waelkens (Heverlee, Belgium)
Variable CS Extinction of HR4049 and HD213985

SI103 - R. Gon (Vilspa, Spain)
UV Monitoring of the Recurrent Nova RS Oph in Quiescence

SI104 - B.J.M. Hassall (Lancashire, UK)
Temperature of White Dwarfs, in Quiescent Dwarf Novae

SI107 - H. Drechsel (Bamberg, Germany)
Highly Interacting Massive Binaries

SI108 - Derck Massa (ARC)
The Incidence and Origin of Rotational Modulation of OB-Star Winds

SI127 - A.J. Castro-Tirado (LAEFF, Spain)
Study of GX 301-2 and Other Two Massive X-Ray Binaries

SI131 - P.L. Selvelli (Trieste, Italy)
The Secrets of T Pyx, a Recurrent Nova with a Long-Awaited Outburst

SI135 - George Sonneborn (NASA/GSFC)
Supernova Spectroscopy

SI136 - J. Krautter (Heidelberg,Germany)
Target-of-Opportunity Observations of Novae

SI139 - M. Friedjung (Paris, France)
Nature of the Extraordinary Short Timescale Variations in the Wind of V 603 AQL Detected with HST

SI154 - H. Nussbaumer (Zurich, Switzerland)
Symbiotic Novae

SI160 - Diane Roussel-Dupre (LANL)
Follow-Up Study of EUVE Transient ALEXIS J1114+43 (AR UMa)

SI168 - Steven B. Howell (PSI/SJI)
Multiwavelength Accretion Studies of AM Herculis Stars

SI169 - Steven B. Howell (PSI/SJI)
Multiwavelength Accretion Studies of AM Herculis Stars

SIEHM - H. Warren Moos (Johns Hopkins University)
Study of the Torus of IO Using IUE

SIFHM - H. Warren Moos (Johns Hopkins University)
Study of the Torus of IO Using the IUE

SIGHM - H. Warren Moos (Johns Hopkins University)
The Stability of the IO Torus

SIHHM - H. Warren Moos (Johns Hopkins University)
The Stability and Longitudinal Homogeneity of the IO Torus

SIIHM - H. Warren Moos (Johns Hopkins University)
The Io Torus: Neutral Injection, Temperture Gradient and Stability

SIJHM - H. Warren Moos (Johns Hopkins University)
IO and the IO Torus

SIKHM - H. Warren Moos (Johns Hopkins University)
Io Atmosphere and Torus

SIKJC - John Clarke (University of Michigan)
Detection of Io's Atmosphere by Particle Excitation in Eclipse

SILWM - H. Warren Moos (Johns Hopkins University)
How Does Io Fuel the Plasma Torus

SIMHM - H. Warren Moos (Johns Hopkins University)
IO and the Plasma Torus

SJBHM - H. Warren Moos (Johns Hopkins University)
IUE Observation of the Jovian and Saturnian Systems in Coordination with the Voyager Flybys

SJBWM - H. Warren Moos (Johns Hopkins University)
IUE Observation of the Jovian and Saturnian Systems in Coordination with the Voyager Flybys.

SJCDM - Dennis L. Matson (JPL)
UV Spectrophotometry of the Galilean Satellites of Jupiter

SJCHM - H. Warren Moos (Johns Hopkins University)
Study of Jovian Aurorae and the Torus of IO using IUE

SJCJT - John T. Trauger (CIT)
IUE Observations of Selected Jovian Atmospheric Features

SJCMB - M. J. Belton (Kitt Peak)
Stability of SO2 Frost and Vapor on IO + Investigation of Longitudinal Asymmetry

SJDDM - Dennis L. Matson (Jet Propulsion Laboratory)
Ultraviolet Spectrophotometry of the Galilean Satellites of Jupiter

SJDHM - H. Warren Moos (Johns Hopkins University)
Study of the Jovian Auroral Intensities & the Torus of io using IUE

SJDJT - John T. Trauger (CIT)
Jovian Atmospheric Dynamics & Photochemistry

SJEDM - Dennis L. Matson (JPL)
Ultraviolet Spectrophotometry of the Galilean Satellites of Jupiter

SJEHM - H. Warren Moos (Johns Hopkins University)
Study of the Jovian Auroral Spectral & Intensity Variations

SJFHM - H. Warren Moos (Johns Hopkins University)
Study of Spatial and Temporal Variations in Jovian Ultraviolet Emissions

SJFJC - John Caldwell (Stony Brook)
IUE Solar System Observations, IV. Chemical Composition at Jupiter's Poles

SJGHM - H. Warren Moos (Johns Hopkins University)
The Interaction Between the Jovian Atmosphere and Magnetosphere

SJHDS - Donald E. Shemansky (Arizona)
Observations of Hydrogen Emission from Jupiter

SJHHM - H. Warren Moos (Johns Hopkins University)
The Long-Term Interaction Between the Jovian Atmosphere and Magnetosphere

SJHJW - J. H. Waite (NASA\Marshall Space Flight Center)
Observations of Jovian ION Aurora

SJIDS - Donald E. Shemansky (Arizona)
Observations of Hydrogen Emission from Juptier

SJIHM - H. Warren Moos (Johns Hopkins University)
Jovian Magnetospheric-Atmospheric Interactions

SJJDS - Donald E. Shemansky (Arizona)
Observations of Hydrogen Emission from Jupiter

SJJHM - H. Warren Moos (Johns Hopkins University)
Excitation of the Jovian Upper Atmosphere

SJJTS - Thomas E. Skinner (Colorado-LASP)
Solar Wind-Jovian Aurora

SJKDS - Donald E. Shemansky (Arizona)
Observations of Hydrogen Emission from Jupiter

SJKHM - H. Warren Moos (Johns Hopkins University)
Excitation of the Jovian Upper Atmosphere

SJKJC - John CLarke (University of Michigan)
The Ionospheric Contribution to Jupiter's H Ly Bulge

SJKJW - J. H. Waite (NASA/GSFC)
Simultaneous UV and IR Observations of Jovian Aurora

SJKRW - Richard Wagener (Suny)
Jovian Auroral Monitoring Coordinated with the IJW

SJLJC - John T. Clarke (Michigan)
Doppler-Shifted H Lyman Alpha Emission from Jupiter's Aurora

SJLWM - H. Warren Moos (Johns Hopkins University)
Excitation of the Jovian Upoper Atmosphere

SJMHM - H. Warren Moos (Johns Hopkins University)
Excitation Processes and Aeronomy in the Jovian Upper Atmosphere

SJMJC - John T. Clarke (Michigan)
Dopper-Shifted H LY Alpha Emissions from Jupiter's Aurora and Equator

SJNHM - Warren Moos (Center for Astrophysical Sciences)
Excitation and Heating of the Jovian Atmosphere

SJNHM - H. Warren Moos (Johns Hopkins University)
Excitation and Heating of the Jovian Atmosphere

SKKAM - Andrew G. Michalitsianos (NASA/GSFC)
Sanduleak's Star: A Possible Supernova Progenitor in the LMC

SKYLW - ( )

SL034 - J. E. Stenflo (Lund Observatory)
Observations of Compact Extragalactic Objects

SLBBH - Bruce Hapke (Pittsburgh)
Measurement of the Far-UV Spectral Reflectances of Selected Lunar Areas and Possible Mercury Using the IUE

SLOCA - Christopher M. Anderson (U Wisconsin - Madison)
A Study of UV Interstellar Extinction Along Sight Lines Sampled by WUPPE

SM053 - William P Blair (Johns Hopkins University)
Spatially-Resolved UV Spectra of Shocked Interstellar Clouds

SM071 - F. Bocchino (Palermo, Italy)
Testing the Emission Conditions of Selected Filaments in the Vela Supernova Remnant

SM121 - M.L. Prevot (Marseille, France)
Last UV/IUE Extinction Curve of Molecular Clouds and Cirrus Clouds

SM150 - M. Deleuil (Marseille, France)
Monitoring of the Spectral Variations in the Circumstellar Disk of Pictoris

SM151 - B. Bates (Belfast, N.Ireland)
Interstellar Gas in the Fields of Globular Clusters

SM167 - Douglas G Currie (U Maryland)
Eta Car Coples: The Structure and Outbursts. A Multi-Wavelength C

SMBAL - Arthur L. Lane (JPL)
IUE Observations of Mars

SMCAL - Arthur L. Lane (Jet Propulsion Laboratory)
IUE Observations of the Seasonal Variability of Ozone on Mars

SMLDS - Donald E. Shemansky (Arizona)
A Search for Cometesimal Derived Atmosphere on the Moon

SMMDS - Donald E. Shemansky (Arizona)
A Search for Cometesimal Derived Atmosphere on the Moon

SMOAB - Alexander Brown (Colorado - JILA)
Simultaneous Multiwavelength Study of "Speedy Mic"

SMOGS - George Sonneborn (NASA/GSFC)
An UV Spectrophotometric Census of B Supergiants in the SMC

SNFRK - Robert P. Kirshner (Michigan)
IUE Supernova Spectroscopy

SNHJC - John J. Caldwell (Stony Brook)
IUE Solar System Observations I. Uranus and Neptune

SNHJS - J. Michael Shull (Colorado-Lasp)
Shock Processing of Interstellar Grains in Monoceros

SNHRF - Robert A. Fesen (Colorado)
UV Observation of the Blue Star Behind the Young Type I SNR of Ad 1006

SNHWB - William Blair (Johns Hopkins University)
An Oxygen-Rich Supernova Remnant in the Small Magellanic Cloud

SNIJC - John J. Caldwell (N. Y. State)
IUE Solar System Observations II. Neptune

SNIJR - John C. Raymond (Harvard CFA - SAO)
The Vela Supernova Remnant

SNIRK - Robert P. Kirshner (CFA)
Supernova Spectroscopy

SNJJC - John T. Clarke (NASA/GSFC)
H LY Alpha Emission From Neptune

SNJRK - Robert P. Kirshner (CFA Harvard)
Continuing Spectroscopy of SN 1987A

SNKRK - Robert P. Kirshner (Harvard CFA - SAO)
Continuing Spectroscopy of SN1987A

SNLRK - Robert P. Kirshner (Harvard)
Supernova Spectroscopy

SNLRW - Richard Wagener (Suny)
Solar System Observations I. Neptune During the Voyager Encounter

SNLSS - S. Alan Stern (Colorado LASP)
IUE Observations of Triton and Neptune at the Time of the Voyager Encounter

SNLWB - William P. Blair (Johns Hopkins University)
UV Observations of the Supernova Remnant N49 in the LMC

SNMGS - George Sonneborn (NASA/GSFC)
Continuing Ultraviolet Spectroscopy of SN 1987A

SNMJR - John C. Raymond (Harvard SAO - CFA)

Emission and Absorption Study of the Vela Supernova Remnant

SNMPW - P. Frank Winkler (Middlebury College)
Circumstellar Material in the Puppis A Supernova Remnant

SNMRK - Robert P. Kirshner (Harvard SAO - CFA)
Supernova Spectroscopy

SNMWB - William P. Blair (Johns Hopkins)
UV Observations of the Cygnus Loop Based on Voyager Data

SNNGS - George Sonneborn (NASA/GSFC)
Continuing Ultraviolet Spectroscopy of SN 1987A

SNNRK - Robert P. Kirshner (Harvard University)
Supernova Spectroscopy

SNOAC - Arlin P. S. Crotts (Columbia University)
SN 1987A Light Echoes: Direct Determination of UV Shock Breakout Flux

SNODM - David M. Meyer (Northwestern University)
High-Velocity Gas in the SN1991T/3C273 Sightline

SNOGS - George Sonneborn (NASA/GSFC)
Late-Time Spectroscopy of SN 1987-A

SNOLD - Laura Danly (STScI)
High Signal-to-Noise Observations of the Intermediate Velocity Arch

SNORK - Robert P. Kirshner (Harvard CFA - SAO)
Supernova Spectroscopy

SNOWK - William C. Keel (U Alabama)
Obscuration and Age Effects in Starburst Nuclei

SNOYC - You-Hua Chu (U Illinois)
A New SNR Candidate Hidden in the Luminous HII Region N 159

SNPAC - Arlin Crotts (Columbia Astrophysics Laboratory)
SN 1987A Light Echoes: Direct Determination of UV Shock Breakout Flux

SNPGS - George Sonneborn (NASA/GSFC)
Interaction of SN 1987-A with its Circumstellar Environment

SNQAC - Arlin Crotts (Columbia Astrophysics Laboratory)
SN 1987A Light Echoes: Direct Determination of UV Schock Breakout Flux

SNQBM - George Sonneborn (NASA/GSFC)
Interaction of SN 1987A with its Circumstellar Environment

SNQRK - Robert Kirshner (Harvard College Observatory)
Supernova Spectroscopy

SNRRK - Robert P. Kirshner (Harvard College Observatory)
Supernova Spectroscopy

SOLAD - Anthony C. Danks (ARC)
A Study of the Stellar Population in Selected SO Galaxies

SOOMC - Michael R. Combi (U Michigan)
Variation of the Solar Lyman Alpha Line Profile with Solar Activity

SP127 - S. R. Pottasch (Groningen)
Central Stars of Planetary Nebulae

SP128 - S. R. Pottasch (Groningen)
SDO and Nova-Like Stars

SP181 - S. R. Pottasch (Groningen)
Black Hole Binaries

SP374 - S. R. Pottasch (Groningen)
The Nebular Continuum from Planetary Nebulae

SP382 - S. R. Pottasch (Groningen)
High-Resolution Observations of Planetary Nebulae

SP390 - S. R. Pottasch (Groningen)
The Peculiar Slow Nova HD 87643

SP391 - S. R. Pottasch (Groningen)
Interstellar Line Measurements of High-Velocity Clouds

SP558 - S. R. Pottasch (Groningen)
Extinction to Planetary Nebulae

SP573 - S. R. Pottasch (Groningen)
Mass-Loss of Wolf-Rayet-Type Central Stars of Planetary Nebulae

SPARK - Warren Sparks (NASA/GSFC)
Commissioning Period Program

SPBJC - John J. Caldwell (Stonybrook)
Solar System Studies

SPBMT - Martin G. Tomasko (Arizona)
Spectrophotometry of Planets, Satellites and Asteroids

SPCJC - John J. Caldwell (Suny at Stony Brook)
Solar System Investigations with the IUE Satellite

SPDHM - H. Warren Moos (Johns Hopkins University)
IUE Observation of thje Saturn and Uranus Systems in Supportof the Voyager Mission

SPDJC - John J. Caldwell (Stony Brook)
Solar System Investigations with the IUE Satellite

SPEHM - H. Warren Moos (Johns Hopkins University)
IUE Study of Emissions from Saturn and Uranus

SPEJC - John J. Caldwell (Stony Brook)
Solar System Investigations with the IUE

SPEJT - John T. Trauger (Cal Tech)
High Spatial Resolution IUE Observations of Jupiter & Saturn

SPEMA - Michael F. A'Hearn (Maryland)
Dusty, Distant Comets

SPFCB - C. Stuart Bowyer (UC Berkeley)
Observations of H LY Alpha Emission from Neptune

SPFHM - H. Warren Moos (Johns Hopkins University)
Study of Ultraviolet Emissions from Saturn, Uranus and Neptune

SPFJC - John J. Caldwell (Stony Brook)
IUE Solar System Observations, I. Uranus and Neptune Below 2000 Angstroms

SPFRN - Robert M. Nelson (JPL)
UV Spectrophotometry of the Galilean Satellites, Saturnian Satellites & Selected Asteroids

SPGHM - H. Warren Moos (Johns Hopkins University)
Study of Ultraviolet Emissions Induced by the Magnetospheres of Saturn and Uranus

SPGMA - Michael A'Hearn (University of Maryland)
Periodic Comets

SPGRN - Robert M. Nelson (JPL)
UV Spectrophotometry of the Galilean Satellites, Saturnian Satellites & Selected Asteroids

SPHPF - Paul D. Feldman (Johns Hopkins University)
IUE Observations of Comets as Targets of Opportunity

SPIJN - John S. Neff (Iowa)
UV Geometric Albedos of Uranus and Neptune

SPIJW - J. H. Waite (NASA/GSFC)
Ongoing Observations of Jupiter and Saturn

SPJJW - J. H. Waite (NASA/GSFC)
Particle Induced UV Emissions at the Outer Planets

SPJMA - Michael F. A'Hearn (Maryland)
Periodic Comets: Encke and Borrelly

SPJRW - Richard Wagener (Applied Research Corp.)
A Search for Nitriles in the Stratosphere of Titan

SPKHM - H. Warren Moos (Johns Hopkins university)
Emissions from Saturn and Uranus

SPKTS - Thomas E. Skinner (Colorado - CASA)
Ultraviolet Observations of Pluto

SPLSS - S. Alan Stern (Colorado LASP)
IUE Observations of Pluto's Surface and Extended Atmosphere

SPQEG - Edward Guinan (Villanova University)
The Sun in Time: An IUE Investigation of Solar Proxies of Different Ages

SPREG - Edward F. Guinan (Villanova University)
An IUE Investigation of Solar Proxies of Different Ages

SQ021 - Bradley M Peterson (Ohio State University)
Reverberation Mapping of Mrk 335

SQ024 - Belenda J Wilkes (Harvard CFA - SAO)
The Ultra-Violet and Soft X-ray Properties of the PB Quasars

SQ026 - Alfred B. Schultz (CSC - Science Programs)
Interacting Spirals in Compact Groups

SQ037 - P.T. O'Brien (Oxford, UK)
International AGN Watch: The Variable Broad Line Radio Galaxy 3C 390.3

SQ039 - K. Mannheim (Goettingen, Germany)
Multi-Frequency Observations of W Comae

SQ040 - D. Reimers (Hamburg, Germany)
A Search for More Transparent Lines of Sight to Bright High Redshift Quasars

SQ080 - James R Webb (Florida Int'l University)
Multifrequency Spectra of Blazars During Outbursts

SQ090 - Richard Edelson (U Iowa)
Coordinated IUE and XTE Monitoring of Active Galactic Nuclei

SQ092 - Frederick C. Bruhweiler (Catholic University)
Multifrequency Observatons of Blazars: MKN 421 & 3C 273

SQ098 - N. Schartel (Vilspa, Spain)
Study of X-Ray Bright Quasars

SQ099 - K. Beuermann (Goettinge, Germany)
Violent Accretion Events in AGN

SQ101 - L. Piro (Frascati, Italy)
The UV to Soft X-Ray "Big Bump" In Seyfert Galaxies: IUE-SAX Simultaneous Observations

SQ113 - Ian M George (USRA)
IUE Observations of 2 XUV-Bright Seyferts

SQ120 - D.R.H. Johnson (Leeds, UK)
Simultaneous UV and TeV Gamma Ray Monitoring of the Blazar Markarian 421

SQ134 - Scott Friedman (Johns Hopkins University)
A Search for High Redshift QSOs Unobscured by Lyman Limit Systems

SQ141 - Joseph E Pesce (STScI)
Understanding Blazar Continuum Emission

SQ144 - G. Ghisellini (Torino, Italy)
Intense Multiwavelength Monitoring of Gamma-Ray Loud Blazars

SQ153 - L. Maraschi (Milano, Italy)
Probing the Relativistic Jet Structure of PKS 2155-304 Through multiwavlength variability

SQ155 - J.M. Mas Hesse (LAEFF, Spain)
X-Ray Luminous IRAS Galaxies: A Link Between Starbursts and Seyfert Galaxies

SQ161 - Gail A Reichert (USRA)
Ultraviolet Observations of NGC 4151 Simultaneous with XTE and OSS

SQ162 - Karen Leighly (RIKEN)
Monitoring MRK 509: The Origin of the Reprocessor

SQ163 - Eric S Perlman (USRA)
Variability of BL Lac Emission Regions

SQ164 - T. Courvoisier (Geneva, Switzerland)
UV Variability of the Quasar 3C 273

SRHLW - Lee Anne Willson (Iowa State)
MGII Emission from Mira Variables

SRJEB - Edward W. Brugel (Colorado - CASA)
Atmospheric Structure, Shocks and Mass Loss in RV Tauri Variables

SRJRF - Robert A. Fesen (Colorado - CASA)
Variations in the Absorption Lines Associated with SN 1006

SRJWB - William P. Blair (Johns Hopkins)
O-Rich Supernova Remnants in the LMC

SRLJE - Joel A. Eaton (Indiana University)
Chromospheric Variability in M Giants

SRLPJ - Philip G. Judge (Colorado - JILA)
Cycle-Dependent Studies of Semi-Regular Giant Stars

SRLRF - Robert A. Fesen (Colorado - CASA)
An Ultraviolet Study of S Andromedae

SRNJE - Joel A. Eaton (Tennessee State University)
Chromospheric Structure and Heating in Semiregular Variables

SRNPJ - Philip G. Judge (Colorado - CASA)
The Mira/Semi-Regular Connection II

SROJE - Joel A. Eaton (Tennessee State University)
Chromospheric Structure and Heating in Semiregular Variables

SRPYC - You-Hua Chu (U Illinois)
Interstellar Absorption Lines as Diagnositcs for Hidden Supernova Remnants

SRRMD - Matthew T. DeLand (Hughes - STX)
Saturn Auroral and Dayglow H2 Emissions

SS048 - Deborah L Domingue (Lunar & Planetary Institute)
IUE Mid-UV Spectroscopy of the Galilean Satellites

SS074 - M.C. Festou (Toulouse, France)
The Origin of Carbon in Comets

SS084 - G. Moreels (Besancon, France)
Search for Emissions of PAH, S2 and Parent Molecules in Comet Honda-Mrkos-Pajdusakova

SS118 - Timothy A Livengood (U Maryland)
Completion of IUE Jovian Studies

SS119 - R. Prange (Paris, France)
Completion of IUE Jovian Studies, Second Year

SS129 - Michael F A'Hearn (U Maryland)
Comets and Related Bodies as Targets of Opportunity

SS170 - M.C. Festou (Toulouse, France)
Mapping OH Emission in the Magnetosphere of Saturn

SS2JJ - Jun Jugaku (Tokyo)
Ultraviolet Spectroscopy of Selected B and A Stars

SSBDM - Dennis L. Matson (JPL)
Spectral Reflectances of the Galilean Satellites of Jupiter

SSCHM - H.Warren Moos (Johns Hopkins University)
Observations of the Saturnian System in Coordination with the Voyager Flybys

SSDAL - Arthur L. Lane (Jet Propulsion Laboratory)
UV Spectrophotometry of the Saturnian Satellites Iapetus & Rhea

SSEAL - Arthur L. Lane (JPL)
UV Spectrophotometry of the Saturnian Satellites Iapetus, Rhea & Dione

SSFJC - John J. Caldwell (Stony Brook)
IUE Solar System Observationd, II. Saturn's Rings

SSGJH - Jay B. Holberg (Arizona)
IUE Observations of Saturn's Rings

SSHJC - John J. Caldwell (Stoney Brook)
IUE Solar System Observations II. Spatial and Temporal Variations on Saturn

SSHJL - Julie H. Lutz (Washington State University)
IUE Studies of Infrared D-Type Symbiotic Stars/Planetary Nebulae

SSHMA - Michael F. A'Hearn (Maryland)
Comets as Targets of Opportunity

SSHRN - Robert M. Nelson (JPL)
UV Spectrophotometry: Galilean and Saturnian Satellites and Asteroids

SSHWJ - William M. Jackson (Howard University)
A Proposal for Observations of Comet C/Giacobini-Zinner

SSIDS - Donald E. Shemansky (Arizona)
Observations of Hydrogen Emission from Saturn

SSIHM - H. Warren Moos (Johns Hopkins University)
Variations in Saturn and Uranus

SSJDS - Donald E. Shemansky (Arizona)
Observations of Hydrogen Emission from Saturn

SSJHM - H. Warren Moos (Johns Hopkins University)
Ultraviolet Emissions from Saturn and Uranus

SSKCM - Christopher W. Mauche (Los Alamos)
The Stromgren Sphere of SS Cyg

SSKDS - Donald E. Shemansky (Arizona)
Observations of Hydrogen Emission from Saturn

SSKTS - Thomas E. Skinner (Colorado LASP)
IUE Observations of Triton in Support of Voyager

SSLDS - Donald E. Shemansky (Arizona)
Observations of Hydorgen Emission from the Sunlit Atmosphere of Saturn

SSLWM - H. Warren Moos (Johns Hopkins University)
Auroral and Diffuse Emissions from Saturn and Uranus

SSMHM - H. Warren Moos (Johns Hopkins University)
The UV Emissions From Saturn and Uranus

SSMJC - John T. Clarke (Michigan)
Saturn's Aurora at Solar Maximum

SSNJC - John T. Clarke (U Michigan)
Targets of Opportunity in the Outer Solar System

SSNMM - Melissa A. McGrath (Johns Hopkins University)
Ultraviolet Emissions from Saturn and Uranus

SSOBL - B. Murray Lewis (Arecibo Observatory - NAIC)
Are Miras with Masers Symbiotic Stars?

SSOBM - Bruce McCollum (CSC - IUE Observatory)
The Circumstellar Material of Socket Stars

SSOHJ - Hollis R. Johnson (Indiana University)
The Unusual S Star System HD 191589

SSOMM - Melissa A. McGrath (Johns Hopkins University)
Targets of Opportunity in the Outer Solar System

SSPRS - Regina E. Schulte-Ladbeck (U Pittsburgh)
Baselineing the UV Properties of Slash Stars

SSPSK - Scott J. Kenyon (Harvard CFA - SAO)
Ultraviolet Observations of Accretion in Two Symbiotic Stars

SSQRP - Ronald Polidan (NASA/GSFC)
SS Sygni in Outburst: Comprehensive Coverage of Wide and Narrow Outbursts

STAND - (Spain)
UV Stellar Classification

STBDB - Don C. Barry (Southern California)
The Sun, A CEN A and Cluster Stars in the HR Diagram

STFCI - Catherine L. Imhoff (CSC)
Ultraviolet Data on Young Stars Relevant to the Earth's Early Atmosphere

STFMA - Michael F. A'Hearn (Maryland)
Solar Analogs for Calibration of Reflectivities of Bodies in the Solar System

STFTA - Thomas R. Ayres (Colorado Lasp)
SME and IUE: The Solar-Stellar Connection

STFTS - (Hawaii)
A Study of Two, Young, Solar Type Stars

STHAH - Albert V. Holm (CSC)
The Strength of Ultraviolet Spectral Features

STHRP - Ronald E. Pitts (CSC)

Ultraviolet Spectra of Spectrophotometric Standard Stars

STIRB - Ralph C. Bohlin (STScI)
IUE Sensitivity Degradation Functions

STJRP - Ronald E. Pitts (CSC)
Trailed Spectra of Bright Spectrophotometric Standard Stars

STKRK - Robert P. Kirshner (Harvard CFA - SAO)
Supernova Spectroscopy

STOFB - Frederick C. Bruhweiler (Catholic University)
Delineating the Spectral Type Boundary for the Onset of Chromospheric Activity

SUECB - C. Stuart Bowyer (Cal Berkeley)
IUE Observations of H LY Alpha Emission From Uranus

SUFCB - C. Stuart Bowyer (UC Berkeley)
Observations of H LY Alpha Emission From Uranus

SUGJC - John J. Caldwell (Stony Brook)
IUE Solar System Observations I. Uranus & Neptune Below 2000

SUGSD - Samuel T. Durrance (Johns Hopkins University)
Variability Time Scale of H Lyman Alpha from Uranus

SUHHM - H. Warren Moos (John Hopkins University)
Ultraviolet Study of Uranus and Saturn: Coordination with the Voyager and Astro Missions

SUHJB - Jay Bergstrahl (Jet Propulsion Laboratory)
Geometric Albedo of Uranus from 2000 A to 300 A

SUHJC - John T. Clarke (MSFC)
Solar Wind Influence on Uranus Aurora

SUIJC - John T. Clarke (NASA/GSFC)
H Lyman Alpha Emission From Uranus

SUKRW - Richard Wagener (Suny)
High Resolution Observations of Uranus and Neptune

SULRK - Robert P. Kirshner (Harvard)
Continuing Spectroscopy of SN 1987A

SULSS - S. Alan Stern (Colorado LASP)
First UV Spectra of Uranian Satellites

SUMRW - Richard Wagener (Suny Stony Brook)
UV Variability of the Sun, Uranus and Neptune

SUNEG - Edward F. Guinan (Villanova University)
An Ultraviolet Study of Solar Proxies of Different Ages

SUOEG - Edward F. Guinan (Villanova University)
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SUOJC - John T. Clarke (U Michigan)
H Lyman-Alpha Dayglow Emission Line Profiles from Saturn and Uranus

SUOMM - Melissa A. McGrath (Johns Hopkins University)
The Auroral and Dayglow Emissions of Saturn and Uranus

SUPRK - Robert P. Kirshner (Harvard CFA - SAO)
Supernova Spectroscopy

SV107 - S. Vauclair (Meudon)
Mercury-Manganese Stars

SVBHM - H. Warren Moos (Johns Hopkins University)
The High Resolution Spectrum of Venus

SVCAL - Arthur L. Lane (JPL)
High Resolution Observations of Venus with IUE

SVCPF - Paul D. Feldman (Johns Hopkins University)
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SVJTS - Thomas E. Skinner (Colorado - CASA)
So 2 on Venus

SVPHD - Horst J. Drechsel (Colorado - JILA)
The Evolutionary State of SV Centauri

SWOJN - Joy Nichols-Bohlin (CSC - Astronomy Programs)
Simultaneous UV and Optical Study of O Star Winds

SX2HG - Herbert Gursky (Harvard CFA - SAO)
Study of the Ultraviolet Spectra of Selected Galactic X-Ray Sources

SYJDC - D. Michael Crenshaw (CSC)
Narrow-Line Seyfert 1 Galaxies

SYJGR - Gail A. Reichert (CSC)
Search for Rapid UV Variability in the Seyfert 1 NGC 4593

SYJJH - Jules P. Halpern (Columbia University)
Bright Seyfert 2 Galaxies

SYLAF - Alexei V. Filippenk (University of California)
Ultraviolet Observations of NGC 4395, the Least Luminous and Nearest Known Seyfert 1 Nucleus

SYMDW - D. Mark Whittle (Virginia)
Anisotropic Continuum Emission in Seyferts

SYOJH - Jules P. Halpern (Columbia University)
Was 49: Mirror for a Hidden Seyfert 1 Galaxy

SYOMM - Matthew A. Malkan (UCLA)
Ultraviolet Spectra of the Complete 12-Micron Seyfert 1 Galaxy Sample

SYQSK - Scott Kenyon (CFA - SAO)
Ultraviolet Observations of Accretion in Two Symbiotic Stars

TBOTS - Theodore Simon (U Hawaii)
Convection, Granulation, and Thermal Bifurcation in the A Stars

TEPNE - Nancy Remage Evans (ISTS - York University)
Temperatures for Stars with Accurate Masses and Radii

TOQSS - Sumner Starrfield (Arizona State University)
Coordinated Multiwavelength Observations of Classical and Recurrent Novae in Outburst

TORDG - Douglas R. Gies (Georgia State University)
Tomography and Colliding Winds of O-Type Binaries: Filling the Gaps

TORSS - Sumner G. Starrfield (Arizona State University)
Coordinated Multiwavelength Observations of Classical and Recurrent Novae in Outburst

TTBCI - Catherine L. Imhoff (Arizona)
Ultraviolet Observations of Pre-Main Sequence Stars

TTBGH - George H. Herbig (UC Santa Cruz)
Ultraviolet Spectroscopy of T Tauri Stars

TTCCI - Catherine L. Imhoff (Arizona)
Ultraviolet Observations of Pre-Main Sequence Emission-Line Stars

TTCLI - Catherine L. Imhoff (Arizona)
Ultraviolet Spectra of T Tauri Stars

TTDMG - Mark S. Giampapa (CFA)
High Dispersion, Long Wavelength Studies of T Tauri Stars

TTECI - Catherine L. Imhoff (CSC)
The Development of Chromospheres & Coronae in the T Tauri Stars

TTELK - Leonard V. Kuhi (UC Berkeley)
The Ultraviolet Excess in T Tauri Stars

TTFJL - Jeffrey L. Linsky (Colorado - JILA)
High Dispersion Study of Two T Tauri Stars: RU Lupi and Cod-34 7151

TTGJL - Jeffrey L. Linsky (Colorado - JILA)
High Dispersion Line Profile Studies of TW HYA and Other Pre-Main Sequence Stars

TTHGB - Gibor S. Basri (Berkeley)
Chromospheric Activity in Solar Mass Pre-Main Sequence Stars

TTHJL - Jeffrey L. Linsky (Colorado - JILA)
The Ultraviolet Spectrum of the T Tauri Star RY TAU Subsequent to its 1983 Brightening

TTIFW - Frederick M. Walter (Colorado - CASA)
Post T Tauri and Naked T Tauri Stars

TTIJL - Jeffery L. Linsky (Colorado)
Continued Long-Term Ultraviolet Monitoring of RY TAU

TTITS - Theodore Simon (Hawaii)
Chromospheric Activity on a T Tauri Star

TTJAB - Alexander Brown (Colorado - JILA)
Continued Ultraviolet Monitoring of RY TAU

TTJFW - Frederick M. Walter (Colorado - CASA)
Naked T Tauri Stars

TTKAB - Alexander Brown (Colorado - JILA)
Chromospheric TR Region Variability of T Tauri Stars

TTKFW - Frederick M. Walter (Colorado - CASA)
Naked T Tauri Stars

TTKGB - Gibor Basri (Berkeley)
Accretion Disks and T Tauri Stars

TTKKB - Karl-Heinz Bohm (Washington)
Collimated Outflows from T Tauri Stars

TTLGB - Gibor S. Basri (Berkeley)
Accretion Disks and T Tauri Stars

TTMSK - Scott J. Kenyon (Harvard SAO - CFA)
HE II Emission in T Tauri Stars

TTNTS - Theodore Simon (U Hawaii)
The Ultraviolet Variability of BP Tauri

TTOGP - Geraldine J. Peters (USC)
IUE Observations of the Early-Type Near Contact System TT Aurigae

TTOPS - Paula A. Szkody (U Washington)
Target of Opportunity: TT Crt and YY Dra at Outburst

TTPFW - Frederick M. Walter (SUNY - Stony Brook)
Atmospheric Structures in Naked T Tauri Strs

TTQCI - C. L. Imhoff (CSC Science Programs)
Star Formation in the Taurus-Auriga Dark Clouds II

TUORP - Ronald S. Polidan (NASA/GSFC)

A Study of Surface Carbon Depletion in the Mass Algol System TU MON

UGOES - Edward M. Sion (Villanova University)
The Cooling of the White Dwarf in U Gem

UI083 - L. Maraschi (Italy)
Coordinated X-Ray and UV Observations of Magnetic White Dwarfs in Binaries

UK001 - R. Wilson (UCLA)
Structure of Stellar Chromospheres and Coronae

UK002 - R. Wilson (UCLA)
A Study of Early Type Emission Line Stars

UK003 - Carnochan (UCLA)
Atmospheric Structure and Abundances in Hot Subluminous Stars

UK005 - C. Jordan (Oxford)
A Study of the Nuclei of Seyfert Galaxies by Observing Their EUV Emission Spectrum

UK006 - Gondhalekar (UCLA)
The Physical and Chemical State of the Interstellar Gas

UK007 - M. J. Seaton (UCLA)
A Study of Novae and Supernovae

UK008 - M. J. Seaton (UCLA)
The Structure of Planetary Nebulae

UK010 - A. Boksenberg (UCLA)
Ultraviolet Observations of Star Clusters

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Atmospheric Dynamics of Cepheid Variables

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A Study of Normal and Peculiar Extra-Galactic Objects

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A Search for Nitric Oxide in Stellar Atmospheres

UK016 - M. S. Longair (Cambri)
Ultraviolet Observations of Extragalactic Objects with Cosmological Relevance

UK017 - P. W. Hill (Saint Andrews)
Ultraviolet Spectra of Early Type Hydrogen Deficient Stars

UK018 - P. W. Hill (Saint Andrews)
Investigation of High Latitude Early Type Stars

UK019 - I. G. Van Breda (RGO)
Interstellar Extinction in the Southern Milky Way

UK020 - B. E. Pagel (RGO)
MG II Emission Line Profiles in Bright F-M Stars

UK021 - D. McNally (UCLA)
Interstellar Spectral Lines in Southern Hemisphere Stars

UK022 - Byrn (Belfast)
Interstellar MG I and MG II Absorption

UK024 - K. Nandy (ROE)
An Investigation of Interstellar and Circumstellar Reddening

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Ultraviolet Observations of Peculair A Stars

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The Detection of Hot Plasma Adjacent to the Galactic Disk

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The Extended Atmospheres of BE Stars

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Circumstellar Material in Eclipsing Binary and IR Excess Stars

UK029 - P. Thonemann (Swansea)
Dynamics of Interstellar Neutral Hydrogen

UK02A - R. Wilson ( )
Subgroup of UK002

UK02B - R. Wilson ( )
Subgroup of UK002

UK02C - R. Wilson ( )
EE UK002

UK031 - A. Boksenberg (UCLA)
A Search for Molecules in Celestial Objects

UK033 - K. Cardiff (Bombay)
Observations of 3C 273, NGC 4151 and Related Objects$ $S. P. Tarafdar

UK035 - R. Wilson (R. Wilson)
A Study of the Peculiar Ultraviolet Objects Discovered by the S2

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An Investigation of the Physical Processes in Dwarf Novae

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The Ultraviolet Spectra and Variability of Galactic and Extragalactic X-Ray Sources

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Interstellar Absorption Lines of Centro Symmetric Molecules

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Extra-Galactic Objects with Predominantly Continuous Optical Spectra

UK042 - W. M. Burton (B. E. Patchett)
Ultraviolet Spectra of Markarian Galaxies

UK043 - Gondhalekar (UCLA)
Observations of Planets and Their Satellites

UK044 - Gondhalekar (UCLA)
Structure of T-Tauri Stars

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Ultraviolet Spectra of Normal Spiral Galaxies

USSBS - Catherine L. Imhoff (CSC)
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VVBAD - Andrea K. Dupree (Smithsonian)
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Ultraviolet Studies of VV Cephei and Related Systems

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VVGSP - Sidney B. Parsons (CSC)
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WAVEC - ( )

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A New WC 11 Star

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Mass Loss and Radiative Levitation in Hot White Dwarfs

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Two Cool White Dwarfs with Metallic Lines

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WDIPS - Paula Szkody (Washington)
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WDJNO - Nancy A. Oliversen (CSC)
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WDNGB - Gibor S. Basri (UC Berkeley)
Temperatures of Hot DA White Dwarfs

WDNJH - Jay B. Holberg (U Arizona)
IUE Observations of Hot DA White Dwarfs Detected by the ROSAT WFC

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The Highest Quality Ultraviolet Spectrum of 40 Eri B

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Wolf-Rayet Stars of WN Subtype

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Spectroscopy of Of/WN Star in M33

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Continuum and UV Extinction in O Stars in M33 and M31

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An Investigation of the Intrinsic Properties of Wolf-Rayet Stars

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WRDJH - Joy Heckathorn (CSC)
A Study of Shell Structures Associable with Wolf-Rayet Stars

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WRNLA - Lawrence Auer (Los Alamos National Labs.)
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IUE Observing Guide

History of the Project

GSFC Observing Scripts - a form for displaying GSFC observing scripts (or preview images) for a specified camera and image sequence number.

IUE Observing Programs - a very long list.

IUE Electronic Newsletters

The following are the electronic newsletters sent out by the IUE Project during 1995 - 1997. As of November 1997, IUE information is being circulated through the new MAST Electronic Newsletters.

- Oct. 1997
- Sept. 1997a
- Sept. 1997
- Aug. 1997
- July 1997
- June 1997
- May 1997
- Apr. 1997
- Mar. 1997
- Feb. 1997
- Jan. 1997
- Dec. 1996
- Nov. 1996
- Oct. 1996
- Sep. 1996
- Aug. 1996
- July 1996
- June 1996
- May 1996
- Mar. 1996
- Feb. 1996
- Dec. 1995
- Nov. 1995
- Oct 1995
- Sep. 1995
- July 1995
- June 1995
- May 1995
- Apr. 1995
- Mar. 1995
- Feb. 1995
- Jan. 1995
- Dec. 1994

NASA IUE Newsletters

During the IUE Mission, the primary means to publish information needed by the users was the IUE Newsletters. Some of the articles will be helpful for archival users, such as those describing instrument performance, observing techniques, calibrations, and processing algorithms, while others are no longer relevant.

Currently we have available a text file, listing the tables of contents of all 57 newsletters. You can use the "Find" function of your web browser to search for specific names or other keywords.

Warning! There are over 600 articles listed!

NASA IUE Newsletters: Tables of Contents

We also have the newsletter articles scanned and available in PDF format. They have not yet been indexed and linked for easy access. However if you can determine the volume in which the article was published, you can view the papers in that volume:

Newsletter Articles by Volume

IMAGE PROCESSING INFORMATION MANUAL

VERSION 2.0

Prepared for
GODDARD SPACE FLIGHT CENTER
By
COMPUTER SCIENCES CORPORATION
Under
Contract NAS 5-27295
Task Assignment 401

CSC/TM-84/6058
Prepared by: B. E. Turnrose and R. W. Thompson
Reviewd by: D. F. Stone and P. M. Perry
Date: December 20, 1984

ABSTRACT

This document presents information needed by users of the International Ultraviolet Explorer (IUE) to understand the methods and products of the new reduction software (introduced in November 1980 for low dispersion and November 1981 for high dispersion) of the IUE Spectral Image Processing System (IUESIPS) at GSFC. Although this Version 2.0 reflects the post-November 1981 state of IUESIPS and therefore describes the net effect of the many other changes made to the system since early 1980 when Version 1.0 was issued, its principal purpose is to document the new reduction software. As a result, Version 2.0 complements, but does not supersede, Version 1.0 or its reissue, Version 1.1.

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Version 2.0

Prepared By

M.P. Garhart, M.A. Smith, B.E. Turnrose, K.L. Levay, and R.W. Thompson

September 1997

Computer Sciences Corporation

Abstract:

This document is intended for use by researchers who wish to analyze data acquired by the *International Ultraviolet Explorer* (*IUE*) and processed for the *IUE* Final Archive with the New Spectral Image Processing System (NEWSIPS) at either Goddard Space Flight Center (GSFC) or the European Space Agency (ESA) Villafranca del Castillo *IUE* Observatory (VILSPA). The information contained in this document explains the instrument characteristics and the processing methodology and calibration techniques used in the NEWSIPS system to produce the output products available to researchers. This second version of the *IUE* NEWSIPS Information Manual has been updated to include the processing techniques for LWR low-dispersion and LWP, LWR, and SWP high-dispersion data.

Karen Levay
04-08-1998

Project Publications

MAST Electronic Newsletters

IUE Electronic Newsletters

NASA IUE Newsletters

IUE Observing Guide

IUESIPS Image Processing Information Manual

NEWSIPS Image Processing Information Manual

IUE Data Analysis Center User's Guide

The EUVE Guest Observer Program Handbook

PostScript files of the EUVE Guest Observer Program Handbook can be obtained individually:

- 1-preface_chap1.ps: (1.5 MB)

  Table of Contents, Preface, Introduction, The EUVE Mission, EUVE Guest Observer Center, Using This Manual

- 2-chap2.ps: (1 MB)

  Science Payload Configuration, The EUVE Spectrometer, the Deep Survey: an EUV Imaging System

- 3-chap3.ps: (1.5 MB)

  Introduction to Planning Observations, Electronic Resources for Proposers, Observability, Effective Area Functions, Spectral Resolution, Estimaged Background Levels, Detection Quality, Time-Critical Observations, Targets of Opportunity, Diffuse and Extended Sources, Imaging Multiple Sources, Quick Reference to Parameters and Equations

- 4-chap4.ps: (1.5 MB)

  Proposal Technical Review, Observation Scheduling, Data Acquisition, EGO Center Processing and Delivery, Guest Observer Data Analysis

- 5-bib.ps: (52 KB)

  Bibliography

- 6-appendices.ps: (1.5 MB)

  A- Sky Survey Instruments
  B- List of EUVE Project Acronyms
  C- Column Densities in the Interstellar Medium: Bibliography

- 7-addendum.ps: (127 KB)

  Addendum

Or the entire Handbook can be obtained as one PostScript file:

- handbook.ps (6.5 MB)

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The EUVE Science Archive Data Products

The EUVE Permanent Archive

There are two components to the EUVE Permanent Archive: the EUVE Telemetry Archive and the EUVE Science Archive. The Telemetry Archive contains a complete copy of the raw telemetry from the entire EUVE mission, and is intended as a permanent record of the mission. It is not primarily designed to support scientific archival research and access to the data will be difficult because of the unprocessed nature of the telemetry. The EUVE Science Archive, however, is intended for scientific research and is what most people probably have in mind when they refer to the "EUVE archive".

The EUVE Permanent Archive was created at the Center for EUV Astrophysics (CEA). The data products in the archive have been delivered from CEA to the NSSDC for distribution to the astronomical community. EUVE Science Archive pointed data products are being made available through archive sites at STScI and the HEASARC. At the time of this writing, EUVE continues to perform Guest Observer (GO) observations of new targets. The data from these observations is periodically delivered by CEA to the NSSDC and becomes available to the public through the archive sites.

Archive Documentation

This document details several aspects of the Science Archive and its use. It is intended as an introduction to the Archive for users who are already familiar with the EUVE GO data products that have been delivered since the start of the GO program. A more complete set of documentation will eventually become available when the *EUVE Guest Observer Software User's Guide* and *EUVE Guest Observer Data Products Guide* are rewritten to describe the Science Archive. Until those documents are revised, they are still useful for their in-depth discussions of data reduction and instrumental issues, but with regard to details about data formats or analysis steps, the descriptions in this introduction should be considered more up-to-date. Archive data users unfamiliar with the previous GO data products might want to consult the earlier documents to understand terms mentioned but not fully described here.

Note that the *EUVE Science Archive User's Guide* that is mentioned in the comments in the archive data headers refers to the rewritten *EUVE Guest Observer Data Products Guide* and therefore is not yet available.

The Science Archive Contents

The EUVE Science Archive contains multiple types of data. During the first six months of the EUVE mission in 1992-1993, a survey of the EUV sky was performed. The maps and catalogs from this survey have been either published in the astronomical literature and/or made available from CEA for several years. These products are part of the Science Archive but are not discussed further in this introduction. Since the end of the survey, EUVE has been performing pointed GO observations. These observations are primarily done with the Deep Survey/Spectrometer (DS/S) telescope; a very small number of pointed observations have been done with the Scanner telescopes. The Science Archive contains event lists and images from all these pointed observations.

Data from pointed observations is delivered at the time of the observation to the GO to whom it belongs. In the past, after the expiration of the proprietary period of the data, CEA also made exact copies of the data sets available to archival researchers. All of the data products delivered from CEA were in a standard format (a mixture of FITS tables, FITS images, and IRAF QPOE files), now called the GO format. Between March 1997 and February 1998, all existing EUVE pointed observations were reprocessed at CEA and data sets were produced in a new format, the Science Archive pointed format. The reprocessing produced a uniformly processed set of observations for the Science Archive.

A side effect of the reprocessing is that there is not a one-to-one correspondence between the observations in the Science Archive and those delivered in the past to GOs and archival users. Some observations were split in pieces, while others were merged together. Where these differences exist, the new Science Archive definitions of the observations are to be considered more accurate (or at least more consistent).

The Science Archive Pointed Format

The Science Archive pointed format (also called the archive format) is substantially simpler than the format in which Guest Observer products were previously shipped (the GO format). The archived nighttime data for a single observation consists of two FITS files, named `events.fit` and `images.fit`. `Events.fit` contains the event and monitor data for the observation, while `images.fit` contains images and filtering data. Each FITS file contains multiple FITS image and/or binary table extensions, which will be described in detail below.

When daytime data is available for an observation, it is packaged in separate files named `events_day.fit` and `images_day.fit`. Daytime data is only available for the SW spectrometer, and only for observations taken before 15 March 1996 (a few earlier observations do not have day data).

Moving targets require more analysis steps than non-moving targets and contain some additional auxiliary data. The `events.fit` file for a moving target will contain two additional extensions with this additional data.

Occasionally, there is an anomaly during the observation or processing of a target that causes the resulting data to have unusual characteristics. When EUVE personnel noticed such an anomaly during the observation or its processing, written notes were appended to the FITS files in an additional binary table extension. We cannot ensure that the notes are comprehensive or always useful to researchers, but at least some information will be available if needed.

Next, we describe the contents of the archive FITS files in the nominal case. We use the abbreviations DS, SW, MW, and LW for the Deep-Survey imager and the Short-, Medium-, and Long-Wavelength spectrometers, respectively, and ScA, ScB, ScC for the Scanner A, Scanner B, and Scanner C telescopes.

Nominal contents of events.fit

Night DS/S data

- Primary HDU, empty

  The header of the primary header and data unit (HDU) contains keywords that are globally applicable to this observation. These keywords are also repeated in each extension. We don't use the INHERIT keyword mechanism supported by some FITS readers (i.e., the INHERIT keyword is always set to the value "F"). The primary data array is always empty.

- Extension 1, BINTABLE, extname = "valid_times"

  Contains the time intervals during which telemetry was present in this observation. The sum of the lengths of these intervals is also in the global keyword VALIDTIM. This is NOT the exposure time, because it does not account for times when the detectors were off. However, it does tell you an upper limit for the exposure time. There is no concept of exposure time for event list data in the absence of any time filters, because the possible arrival times for events are unrestricted. Therefore, no exposure times appear in the headers in `events.fit`. To see exposure times, look in `images.fit`.

- Extension 2, BINTABLE, extname = "ds_events"

  Contains the DS event list for this observation.

- Extension 3, BINTABLE, extname = "sw_events"

  Contains the SW event list for this observation.

- Extension 4, BINTABLE, extname = "mw_events"

  Contains the MW event list for this observation.

- Extension 5, BINTABLE, extname = "lw_events"

  Contains the LW event list for this observation.

- Extension 6, BINTABLE, extname = "quadrant"

  Contains quadrant-specific information for this observation. Only quadrants for which data is present in the event lists are included (except in the sums), meaning only one quadrant per detector in the archive. The information given for each quadrant is quadrant counts, telemetered counts, summed quadrant counts over all detector quadrants, deadtime correction, and combined deadtime & primbsch correction.

- Extension 7, BINTABLE, extname = "adcnts"

  Contains the detector A-D counts for each detector that has an event list in this observation.

- Extension 8, BINTABLE, extname = "orientation"

  Contains aspect and position information for the EUVE spacecraft during the observation.

- Extension 9, BINTABLE, extname = "corrected_aspect"

  Contains the corrected aspect for moving targets that have been corrected by an ephemeris. The extension is omitted if not needed.

- Extension 10, BINTABLE, extname = "ephemeris"

  Contains the ephemeris used to correct the aspect for moving targets. The extension is omitted if not needed.

- Extension 11, BINTABLE, extname = "anomaly"

  Contains a written description of any anomalies or other unusual characteristics of this observation that may impact the analysis of the data. The text is encoded as rows of a binary table with a single 80 character wide column. The extension is omitted if not needed.

The extension numbers are for the nominal case. The final three extensions are optional, and if data for any detector is, for some reason, not present for an observation, the corresponding extensions are simply omitted from the FITS files. Therefore, extension numbers may vary. However, the order of the extensions is always the same when they are present. Always check the contents of your FITS files before using them.

Day DS/S data

In daytime DS/S data, the format is the same as for night data except that only the SW spectrometer data is present. This means that only one event list extension (sw_events) is included and the quadrant and adcnts extensions contain only columns relevant to the SW spectrometer.

Scanner data

In scanner data, the format is the same as for night DS/S data except that the appropriate scanner detectors replace the DS and spectrometer detectors. There is never daytime scanner data.

Nominal contents of images.fit

Night DS/S data

- Primary HDU, empty

  The header of the primary HDU contains keywords that are globally applicable to this observation. These keywords are also repeated in each extension. We don't use the INHERIT keyword mechanism supported by some FITS readers. The primary data array is always empty.

- Extension 1, IMAGE, extname = "ds"

  Contains an image of the DS event list, made by binning the events in sky coordinates after applying filters.

- Extension 2, IMAGE, extname = "sw_night"

  Contains an image of the SW event list, made by binning the events in wavelength coordinates after applying filters.

- Extension 3, IMAGE, extname = "mw"

  Contains an image of the MW event list, made by binning the events in wavelength coordinates after applying filters.

- Extension 4, IMAGE, extname = "lw"

  Contains an image of the LW event list, made by binning the events in wavelength coordinates after applying filters.

- Extension 5, BINTABLE, extname = "ds_limits"

  Contains the filter limits used to produce the DS image in the ds extension from the event list.

- Extension 6, BINTABLE, extname = "sw_night_limits"

  Contains the filter limits used to produce the SW image in the sw_night extension from the event list.

- Extension 7, BINTABLE, extname = "mw_limits"

  Contains the filter limits used to produce the MW image in the mw extension from the event list.

- Extension 8, BINTABLE, extname = "lw_limits"

  Contains the filter limits used to produce the LW image in the lw extension from the event list.

- Extension 9, BINTABLE, extname = "anomaly"

  Contains a written description of any anomalies or other unusual characteristics of this observation that may impact the analysis of the data. The text is encoded as the rows of a binary table with a single 80 character wide column. The extension is omitted if not needed.

Day DS/S data

In daytime data, the format is the same as the night data except that only the SW spectrometer data is present; this means that only one image (named sw_day) and limits table (named sw_day_limits) are included.

Scanner data

In scanner data, the format is the same as for night DS/S data except that the appropriate scanner detectors replace the DS and spectrometer detectors. There is never daytime scanner data.

Description of Science Archive header keywords

This is a brief description of the header keywords that appear in the archive FITS files.

Standard FITS keywords

The following are standard FITS keywords with a standard meaning and are not described here: SIMPLE, BITPIX, NAXIS, NAXISn, EXTEND, DATE, ORIGIN, CREATOR, and END.

These are standard FITS keywords used to describe an extension and its structure (some are BINTABLE specific): XTENSION, PCOUNT, GCOUNT, TFIELDS, EXTNAME, TTYPEn, FORMn, TUNITn, TDISPn, TLMINn, TLMAXn, TDMINn, TDMAXn, TNULLn, and INHERIT.

These are standard FITS keywords used in images for scaling and world coordinate system information, or identification: BSCALE, BZERO, CTYPEn, CRVALn, CRPIXn, CDELTn, CUNITn, and FILENAME.

EUVE Science Archive keywords

- TELESCOP

  The name of the entire observatory, i.e., "EUVE".

- INSTTYPE

  The type of EUVE telescope/instrument that produced this data: "DS/S" or "SCANNER".

- INSTRUME

  The particular EUVE telescope/instrument that produced this data: "DS/S", "ScA", "ScB", or "ScC". In scanner data, this keyword varies for each event list.

- DETNAM

  The EUVE detector that produced this data: "ScA", "ScB", "ScC", "SW", "MW", "LW", or "DS". This keyword varies for each event list, since each detector's events are in a separate extension.

- PHOTOND

  This is a numerical detector number. It ranges from one to seven, corresponding to each of the detector values possible for the keyword DETNAM.

- TIMEDEL

For tables containing rows at regularly spaced time intervals, found in the quadrant, adcnts, orientation, and corrected_aspect extensions, this is the nominal interval length.

- OBJECT

  The name of the target. Note that many EUVE targets have been observed multiple times and were often proposed under differing names. A single name has been selected for each target and used consistently for all observations.

- RA_OBJ, DEC_OBJ

  The coordinates of the target, in decimal degrees, taken from the EUVE database. These are typically the coordinates the original Guest Observer specified, or coordinates taken from the SIMBAD database. For the DS or scanner detectors, the processed image is centered at these coordinates. For a moving target, these are the mean of the ephemeris coordinates during the observation.

- RA_PNT, DEC_PNT

  The median coordinates, in decimal degrees, at which the instrument was actually pointed during the observation. This will be different from RA_OBJ and DEC_OBJ if the observation was performed off-axis or for moving targets. Most EUVE observations are performed at least slightly off-axis to avoid the DS deadspot.

- RA_PROC, DEC_PROC

  The coordinates, in decimal degrees, that were used to process the spectrometer data. These are derived from a centroid of the image of the target on the sky as seen in the DS detector. Not all targets have a visible DS image - if the centroid could not be computed, RA_OBJ and DEC_OBJ are used in the spectrometer processing. In moving targets, this is always the same as RA_OBJ and DEC_OBJ.

- OBSERVER

  The original PI that had the rights to this observation. In some observations, multiple PIs were given the rights to the data, but only one PI is listed here. If this was a calibration observation without a PI, the keyword will have the value "EUVE". In some cases, calibration targets also had PIs but are listed as "EUVE".

- DATE-OBS, TIME-OBS

  The date and time (GMT) of the start of the observation. Note that the year assumes a prefix of 19.

- DATE-END, TIME-END

  The date and time (GMT) of the end of the observation. Note that the year assumes a prefix of 19.

- OBS_MODE

  The spacecraft pointing mode during this observation. For archive data, this will always be "POINTING". Other modes would apply, for example, in survey, or while the spacecraft was slewing between targets.

- DITHER

  The dithering mode during this observation: "DITHERED", "SPIRAL", or "NONE". Dithering is a procedure of slightly changing the pointing position during the observation to reduce the effects of fixed-pattern noise. There are two kinds of dithering done by EUVE: pointed dithers (including nodding) and spiral dithering.

- DETMODE

  The detector coordinate conversion mode during this observation: "WSZ" or "XY". The EUVE telemetry can contain raw WSZ coordinates or converted XY coordinates. This mode can change during an observation and is determined separately for each event. The value of this keyword represents the mode of the majority of the events in the observation (in all event lists) and not necessarily the mode of all events. The mode of an individual event can be determined by inspecting the PH (pulse height) column in the event list. Events in XY mode will have an undefined PH. The mode also affects the precision of time stamps on the events; see the discussion of the TIERRABS keyword.

- OFF-AXIS

  A Boolean flag indicating whether or not this observation was done primarily off-axis. This does not include small off-axis deviations due to dithering or DS deadspot avoidance.

- MOVING

  A Boolean flag indicating whether this was a moving target. If so, aspect correction will have been performed, and the `events.fit` file should contain the optional corrected_aspect and ephemeris extensions. When the target is moving, the meanings of the coordinate keywords are changed as described earlier.

- DAYNIGHT

  The telemetry type included in this observation: "DAY", "NIGHT", or "BOTH".

- VALIDTIM

  The sum of the lengths of the intervals in the valid_times extension, representing the total amount of telemetry which is present. This is NOT the exposure time, because it does not account for times when the detectors were off. However, it does tell you an upper limit for the exposure time. There is no concept of exposure time for event list data in the absence of any time filters, because the possible arrival times for events are unrestricted. Therefore, no exposure times appear in the headers in `events.fit`. In `images.fit`, the images have been made from filtered event lists, and the exposure times appear in the EXPTIME keyword.

- RA_UNIT, DEC_UNIT

  The units of the RA and DEC values that appear in other keywords. Always has the value "deg" in the archive.

- EQUINOX

  The equinox used for specifying coordinates in this observation. Always set to "2000." in the archive.

- RADECSYS

  The coordinate reference frame for this observation. Always set to "FK5" in the archive.

- TIMESYS

  The time system used to specify times in this observation. In the archive, this refers to the TIME columns that appear in a number of the tables, as well as the TSTART and TSTOP keywords. The value is always "MJD". Note, however, that EUVE times are not simply the MJD, but rather the number of seconds since some specific MJD; see the MJDREF keyword below.

- TIMEZERO

  An offset to be added to all EUVE event times to get their true time. This always has the value "0." in the archive, meaning that EUVE times are already in the time system described by the keywords TIMESYS, TIMEUNIT, MJDREF.

- TIMEUNIT

  The units of the EUVE times specified in this observation. This always has the value "s", meaning all EUVE times are in seconds since the time specified in the keyword MJDREF.

- CLOCKCOR

  A clock correction flag. Always has the value "NO" meaning that EUVE times are not guaranteed to be corrected to UT. Regular corrections are applied to the EUVE spacecraft clock to keep EUVE times near UT, but there is drift between corrections. The EUVE time is always kept within 0.9 msec of UT, and usually within 0.7 msec.

- TIMEREF

  Another time correction flag. Always has the value "LOCAL", indicating that EUVE times are in the time frame of the satellite, and are not corrected to the solar system barycenter or anywhere else.

- TASSIGN

  The location where times are assigned to EUVE event detections. Always has the value "SATELLITE", meaning that the times are assigned on the satellite.

- TSTART, TSTOP

  The start and end time of the observation, corresponding to the DATE_OBS, TIME_OBS, DATE_END, and TIME_END keywords described earlier, but in the EUVE time system rather than UTC.

- TIERRABS

  The precision of the EUVE times. For time tags on events, this depends on the coordinate conversion mode of the event (see the DETMODE keyword). WSZ mode events have time tags precise to 0.001 s, while XY mode events are only known to 0.008 s. In an event list, the TIERRABS keyword will have the value "0.001" or "0.008", depending on the DETMODE of the observation, but remember that timing of an individual event depends on the mode of that event. For a non-event-list table, the precision is always 0.001 seconds. The absolute EUVE time frame can drift slightly relative to UT, but the maximum drift is always smaller than the precision of the time tags; see the notes on the CLOCKCOR keyword above.

- MJDREF

  The reference time for all EUVE times. This always has the value "40000." for the archive, meaning that the EUVE times are in seconds relative to a zero point at MJD = 40000 (JD = 2440000.5, or 24.00 May 1968).

- EGOCSVER

  The EUVE processing software version used to produce this FITS file.

- REFVERS

  The EUVE reference calibration data set used to produce this FITS file.

- EXPTIME

  The exposure time for this image. This keyword appears in `images.fit` only and gives the exposure time for the image, corrected for the effects of primbsching and deadtime.

- RAWEXP

  The raw exposure time for this image. This keyword appears in `images.fit` only and gives the exposure time for the image, NOT corrected for the effects of primbsching and deadtime.

Description of FITS extensions

This is a description of the structure and meaning of all of the binary table and image extensions which can appear in Science Archive FITS files. No single FITS file will contain all these extensions. A table describing the columns of each binary table extension is given. The "Type" field refers to the FITS standard data types.

There are several categories of data in the binary table extensions. Event lists contain a row for every event detected by the EUVE detectors. Auxiliary values are reported in the telemetry at regular intervals during the observation, or derived from other auxiliary values or the event data. These values describe the state of the spacecraft or instruments. Other possibilities are time intervals, filter limits, or an ephemeris.

Events.fit extensions

valid_times

This is a binary table extension containing the time intervals for which telemetry was present during this observation. Each row contains the starting and ending times of a single time interval. The total time contained in all the intervals in this extension appears in the keyword VALIDTIM. The presence of telemetry does not imply that data is necessarily present in any detectors; for example, one or more detectors might be turned off. Therefore, these intervals do not represent the exposure time of the observation. The actual exposure time can only be defined by restricting the event lists to time intervals when the detectors were turned on. This is done during the processing of EUVE data when time filters based on A-D counts are applied in order to construct the images that appear in `images.fit`. See the discussion at the adcnts extension and the description of the EXPTIME keyword.

Column	Type	Units	Description
START	D	seconds	Starting time of interval.
STOP	D	seconds	Ending time of interval.

ds_events, sca_events, scb_events, scc_events

These are binary table extensions containing event lists for the EUVE imaging instruments. A separate extension is present for each detector that contained data for the observation. Each row of the table represents a single detected event.

Column	Type	Units	Description
TIME	D	seconds	Time of the event.
RA	D	degrees	Right ascension of the event.
DEC	D	degrees	Declination of the event.
DETX	I	pixel	Detector x-coordinate of the event.
DETY	I	pixel	Detector y-coordinate of the event.
PH	I		Pulse height of the event. This is only defined if the detector was in WSZ mode when this event arrived. See the discussion of the DETMODE keyword.

sw_events, mw_events, lw_events

These are binary table extensions containing event lists for the EUVE spectrometers. A separate extension is present for each detector that contained data for the observation. Each row of the table represents a single detected event.

Column	Type	Units	Description
TIME	D	seconds	Time of the event.
WAVELENGTH	E	Angstroms	The wavelength of the event.
ANGLE	E	degrees	The imaging angle of the event.
DETX	I	pixel	Detector x-coordinate of the event.
DETY	I	pixel	Detector y-coordinate of the event.
PH	I		Pulse height of the event. This is only defined if the detector was in WSZ mode when this event arrived. See the discussion of the DETMODE keyword.

quadrant

This binary table extension contains quadrant-specific auxiliary information for this observation, reported every 2.048 seconds, with occasional gaps in the data. The values in each row apply to the 2.048-second interval ending at the time of the row.

The columns that are present in this table vary; values are only included for quadrants which have potentially produced events in the event lists for this data set. A quadrant is (for our purposes) just a region of a detector over which quadrant counts are counted. EUVE detectors have one, two, three, or four quadrants. In most archive data sets, only one quadrant appears in this table for each detector: the quadrant that contains the source being observed. This is possible because in the DS/S instruments, sources are always observed in the same quadrants. These quadrants are SW: 0, MW: 1, LW: 1, and DS: 1. For pointed scanner observations, however, we cannot know the quadrant in which the source appears. Therefore, scanner data sets contain auxiliary values from all four quadrants for each detector present. The table below shows the columns you would expect to see in a DS/S observation with all detectors in use.

Quadrant counts are the total number of events detected in a detector quadrant during each 2.048-second interval, as determined on the spacecraft. The telemetered counts are the total number of events in a quadrant that appear in the telemetry as received on the ground. These two counts will differ due to loss of events during the telemetering process, typically due to insufficient bandwidth. The procedure by which events are selected for telemetering is called primbsching and the ratio of the quadrant counts to telemetered counts is called the primbsch correction. The summed quadrant counts are the sum of the individual quadrant counts for all quadrants of the detector, including those that do not appear in the table. This sum is used to determine the deadtime correction, a measure of the loss of events onboard the spacecraft due to deadtime in the processing hardware and software. Finally, the combined correction is the product of the deadtime and primbsch corrections.

Column	Type	Units	Description
TIME	D	seconds	Time for this row.
SWQ0SF	I	count	The quadrant counts in the SW quadrant 0.
SWQ0TM	I	count	The telemetered counts in the SW quadrant 0.
SWSUMQ	J	count	The summed quadrant counts over all SW quadrants.
SWDC	E		The SW deadtime correction.
SWQ0DPC	E		The combined SW deadtime and primbsch correction.
?	?	?	The last five rows repeat for every detector that is present in this observation, typically in the order SW, MW, LW, DS.

adcnts

This binary table extension contains auxiliary data that applies to an entire detector, reported every 1.024 seconds, with occasional gaps in the data. The values in each row apply to the 1.024-second interval ending at the time of the row.

The columns that are present in this table depend on which detectors are present in this data set. There will be one column containing A-D counts for each detector present

The A-D counts are hardware counts of the detections on each detector. They will differ from the summed quadrant counts for the same time interval because of filtering of events by the pulseheight threshold and loss of events due to deadtime in the detector electronics. A-D counts are used to detect whether a detector is on or off; three or more counts in a 1.024-second interval is normally taken to indicate that the detector is on. A-D counts can also be used for data-quality filtering, such as removal of times of high background.

Column	Type	Units	Description
TIME	D	seconds	Time for this row.
SWADCT	I	count	The A-D counts in the SW spectrometer.
MWADCT	I	count	The A-D counts in the MW spectrometer.
LWADCT	I	count	The A-D counts in the LW spectrometer.
DSADCT	I	count	The A-D counts in the DS detector.

orientation

This binary table extension contains auxiliary data describing the position and orientation of the EUVE spacecraft, reported every 1.024 seconds, with occasional gaps in the data. The values in a row apply at the instantaneous time of the row. Note that the row times in the orientation table are not exactly the same as those in the adcnts table.

The columns in this table are independent of which detectors have data in this data set, and are always as shown below.

The orientation information appears as the four components of a quaternion (the aspect) which represents the rotation from J2000 equatorial coordinates to a coordinate system fixed with respect to the spacecraft. For more details of the use of the aspect quaternion and additional references, see Abbott, *et al.* 1996, ApJS, **107**, 451. If this is a moving target and the aspect has been corrected for the motion of the source on the sky, an additional binary table extension named corrected_aspect will be present in this data set. The position information appears as the Cartesian coordinates of the spacecraft in the J2000 equatorial frame, in units of meters. The length of the position vector yields the spacecraft altitude.

Column	Type	Units	Description
TIME	D	seconds	Time for this row.
ASPECTW	D		Quaternion component.
ASPECTX	D		Quaternion component.
ASPECTY	D		Quaternion component.
ASPECTZ	D		Quaternion component.
POSITIONX	D	meters	J2000 equatorial spacecraft position component.
POSITIONY	D	meters	J2000 equatorial spacecraft position component.
POSITIONZ	D	meters	J2000 equatorial spacecraft position component.

corrected_aspect

This optional binary table extension is equivalent to the aspect portion of the orientation extension, except that the aspect values have been corrected for the motion of the source on the sky. This extension only appears for moving targets. The correction uses the source position information in the ephemeris extension.

Column	Type	Units	Description
TIME	D	seconds	Time for this row.
ASPECTW	D		Quaternion component.
ASPECTX	D		Quaternion component.
ASPECTY	D		Quaternion component.
ASPECTZ	D		Quaternion component.

ephemeris

This optional binary table extension contains an ephemeris for the source during this observation. This extension only appears for moving targets. The values on each row apply to the instantaneous time of that row. The frequency of tabulated points will vary.

The positions in this ephemeris represent the J2000 coordinates of the target as seen from EUVE, including any significant parallax effects. These positions are used to correct the aspect values for this observation to account for the motion of the source on the sky. The corrected values appear in the corrected_aspect extension.

Column	Type	Units	Description
TIME	D	seconds	Time for this row.
RA	D	degrees	Target right ascension.
DEC	D	degrees	Target declination.
DIST	D	AU	Target geocentric distance.

Images.fit extensions

ds, sca, scb, scc

These are image extensions containing images constructed by binning the detector event lists in remapped (sky) coordinates. RA is increasing along the x-axis and Dec is increasing along the y-axis. The event data is filtered using time filters constructed from the limits specified in the corresponding table extension (ds_limits, etc.).

sw_night, mw, lw

These are image extensions containing images constructed by binning the detector event lists in remapped (spectral) coordinates. Wavelength is increasing along the x-axis and imaging is increasing along the y-axis. The event data is filtered using time filters constructed from the limits specified in the corresponding table extension (sw_night_limits, etc.).

ds_limits, sw_night_limits, mw_limits, lw_limits

These binary table extensions contain limits on auxiliary data values that are used to filter event data for the observation when constructing images. This filtering removes earth-blocked times, times of high background, and times when the detectors were turned off.

Column	Type	Units	Description
NAME	A		Name of limited value.
LOW	E	unknown	Lower limit.
HIGH	E	unknown	Upper limit.

Common extensions

anomaly

This optional binary table extension contains a varying number of rows of text describing any anomalies in the data that were noticed during the observation or processing of this target. The extension only appears when needed. The comments are subjective in nature and are not guaranteed to be complete or useful.

Column	Type	Units	Description
TEXT	A		

Working With Science Archive Data

The archive format has been designed primarily as a FITS format. That means that considerable care has been taken to make the FITS files well organized and easily understood, and to provide complete meta-data in the headers. This means that the data is now much easier to read and manipulate using ordinary FITS tools. This is especially helpful to users who wish to bypass the IRAF file formats used in the EUV package and do their analysis in a non-IRAF environment. The description of the headers and tables given earlier should be sufficient for such users.

On the other hand, those users who wish to use the EUV package, or simply return to more familiar products, will have to reconstruct those products from the archive FITS files. Here are step-by-step instructions to unpack your data and reproduce the basic analysis steps, using IRAF and the EUV software package. The resulting products are very similar to the products that were delivered in the old GO format.

Note that the new procedure is rather different from the one you may have used in the past to unpack GO format data. In particular, you no longer need to use the EUV package task **qprst**.

IRAF releases and the EUV package

At the time of this writing, the most recent publicly available version of the EUV software package is version 1.7. That version of the EUV package is compatible with IRAF 2.10.4, but not with the most recent IRAF release, 2.11. Release 1.8 of the EUV package will work with IRAF 2.11.

This document is applicable to either version of the EUV package. In the instructions below, where parameter lists are shown for IRAF tasks, they will be the IRAF 2.11 versions (any differences are minor). The same instructions can be used with IRAF 2.10.4/EUV 1.7, but you need to refer to unpacked ST tables and IRAF images, as described in the next section, rather than FITS extensions.

Referring to tables and images

If you are using IRAF 2.11/EUV 1.8, you have several options available regarding the method you use to access the tables in your data set. Under IRAF 2.11, image and table processing tasks can directly read FITS image and binary table extensions. Several software tasks described below require tables from the data set as input. You can either unpack the FITS files into a one or more standalone ST tables, which you then specify as input where needed, or you can specify individual FITS binary table extensions directly as input to the software.

If you choose to use the FITS extensions directly, you have two ways to refer to a specific extension: by number, or by name. The extensions are numbered starting at one. This is probably most easily illustrated with a specific example. Let?s assume you have unpacked your event file `events.fit` into individual ST tables using the method described below (the FITS file is assumed to have the nominal DS/S night contents described earlier). You therefore have an ST table named `ds_events.tab` in the current directory (as well as several other tables) and you also still have the original FITS file. You now need to specify the DS event list to a program. The following are all legal references to the DS event list:

`ds_events.tab`	Read the unpacked ST table.
`ds_events`	Same as the previous example. The ".tab" filename extension is assumed if not present.
`events.fit[extension=2]`	Read directly from the second extension in the FITS file.
`events.fit[2]`	Same as the previous example. A number is assumed to refer to an extension number.
`events.fit[extname=ds_events]`	Also reads from the second FITS extension, this time selecting the extension by name.
`events.fit[ds_events]`	Same as the previous example. Any word not otherwise meaningful is assumed to refer to an extension name.

We will always use the last of these methods of specifying a table in the code examples below. You can choose another if it is more convenient. Also, keep in mind that the files don?t have to be in the current directory; you can specify the path to the file if needed.

There is one additional complication: the IRAF CL will try to interpret certain characters specially if you do not prevent it. In particular, it won?t like the "=" (equals sign) character in the above examples. So when typing an expression on the command line, you either can quote the entire expression (using single or double quotes), or escape the equals sign, as in

```
?events.fit[extname=ds_events]?
```

or

```
events.fit[extname\=ds_events]
```

Of course, you can also avoid this problem by using one of the table references that doesn?t contain an equals sign, or by entering your parameters in the IRAF **epar** utility, where they are not interpreted by the CL.

Important IRAF 2.10.4 note: If you are using IRAF 2.10.4, directly reading from a FITS file is not possible. You must always unpack your FITS files as described below and then refer to the ST tables using one of the first two methods in the above table.

Unpacking your FITS files

Convert the FITS extensions into ST tables and IRAF images. This step is optional when using IRAF 2.11/EUV 1.8, but required under IRAF 2.10.4. The conversion can be done using the **strfits** task in the TABLES package. Set up your parameters like this:

fits_files = ""	FITS data source
file_list = ""	File list
iraf_files = ""	IRAF filename
(template = "none")	template filename
(long_header = no)	Print FITS header cards?
(short_header = yes)	Print short header?
(datatype = "default")	IRAF data type
(blank = 0.)	Blank value
(scale = yes)	Scale the data?
(xdimtogf = no)	Transform xdim FITS to multigroup?
(oldirafname = yes)	Use old IRAF name in place of iraf_file?
(force = yes)	Force conversion from fits?
(offset = 0)	Tape file offset

The essential parameter is `oldirafname,` which should be set to "yes", causing the newly created tables and images to have the same names as the FITS extensions they came from. Change to a directory where you want the unpacked products to appear. To unpack all of the extensions in a FITS file, run **strfits** using command lines like

```
cl> strfits events.fit 1 ""
```

and/or

```
cl> strfits images.fit 1 ""
```

where you replace the pathname of the FITS files with whatever is correct for the observation in your system. The FITS files need not be in the current directory; simply supply the full path (they can even be on a CDROM). Obviously, if you don't require both the event lists and images you need only unpack one of the FITS files.

To unpack only a single extension, specify the desired extension by number, such as

```
cl> strfits images.fit[1] 1 ""
```

Alternatively, you can simply copy the extension out using the **tcopy** task for a table, or the **imcopy** task for an image, which also conveniently allows you to specify the extension by name:

```
cl> tcopy events.fit[ds_events] ds.tab

cl> imcopy images.fit[ds] ds.imh
```

In addition to producing an ST table for each BINTABLE extension and an IRAF image for each IMAGE extension in the FITS files, **strfits** will leave behind an image named `tmp001.imh` or something very similar. This is an empty image representing the contents of the Primary HDU, which contains no data in EUVE archive files. You can safely delete that image if you wish.

Building IRAF data files

1. Reconstruct a QPOE file for an event list. At this point, you have either unpacked an event list from `events.fit` using the previous step, resulting in an ST table, or you are running IRAF 2.11/EUV 1.8 and you are working directly from the FITS file. The reconstruction is done using the task **cep** in the EUV package.

   We assume that you have a subdirectory (or a link to a directory) in your current directory named `reference` that contains an installed copy of the EGODATA reference data set. You must have EGODATA version 1.15 or later, since that version contains new **cep** scripts for working with archive data.

   Spectrometer data

   To build a spectrometer QPOE file, set up the parameters for the task **cep** as follows:

database = "reference/archpipe"	Processing text database name
pipeline = "Rebuild SW Spectrometer Archive QPOE"	Pipeline record name
(ra = INDEF)	Source right ascension
(dec = INDEF)	Source declination
(raunits = "degrees")	Units for RA [degrees|hours]
(tableindex = "")	Observation table index file
(events = "events.fit[sw_events]")	Observation event list table
(aspect = "")	Observation aspect table
(reference = "")	CEP reference file

   The key parameters here are `database`, which we have set to point to a special pipeline database used for working with archive data; `pipeline`, which identifies the specific script **cep** will execute; and `events`, which identifies the input event list. All other parameters can be left at their defaults.

   If you are building an MW or LW spectrometer QPOE, rather than SW, you need to change the `pipeline` parameter to refer to the appropriately named script, and change the `event` parameter to refer to the appropriate event list.

   Non-moving imaging data

   If you are building a non-moving imaging QPOE (DS or scanner), rather than a spectrometer, you need to change `pipeline` and `events`. You must also enter the coordinates at which the QPOE should be centered. The parameter setup for **cep** for a DS QPOE would resemble this:

database = "reference/archpipe"	Processing text database name
pipeline = "Rebuild DS Remapped Archive QPOE"	Pipeline record name
(ra = 123.45)	Source right ascension
(dec = 67.89)	Source declination
(raunits = "degrees")	Units for RA [degrees|hours]
(tableindex = "")	Observation table index file
(events = "events.fit[ds_events]")	Observation event list table
(aspect = "")	Observation aspect table
(reference = "")	CEP reference file

   You can enter any `ra` and `dec` at which you would like the QPOE centered. However, if you want to exactly reproduce the processing done at CEA, enter the values from the RA_OBJ and DEC_OBJ header keywords for the observation in question (dump the header of any table or image to see those).

   For the scanner detectors, simply substitute the appropriate pipeline script: ScA, ScB, or ScC instead of DS.

   Moving imaging data

   If you are building an imaging QPOE (DS or scanner) for a moving target, the only change from a non-moving imaging target is that you should use the "SourceCentered" `pipeline` script, as shown in this example parameter setup:

database = "reference/archpipe"	Processing text database name
pipeline = "Rebuild DS SourceCentered Archive QPOE"	Pipeline record name
(ra = 0.)	Source right ascension
(dec = 0.)	Source declination
(raunits = "degrees")	Units for RA [degrees|hours]
(tableindex = "")	Observation table index file
(events = "events.fit[ds_events]")	Observation event list table
(aspect = "")	Observation aspect table
(reference = "")	CEP reference file

   In this case, you almost certainly want to supply an `ra` and `dec` of (0., 0.) so the center of the QPOE is the center of the source.

   Those of you familiar with the EUV package and **cep** task will be glad to know that, when used for rebuilding a QPOE as described here, **cep** runs more quickly than during a reduction from raw data. This is because no calculations need to be performed. The running time will depend on the number of events in the event list.

   The **cep** rebuild scripts do not support the rebuilding of multiple QPOE files at once because in this usage the input comes from a different file or extension for each event list; you will have to run **cep** once for each detector.

2. If you want to recreate the filters that were used to produce the images in the archive from the event lists, you will first need to build the earth blockage table using the EUV package task **backmon**. Assuming you have the EGODATA data set in the `reference` subdirectory as described in step 1, the parameters should be set up as

output = "backmon"	Name of output ST table
(orient = "events.fit[orientation]")	Name of input orientation ST table
(refdata = "reference/detector")	Name of ST table for reference data
(detectors = "ds")	Detector (for boresight quaternions)
(skip = 1)	Number of rows to skip over
(maxtimegap = 600)	Max gap in time (secs) for Sat. Vel. Vectors
(time = "time")	Time column of orientation table
(aspectw = "aspectw")	Aspect W input column name
(aspectx = "aspectx")	Aspect X input column name
(aspecty = "aspecty")	Aspect Y input column name
(aspectz = "aspectz")	Aspect Z input column name
(posx = "positionx")	Position X input column name
(posy = "positiony")	Position Y input column name
(posz = "positionz")	Position Z input column name

   The default parameter values are set up for GO format products and must be changed slightly for archive format. The parameter `time` should be given the value "time". The parameter `detectors` can, for computing earth blockage, be set to any detector of the same instrument type, so "ds" is a valid value for any of the DS/S detectors. The parameter `skip` determines the time frequency of computed values-the value "1" will give the most accurate determination of earth blockage (one point per 1.024 seconds). The parameter `orient` should refer to the table containing EUVE position information.

   Next, you use the EUV package task **dqselect** to generate the time filters. The parameters can be set up like this:

tables = "events.fit[adcnts],events.fit[quadrant],backmon"	Monitor Tables	
(limits = "")	Limits Tables	
(gap = 1)	Time Gap	
(imode = "line")	Input mode	
(format = "14.4f")	Interval format control	
(device = "stdgraph")	Graphics device	

   where the important parameter is `gap`, which should have the value "1". This indicates that any intervals of missing data larger than the nominal interval spacing will cause a break in the filter. **Dqselect** is an interactive task, so you can run it and use a session like this:

   ```
   eu> dqselect

   Command> limload images.fit[sw_night_limits]

   Command> gtgen

   Command> gtsave sw_gt

   Command> q
   ```

   This produces the table `sw_gt` containing the filter intervals when the detector was on and not earth-blocked, by filtering on the SW A-D counts and the DS/S look-zenith angle. If you want to see the particular monitor limits that were used to make the filter, dump the contents of the sw_night_limits table in `images.fit`. This example is for the SW spectrometer; you could do any other spectrometer by loading the appropriate limits file with the `limload` command and using an appropriate name with `gtsave`.

   There appears to be a bug lurking in the **dqselect** program that causes it to sometimes fail when the `limload` command is run directly on a FITS file as in the example above. If this happens to you, the best solution is to unpack the limits file from the FITS file into an ST table before loading it into **dqselect**. For example,

   ```
   eu> tcopy images.fit[sw_night_limits] sw_night_limits.tab

   eu> dqselect

   Command> limload sw_night_limits
   ```

3. Add the time filter to the QPOE file as a macro. This step makes the filter available for use in QPOE expressions. The task **tfilter** can be set up like this:

input = "sw_gt"	Input table name
(output = "sw.qp")	Output file
(name = "sw_gt")	Name of output macro
(start = "stime")	Name of starting column
(start = "etime")	Name of ending column
(cmdline = no)	Command line output flag
(format = "14.4f")	Interval format control

which will cause the ST table `sw_gt.tab` to be read and the intervals written in the QPOE file `sw.qp` as the macro named `sw_gt`.

If you want to see a list of the macros which are defined in your QPOE file, and their values, use

```
eu> qpmedit sw.qp * .
```

4. The final step is to create an image by binning the event list. The task **qpmkim** is used for that purpose.

input = "sw.qp[time=(sw_gt)]"	QPOE file
output = "mysw.imh"	Image file
(corrtab = "events.fit[quadrant]")	correction table name
(refdata = "reference/detector")	reference directory
(applycorr = yes)	apply correction
(adjexptime = yes)	adjust exposure time
(errband = no)	create error band
(deadtime = yes)	do deadtime correction
(primbsch = yes)	do primbsch correction
(timecol = "")	optional alternate time column name
(corrcol = "")	optional alternate correction column name
(tepsilon = INDEF)	alternate epsilon value used for time comparison
(deltime = INDEF)	alternate delta of correction times
(detector = "")	detector name
(quadrant = INDEF)	source detector quadrant [INDEF or 0-3]
(infomsgs = yes)	give processing information messages
(fixmwcs = yes)	apply QPOE mwcs workaround fix
(timefield = "time")	QPOE event time field
(dxfield = "dx")	QPOE event dx field
(dyfield = "dy")	QPOE event dy field

The *`input`* parameter specifies the QPOE file to bin and a time filter to apply. The parameter *`corrtab`* refers to the table containing the primbsch and deadtime correction values. **Qpmkim** will determine which detector it is processing from the QPOE header keywords, and use the appropriate column from the correction table. The exposure time will be written into the image header.

The resulting image will be exactly equivalent to the corresponding image in the `images.fit` archive file. We have noticed that a very small number of events are sometimes shifted by one pixel in the images rebuilt with the procedure described here, versus the image taken straight from the archive. The shift is always along the x-axis (RA) and is most likely caused by a roundoff error at some point in the processing. (By the time you run **qpmkim**, the event list has been converted from a QPOE to an ST table to a FITS binary table and back to a QPOE).

Changes From Previous Guest Observer Data

Comparison to GO format

Users familiar with the format previously used to deliver EUVE Guest Observer and Archive data (referred to as the "GO format") will initially find the new format to be rather different. The new format has been designed from the start as a FITS format for EUVE data. That means that all design decisions have been made with the goal of producing FITS files that are portable and compatible with other standards or conventions for delivering event data as FITS.

Within those restrictions, however, the format has been designed to be as backwardly compatible as possible with the GO format. This means that the FITS files can be unpacked to ST Tables and QPOE files can be rebuilt. The resulting set of files will resemble the equivalent files in the GO format. In addition, all tasks in the EUV/IRAF analysis package have been modified (as of version 1.7) to work with both GO & archive data formats with little change from the user's point of view.

More subtle than the data format changes are changes to the science content of the data. These have been made to try to accommodate the majority of scientific uses of the data while minimizing the size of the archive. The changes also attempt to maximize the utility of more reduced products such as images. This lessens the likelihood that a researcher will need to work with the less reduced event list products, since the latter are larger and more complex.

These are the most significant changes:

- The archive data products do not contain the complete raw telemetry for the observation. In particular, they do not contain all events that were detected during the observation. For those events which are delivered, we still provide both remapped and detector coordinates, so that the data may still be reprocessed. However, in the GO format, it was possible to go to the raw data in the ST Tables to get access to events that were stripped out of the QPOE files. This is no longer possible. For example, there is no access to the stimpins in the spectrometers.
- In the spectrometers, we still deliver only events in a strip in remapped coordinates. The strip has now been narrowed from Y=720:1299 to Y=875:1174 (about 22 arcmin). For extended sources for which the strip would render the data less useful, we make an exception and open the strip to Y=1:2048 (the whole field of view).
- In the DS data, while we still process only events in the Lexan quadrant, we no longer deliver only a horizontal strip of events in the range Y=720:1299 in remapped coordinates. All events in the Lexan quadrant are now included in the event list and image.
- The vast majority of engineering monitors-the columns in tables 1-8 in the GO format-have been dropped. Only those monitors which are believed to be in common use for data analysis will be in the archive: aspect, position, quadrant counts, and A-D counts (along with primbsch/deadtime information).
- The monitors have been reorganized. The quadrant extension contains quadrant counts previously in table2 and primbsch and deadtime info previously in the primbsch table. The adcnts extension contains A-D counts previously in table1. The orientation extension contains aspect and position information previously in table1.
- The event list FITS extensions are sorted by time, whereas the QPOE files in the GO format were sorted by position.
- In event lists containing sky coordinates, we have changed the RA values to be in the range 0 to 360 degrees. In previous data, it was in the range -180 to 180 degrees.
- All event lists now contain pulse height information for each event for which it was available (meaning all events taken in WSZ mode).
- The header keywords in the tables and images have been completely reworked to meet FITS standards or guidelines from the HEASARC for event list data. In particular, the cards JDREF, OBSERVAT, and PI_NAME have been deleted. The cards INSTRUME, TELESCOP, TIMESYS, and ORIGIN now have different values. And many, many new cards have been added.
- The data types of some table columns have changed from floating point to integers: primarily all the counts in the quadrant extension.
- The DS image we produce has now been filtered with an upper limit on the quadrant counts in quadrant 1 (the Lexan filter). The upper limit is 50 counts per two frames for all but a handful of the brightest DS sources; for those, we increase it to 150. In GO format data, there was no upper limit in the DS count rate filter.
- For moving targets, we now use an ephemeris to correct the aspect for the motion of the target on the sky. The ephemeris and the corrected aspect values are included with the observation data set.
- For some moving targets, in addition to the strips of events mentioned above, we also remove events in certain portions of the detector specified in detector coordinates, such as the stimpins and unused quadrants. This is to prevent these detector features from being smeared all over the image of the source due to the large source motion on the detector.

Frequently Asked Questions

Why is the extension containing SW spectrometer data named sw_night in `images.fit`, but only sw in `events.fit`?

> When the archive format was originally designed, we considered the possibility that the sites delivering archive data would wish to combine the night and day image data into a single FITS file. This could be convenient since those products are presumably the most commonly desired for any observation. In order to support this, we had to give the SW spectrometer day and night data different extension names. To date, no such combined delivery is being done, as far as we know, but it is still supported.

Where is the DISPAXIS header keyword that **euvextract** complains is missing from my image?

> The old GO format products had a header keyword named DISPAXIS in each spectrometer image. This keyword is used by some spectral analysis programs in IRAF to identify the orientation of the spectrum; for example, it is used in the extraction program **euvextract** in the EUV package. Because the keyword was specific to certain analysis programs, we omitted it from the archive image headers.
>
> If you need to use such a program, you can add the keyword to the image using the IRAF task **hedit**. For nominal EUV spectra, the value of the keyword should be "1", indicating that the spectrum lies along the x-axis. The **euvextract** in particular has been modified in version 1.8 of the EUV package to have an additional parameter which allows you to specify the dispersion axis without having to add a keyword.

How do I see the ephemeris used in my moving target analysis before parallax corrections were applied?

> Unfortunately, this is not possible. The archive products for moving targets include the ephemeris after the application of parallax corrections for the position of EUVE (applied using the EUV package task **parallax**). There is no simple way to remove those corrections. In hindsight, this was a poor decision. It would have been better to include the raw ephemeris, since users could always have reapplied the parallax corrections using the **parallax** task and the orientation table.

How can I rebuild QPOE files for all of the event lists at once?

> You cannot. The rebuild scripts for **cep** are only capable of functioning on one event list at a time. This is a limitation of the **cep** program (it can only read from one table) and cannot be reasonably worked around.

Where are the extracted spectra?

> No extracted spectra are part of the EUVE Science Archive. This was done because automatic extraction of spectra during the pipeline processing of observations at CEA is very unreliable. EUVE spectral images typically have a very low background, and many spectral sources are faint and are composed of discontinous spectral lines. These features make it very difficult for tracing algorithms to find the spectra on the images. In addition, flexure of the instrumentation means we cannot know in advance precisely where the spectrum will fall on the image in every case. Because of these reasons, we do not automatically produce extracted spectra, and resource limitations did not allow hand extraction of spectra for the archive.
>
> The archive sites may in the future make available quick-look spectra that are produced during processing using the assumption of no flexure and a perfectly straight spectrum. However, in many cases these spectra are known to be inaccurate. They also are not subject to the same quality control as the event and image data. If you obtain such spectra, please use them extreme caution-they are for quick-look purposes only and should not be used for analysis. You should always do science with spectra that have been hand-extracted from the images.

Mark Abbott

Center for EUV Astrophysics

26 June, 1998

EUVE Target Search
EUVE Home
Getting Started
Search & Retrieval
Search Form
Search Help
What's New
FAQ
Data Reduction/Analysis
EUVE IRAF Software
ISM H Col Density Tool
Software Users Guide
Instrument and Operations
Science Hightlights
Coordinated Data
All Sky Survey
Project Publications
GO Handbook
Data Products Guide
Software Users Guide
Electronic Newsletters
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Related Sites
Gallery
Acknowledgments

The EUVE Guest Observer Program Software User's Guide Version 1.5

This User's Guide contains information relating to IRAF/EUV layered package. This Guide is for use with IRAF/EUV software Version 1.5.

Document DVI format (525Kb)
Figures (975Kb)

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  E             U         U      V       V     E
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-----------------------------------------------------------------
        ELECTRONIC NEWSLETTER OF THE EUVE OBSERVATORY
-----------------------------------------------------------------
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The EUVE Electronic Newsletter was published quarterly by the EUVE Science Archive group and contained information on a variety of mission-related topics (e.g., science discoveries, the Guest Observer Program and the Science Archive). As events warranted, periodic news "flashes" were distributed to convey urgent and/or time-critical information. Past issues of the newsletter, along with some of the major highlights for each, are available below.

Past Issues of the EUVE Electronic Newsletter:

2000 Issues:

- 02 October 2000 (V9.2) -- NASA Senior Review Terminates EUVE Mission; Senior Review Results Trigger EUVE End-of-Mission Activities; Survey Shows High Levels of EUVE GO Satisfaction; EUVE Team Received Award from NASA Administrator; EUVE FOT Implements Complicated Observation of Comet LINEAR; EUVE and Chandra Team Discover Charge Exchange Emission from Comet LINEAR; First with EUVE: Observation of Sharp Turn-on in Flux between Her X-1 Short High and Low States; EUVE Catches OY Car in Superoutburst; and EUVE Results from XTE J1118+480.
- 18 July 2000 (V9.2) --UCB Celebrates EUVE 8-year Launch Anniverary; EUVE Science Session well attended at June AAS; EUVE Battery Failure Prompts Safe-Hold Mode Entries; EUVE Coordinated TOOs of New X-Ray Transient; UCB Submits EUVE Proposal to Senior Review; UCB Celebrates 3-Year Outsourcing Anniversary; EUVE Conducts Innovative TOO Collaboration with AAVSO; UCB Released New Version of EUVE Data Analysis Package.
- 09 February 2000 (V9.1) -- Battery dVs Trigger EUVE Entry into Safe-Hold Mode; FOT Adjusts EUVE Frequency; Update on 1999 EUVE Archival Data Demands; EUVE Releases Science Recalibration Results; EUVE FOT Continues Active Battery Management; EUVE Cycle 8 TAC Results; and EUVE Science Advisory Board Public Meeting Held.

1999 Issues:

- 11 October 1999 (V8.2) -- EUVE set to destaff weekends; EUVE Science Advisory Board (ESAB) to hold public meeting at AAS January meeting; findings on Her X-1, G191-B2B, and discovery of AM Her star EUVE J0425.6-5714; EUVE Episode 8 proposals due October 13, 1999
- 03 August 1999 (V8.1) -- EUVE completes "Lessons Learned" report; EUVE Science Advisory Board (ESAB) submits FY98 report to NASA; EUVE project prepares to release Announcement of Opportunity for an eighth observing cycle

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1997 Issues:

- 23 December 1997 (V7.12) -- EUVE Observers U Gem as TOO; GO Support Being Folded Into Operations

  Note that this issue of the EUVE electronic newsletter will be the last published on a monthly basis; beginning in 1998 distributions will be continued as events warrant (e.g., on a quarterly basis). This publication change is in response to the continued shrinking of available EUVE mission staffing and budgetary resources.

- 26 November 1997 (V7.11) -- NSSDC To Take Over EUVE Archival Data Delivery; EUVE Conducts Reaction Wheel Assembly Tests; IP Transition Proceeding
- 31 October 1997 (V7.10) -- Cycle 6 Announcement of Opportunity; Proposal Review Process for Cycle 6; FDF Sees Unexpected Decrease in EUVE's Velocity
- 29 September 1997 (V7.9) -- ESAB Meeting to be Broadcast Live on Internet; EUVE/ALEXIS Transient Reobserved; UCB Makes Progress on PACOR Replacement
- 31 August 1997 (V7.8) -- EUVE Science Program Management Changes; ALEXIS "Bastille Day" Transient; Observation of P/Encke; FOT Successfully Implements Payload ATCs
- 31 July 1997 (V7.7) -- EUVE Celebrates Five Years in Orbit; EUVE Offers Coordinated Observations to XTE/ASCA Proposers; EGO Center Releases New Software and Calibration Data; DS/S Calibration Observation of HZ 43; New TPOCC Software Release Delivered
- 27 June 1997 (V7.6) -- EUVE TPOCC Software Delivery Plan Set; UCB/CEA Software Development Milestones; Farewell to George Kaplan
- 2 June 1997 (V7.5) -- List of Approved Cycle 5 Proposals; EUVE Data Delivery Resumes; Subsystem Trending Begins Again; UCB Receives Additional Services from NCC; GFE Shipment Completed; DSN Test Conducted Successfully
- 30 April 1997 (V7.4) -- EUVE Under New Management; TOO to ALEXIS Transient; New Data Service to EUVE Observers; UCB Assumes Operational Contol of EP Spacecraft
- 1 April 1997 (V7.3) -- UCB-CEA Begins Realtime Operations of EP Spacecraft; EUVE Target of Opportunity: T Leo; Extended Survey Period for Spacecraft Calibrations; UCB-CEA Handles Its First Spacecraft Anomaly; Commencement of Phase 2 "Realtime" Shadow Operations
- 22 February 1997 (V7.2) -- EUVE GO Cycle 5 Proposals Due; Call for Reviewers; EUVE Stellar Spectral Atlas
- 31 January 1997 (V7.1) -- EUVE Spacecraft in Safe-Hold Mode; Mission Operations Review at GSFC; CEA FOT Fully Staffed; EPOC Systems Testing

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1996 Issues:

- 27 December 1996 (V6.12) -- Upcoming Release of Cycle 5 NRA; Call for Proposals for EUVE RAP Program; New Contact Information for EUVE Observatory
- 30 November 1996 (V6.11) -- EUVE Episode 5 NRA; NASA SEUS Strategic Planning; Notice To GOs On Turn-Off of EUVE Scanner C
- 29 October 1996 (V6.10) -- EUVE Observations of AR Lacertae; EPOC FOT hiring and training; Science Education notes
- 30 September 1996 (V6.9) -- EUVE Observations of EUVE J0720-317 and EUVE J0723-277; Safe-Hold Event Summary; Formation of EUVE Science Advisory Board
- 30 August 1996 (V6.8) -- EUVE Observations of AU Mic, and EUVE Outsourced Extended Mission Status Report
- 29 July 1996 (V6.7) -- EUVE Observations of RX J0437.4-4711, AM Herculis, and CF Tucanae.
- 29 June 1996 (V6.6) -- FIP effect in Epsilon Eridani; Initial release of RAP data.
- 31 May 1996 (V6.5) -- EUVE Observations of the Bright Comet B2 1996 (Hyakutake)
- 26 April 1996 (V6.4) -- New EUVE Software and Reference Data Releases
- 29 March 1996 (V6.3) -- IAU Circular Regarding EUVE J2115-58.6
- 29 February 1996 (V6.2) -- Hot Spots in the SW Spectrometer
- 31 January 1996 (V6.1) -- Accepted Cycle 4 Proposals and Targets

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1995 Issues:

- 22 December 1995 (V5.12) -- Two New Scientists Join CEA/EUVE Team; New GO Data Products Guide; 1:0 Phase 1 Transition Implemented in the ESOC
- 27 November 1995 (V5.11) -- Cycle 4 GO Proposal Summary; New IRAF/EUV and EGODATA Releases; EUVE Enters Safe-Hold Mode for the First Time; 1:0 Transition in the ESOC; EUVE Represented at Telemetering Conference
- 24 October 1995 (V5.10) -- TIF Reset Caught by AI Software; ESOC Procedures Augmented Using FrameMaker 5; Educational Outreach: Innovative CEA Information Server
- 25 September 1995 (V5.9) -- NRA Appendix E: Update on Observations; New On-Line Search Tools for Proposal Database; Spiral Dithering Test Resultsl; Cycle 3 Observation Scheduling Status Report
- 25 August 1995 (V5.8) -- VW Hyi Caught In Outburst As TOO; EUVE Optical Identification Discovery Announced in IAUC; CEA Teams with ARC on BU's TERRIERS Mission
- 19 July 1995 (V5.7) -- Release of Cycle 4 NRA; Educational Outreach Via SOL/SII, CEA Test-Bed Awarded CALSPACE Grant
- 16 June 1995 (V5.6) -- User's Committee Meeting at GSFC; Test of New Dithering Operatins; Scanner C Anode Blanking Enabled
- 17 May 1995 (V5.5) -- Innovations in Electronic Documentation; EUVE NRA for Cycle 4; Accepted Public RAP Proposals
- 18 Apr 1995 (V5.4) -- Release of egocs1.5.1; GI Program; Public RAP Proposals
- 17 Mar 1995 (V5.3) -- EUVE Papers for the IAU; Payload Health Status Report
- 01 Mar 1995 (V5.2b; NEWSFLASH) -- New Standard Data Collection Mode for EUVE
- 16 Feb 1995 (V5.2) -- EUVE Science Archive: 1994 in Review
- 20 Jan 1995 (V5.1) -- Approved Cycle 3 GO Programs; Failure of On-Board Tape Recorder Unit; EUVE Public RAP

1994 Issues:

- 22 Dec 1994 (V4.12) -- NASA Announces EUVE Extended Mission; EUVE Science at 185th AAS Meeting
- 16 Nov 1994 (V4.11) -- Update on EUVE Test-Bed Activities; EUVE Science Archive Guest Investigator (GI) Program
- 18 Oct 1994 (V4.10) -- NASA Administrator Dr. Dan Goldin Comments on EUVE; Education Outreach at CEA
- 14 Sep 1994 (V4.9) -- Public Release of the EUVE Sky-Survey Data
- 29 Aug 1994 (V4.8b; NEWSFLASH) -- Public Release of EUVE Sky Survey Data
- 10 Aug 1994 (V4.8) -- Early Results of the SL-9/Jupiter Impact Observations
- 13 Jul 1994 (V4.7) -- The EUVE Comet Impact Event: Cosmic Collisions
- 14 Jun 1994 (V4.6) -- EUVE User's Committee Extended Mission Proposal Presented at AAS; NASA's EUVE Observatory Researchers Share a Ride with Educators on the Information Superhighway
- 15 May 1994 (V4.5) -- NASA Astronaut Visits Bay Area; CD-ROM Volume 2, Number 2 for AAS
- 12 Apr 1994 (V4.4) -- The Beta Cen Mystery: Evidence for Recent Degradation of the Al/Ti/C Filter of Scanner A; First Hardware Failure on EUVE
- 25 Mar 1994 (V4.3a; NEWSFLASH) -- Initial Public Release of Guest Observer Data
- 09 Mar 1994 (V4.3) -- "Space News" Highlights EUVE Innovation in Science Operations

- 09 Feb 1994 (V4.2) -- IAU Colloquium Announcement: Astrophysics in the Extreme Ultraviolet; Right-Angle-Program Results at AAS
- 06 Jan 1994 (V4.1) -- EUVE CD-ROM V2.1 (A/B/C) to be Distributed; EUVE Innovation in Science Operations at CEA
- 05 Jan 1994 (V4.0a; NEWSFLASH) -- EUVE Strategy Session at AAS

1993 Issues:

- 06 Dec 1993 (V3.16) -- EUVE User's Committee Members; Spectrometer Dithering Test Results
- 05 Nov 1993 (V3.15) -- Extreme Ultraviolet Explorer Second NRA; EGO Program Notes Regarding the Deep Survey/Spectrometer Instruments
- 22 Sep 1993 V3.14) -- Project Seeks GO Science Contributions; EUVE Detecting New Sources Serendipitously
- 27 Aug 1993 (V3.13) -- Target of Opportunity Knocks for EUVE; Spectrometer Off-Boresight Wavelength Accuracy
- 24 Aug 1993 (V3.12) -- Announcement of Opportunity for EUVE Observations of Comet Shoemaker-Levy
- 13 Aug 1993 (V3.11) -- NRA 93-OSS-02 Deadline; NASA Policy on EUVE Proposals
- 21 Jul 1993 (V3.10) -- Announcement of AU Mic data release
- 28 Jun 1993 (V3.9) -- New Archive Releases
- 18 Jun 1993 (V3.8) -- Public Release of EUVE Calibration Data
- 03 Jun 1993 (V3.7) -- EUVE at AAS Meeting -- Invitation to CEA Reception; CD-ROM Released at AAS Meeting
- 11 May 1993 (V3.6) -- EUVE Science Archive Releases First CD-ROM at June AAS; EUV Astronomy Featured at AAS -- Invitation to CEA Reception
- 05 May 1993 (V3.5) -- EUVE Spacecraft and Instruments Continue to Operate Flawlessly
- 01 Apr 1993 (V3.4a) -- April Fools!
- 02 Mar 1993 (V3.4) -- First EUVE Image of the Vela Supernova Remnant; EUVE Guest Observer Program Delivers First Data to Guest Observers
- 07 Feb 1993 (V3.3) -- EUVE Guest Observer Program Initiated; First EUVE Image of Cygnus Loop; EUVE Archive Releases Lunar Spectra
- 16 Jan 1993 V3.2) -- EUVE Guest Observer Approved Targets: Schedule for Observation
- 15 Jan 1993 (V3.1) -- EUVE Completes All-Sky Survey

1992 Issues:

- 24 Dec 1992 (V2.14) -- EUVE Detects 100th EUV Source; EUVE GO Program to Start on Schedule
- 09 Dec 1992 (V2.13) -- New Very Bright EUVE White Dwarf; New EUVE Background Limits
- 06 Dec 1992 (V2.12) -- Two New Extragalactic EUVE Sources Discovered; VW Hyi was Observed During Flare
- 25 Nov 1992 (V2.11) -- Internal Release of First EUVE Bright Source List; Prox Cen Flare observed by EUVE: a Very Small Flare
- 16 Nov 1992 (V2.10) -- EUVE Discovers Brightest EUV Source in the Sky; New Spectra Released: AU Mic Flare, MCT 2020-4234
- 12 Nov 1992 (V2.9) -- EUVE Results to be Presented at the January 1993 AAS
- 06 Oct 1992 (V2.8) -- EUVE Survey Continues; EUVE Public Archive Releases Two New White Dwarf Spectra
- 19 Sep 1992 (v2.7) -- EUVE Sky Survey Proceding Smoothly; Geomagnetic Storms Lead to Enhanced Backgrounds
- 23 Aug 1992 (V2.6) -- EUVE Science Team Meeting Discusses First Week of EUVE Sky Survey; EUVE Public Archive Releases: Spectrum of AU Mic, Raw EUV Spectrum of Extragalactic Object, Moon Images in the EUV
- 10 Aug 1992 (V2.5) -- EUVE Continues Sky Survey
- 26 Jul 1992 (V2.4) --EUVE Begins Sky Survey
- 17 Jul 1992 (V2.3) -- CEA Data Archive Opens
- 13 Jul 1992 (V2.2) -- News Summary; Calibration and Check-Out Program
- 02 Jul 1992 (V2.1) -- EUVE Observatory is Operational -- Works Great
- 23 Jun 1992 (V1.15) -- EUVE Observatory Sees First Light
- 21 Jun 1992 (V1.14b; NEWSFLASH) -- EUVE Observatory Sees First Light
- 10 Jun 1992 (V1.14) -- EUVE Launches Successfully
- 22 May 1992 (V1.13) -- EUVE Moves to Launch Pad
- 06 May 1992 (V1.12) -- Revision to EGO Handbook
- 01 May 1992 (V1.11) -- EUVE Launch Date Moved to June
- 06 Apr 1992 (V1.10) -- EUVE Launch Date; EUVE Guest Observer NRA
- 04 Mar 1992 (V1.9) -- KSC Update
- 27 Jan 1992 (V1.8) -- EUVE Shipped to KSC
- 10 Jan 1992 (V1.7) -- EUVE Participation at January AAS Meeting

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1991 Issues:

- 13 Dec 1991 (V1.6) -- Status of EUVE
- 21 Oct 1991 (V1.5) -- CEA Unharmed in Big Fire
- 04 Oct 1991 (V1.4) -- Status of the EUVE Science Payload and Spacecraft
- 10 Sep 1991 (V1.3) -- Status of the EUVE Science Payload and Spacecraft
- 05 Aug 1991 (V1.2) -- EUVE Sky Survey Science Software Development; Calendar of Forthcoming Events
- 08 Jul 1991 (V1.1) -- Introduction to EUVE and the Newsletter

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Project Publications

- GO Handbook
- Data Products Guide
- Software Users Guide
- Electronic Newsletters

Analysis of Individual Copernicus Scans of a Star

One the useful aspects of the Copernicus archive is that it can be used in searches for spectral variability of bright stars. Using gamma Cas as an example, let's say we want to check the results of <Slettebak and Snow (1978)> who reported the amazing development of emission in the UV resonance lines of Si IV and Mg II in just a few minutes. The feature was not present in the first spectral line Copernicus scanned, yet it was found to develop over the time it took the scan to reach the second (bluer) line in each doublet. Do we believe this? To check out this claim, we can access and compare individual Copernicus scans from the original study.

This can be done in a variety ways, either interactively on Copernicus Web pages, or using the IDL-based FITS readers ***mrdfits*** or ***ifitsrd*** (IRAF/STSDAS tasks do not yet read most Copernicus FITS files because these files generally contain variable array lengths. The IDL-based routine fxbread also works, but only on one file row (scan) per read. It is impractical to use it for reading many rows). It is usually convenient to determine first the scan numbers needed, e.g. by inputting the observing times into the Copernicus search page.

One should recall that Copernicus scans are stored in 5- or 6-row groups. This is because Copernicus observations were made with simultaneous U1 (U2, U3) and V1 (V2, V3) tubes. U3 and/or V3 were used to monitor particle backgrounds empirically. An alternate tube (e.g. U2 for U1, V2 for V1, or vice versa) was employed to shield the tube used for data collection from scattered light. Data for each of these tubes was recorded as a separate binary row (scan). Additionally, the ***tback*** field in each data scan is a modeled radiation background spectrum. This background can be subtracted from the ***tcounts*** array to produce a "net" spectrum.

Step 1: get object number and the scan numbers

The first step is to determine the object number of interest. A single FITS file for the object contains all the observations done by Copernicus. This file contains a 3-digit number corresponding to the object name for the mission. (This number is given by the ***star_num*** field.) To do this, go to the <complete target list> page. For gamma Cas, one finds the filename c084.pep, so the object number is 084.

Next one should determine the range of scan numbers. This can be best learned from the search Web page under "Co-added Scans" by putting in the starname, wavelength limits, and rage of observation dates. For our present query, enter "gamma Cas," "1380," "1415," and "27 Jan 1977 .. 29 Jan 1977), respectively, and run the search. One record is returned with the scan range 1974--2273. We may now download the software and work on it with our favorite IDL-based FITS reader.

Step 2: get the times

The REC_* keywords indicate only the time for a reference position in that Copernicus orbit during which observations were made, not the exact observation time (the difference between these times may be up to one orbital period of about 96 minutes). A conveninent way of getting the correct time of observation is to download the program ***coptime*** from the ftp area) (<ftp://archive.stsci.edu/pub/copernicus>) and use it for the scan(s) of interest to determine these times. This is shown for scans 1974-2273 as follows:

```
i  = indgen(300) +1974
coptime,'c084.pep',i
```

The output provides a listing of start and end times which are accurate to about 1s.

Step 3: read the file in your IDL session

Here are three examples of reading in scans 1974-2273 in ***mrdfits*** or ***ifitsrd***. Of the two routines, mrdfits reads in multiple file rows much faster, but ***ifitsrd*** permits an alternative to IDL structures and working with selected data fields. (For a primer on IDL structures, click <here.>)

Example 1, with mrdfits (structure only):

```
p  = mrdfits('c084.pep',1,h,range=[1973,2272])
```

(Note the 0-based indexing.)

Example 2, with ifitsrd (structure option)

```
i  = indgen(300) + 1974
ifitsrd,'c084.pep',i,h,e,p,/struc,/sil,/nvla
```

The array ***i*** contains the indices corresponding to the 300 scans of potential interest. The array ***h*** contains keywords unique to the object gamma Cas and is the header of the primary array record (which contains only this header, no data). The parameter ***e*** is the keyword header for each of the 40 data fields and includes the field name for each. The parameter ***p*** is the data structure containing the observations. The IDL keyword ***/struc*** specifies the data are to be packed into an IDL structure, while ***/sil*** suppresses a summary of the data contents to the screen. In this case, ***/nvla*** is critical for Copernicus files because it suppresses an optional keyword array which would attempt to report the number of elements in the variable length arrays. For Copernicus data this value, the number of wavelength points scanned, often varies from observation to observation. If ***/nvla*** is not specified, the run of ***ifitsrd*** will abort if the number of array elements in successive scans differs from the first scan read.

An alternative way of examining the data structure contents is to type:

```
help,/struct,a
```

By either printing out of the keywords in the string array ***e*** or by this "help" command one obtains the field-name convention needed to work with data fields.

Example 3, with ifitsrd (selected fields option):

Let's suppose we want work with the following fields: **rec_num, tube_name, nnn** (array length)**, yr_obs, day_obs, hr_obs, min_obs, tlambda** (wavelength array)**, tcounts (raw counts), tback (background)**. These are, respectively field numbers 3, 14, 15, 16, 17, 18, 19, 36, 37, 39), which we will designate as variables with the letter f. In the call to ***ifitsrd***, we use the keyword **efld** to list these field numbers corresponding to the extracted data fields, as follows:

```
i   = indgen(300) + 1974
ifitsrd,'c084.pep',h,ex,i,f3,f14,f16,f17,f18,f19,f36,f37,f38, $
  efld=[3,14,16,17,18,19,36,37,38],/sil
```

Step 4: Work with the data

At this point it's a good idea to check on the wavelength direction of the scan, e.g. by printing out the first and last wavelength element. These elements are numbered in the sense they were observed, with the first element (either shortest or longest wavelength) being the one first recorded in time.

From coptime and the Slettebak and Snow paper, we find that the observations of interest are scans 2144 (Si IV doublet) and 2145 (Mg II) doublet. These are monitored by the U2 and V2 tubes, respectively. We may compare these, for example, to the immediately preceding observations, 2139 and 2140, by printing or plotting them out. Note here that all arrays are padded to 176 elements (except for arrays already containing 176 scanned elements). Thus, generally we must first determine the number of actual (nonzero) data points; for these two pairs of observations these array lengths are 148, 176, respectively. Finally, we plot out the arrays of interest. For example:

```
plot,a(170).tlambda(0:147),a(170).tcounts(0:147) - a(170).tback(0:147)
oplot,a(165).tlambda(0:147),a(165).tcounts(0:147) - a(165).tback(0:147), linesty=2
```

and so forth.

Do you see the published variations?

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Coadd Data Search
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Getting Started
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Obtaining Copernicus data
Reading Copernicus data
Data Products
Data Search
Raw Data
Coadded Scan Data
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Extract & Display Data
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FAQ
Data Reduction/Analysis
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Related Sites
Acknowledgments

How to Read Copernicus Files

This page provides information on reading the Copernicus data sets using FITS readers written in various languages. As mentioned elsewhere, all the Copernicus data sets use the FITS binary table extension format which was approved by the IAU in 1994. The raw data sets however use the variable length array facility which, although included in the original binary table proposal, was not part of the officially approved format. Users may have more trouble therefore reading the raw files than the coadded scans or spectral atlas files, although there are many publicly-available FITS readers that can read all 3 formats.

FTOOLS:

One of the best supported, and most extensive, FITS readers is the **FTOOLS** and FITSIO software library written in C and FORTRAN by Bill Pence from **HEASARC**. These programs should be able to read all the various Copernicus data sets. The suite of programs can be built as either a stand-alone package or as an IRAF subpackage. The **first example** shows how to convert a quick-look co-added spectrum to an ASCII table. The **second example** hows how to create an ASCII table containing a single scan from a raw data (.pep) file. The **third example** shows how to access and manipulate individual Copernicus scans in a time series of a target pep file (i.e. constituent scans of the co-added data).

IDL FITS Readers:

There are a number of FITS readers that are written using the Interactive Data Language **(IDL)** A number of the FITS readers are included in IDL libraries that are available for free via the WEB and run on several different platforms. (Note however that IDL must be purchased for the local computer). One such library is the **IUEDAC** software package, originally written for analyzing data from the International Ultraviolet Explorer (IUE) satellite project. The **IUEDAC examples** show how to use the program **IFITSRD** to read the raw, coadded scan, and spectral atlas files, and plot counts versus wavelength. More information on **IFITSRD** can be found in the prolog of the program.

Another widely used IDL library is the **IDL Astronomy User's Library**. This library contains astronomy-related programs donated by several projects and includes several IDL FITS Readers. Three of the FITS readers are described in the **Astronomy Library examples**. (note that the Readfits(), Fits_*, and FTAB_* routines can not read the variable length arrays used in the raw data sets, but CAN read the coadded scan and spectral atlas FITS files). Additional documentation on all the listed IDL programs can be found in the procedure prologs.

Index of Early Copernicus Memos

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2. Stray Light in PEP, II - 15 December 1972
3. Scattered Light in U1 - 2 March 1973
4. Background in *Copernicus* Data Tubes - 9 December 1974
5. U1 Instrumental Profile - 11 April 1975
6. Corrections to the U2 Wavelength Scale Between 1026 and 1110Å - 7 January 1976
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8. Sensitivity Loss in *Copernicus* - 8 September 1982

Princeton University Observatory

Princeton, New Jersey

Stray Light in PEP

D. G. York

December 8, 1972

Recently, a test was done on Lambda Ori to determine the cause of residual light at the bottom of saturated absorption lines. The basic procedure was to hold U1 fixed at the bottom of four lines: 1026 Å, 1077 Å, 1216 Å, and 1302 Å, while moving Carriage two. Far from the suspected stray light source (50 Å longward of the U1 slit), observations were made by moving U2 20 Å at a step, then doing a standard routine on U1 with U2 motionless. At Ly Alpha and Ly Beta, the standard routine did not take U1 out of the bottom of the line. For the 1302 line the standard routine included a point in the continuum shortward of the line wings. For the 1077 line, a point in the shortward wing was included.

These low resolution results are shown in Figures 1, 2, 3, and 4. In Figure 2, the regions where the slit and stray light hole are separately or simultaneously occulted are labeled. In Figure 3, the various background components are labeled as 1) particles, 2) stray light through the hole about 50 Å longward of the slit, and 3) scattered light. This last designation comes chiefly from the fact that a component of background remains after the dipping mirror occults the stray light hole and before the slit on U1 is occulted by the mirror, but the component disappears when the slit is occulted. This component may be due to grating scatter or to some other very localized scatter.

High resolution scans of the stray light occultation are shown in Figures 5 and 6 (with U1 at 1216 Å and 1026 Å, respectively). Counts on U1 are shown as a function of the U2 slit wavelength. The discontinuity after dump 1397 in Figure 5 may be partially explained by a high particle count on U1 (U3 showed a background level three times higher than normal). The discontinuity at dump 1415 in Figure 6 is not so easily explained.

The present position of the dipping mirror relative to the U2 slit is shown by occulting the U1 slit positioned at continuum points near Ly Alpha and Ly Beta in Figures 7 and 8.

Based on the various background components observed, the following scheme was derived for computing background corrections where saturated lines are not available, i.e., particularly in the case of molecular lines and unreddened stars.

Lambda=wavelength being observed on U1
$S_{2,avg}$(Lambda + 55)=average continuum level on U2 measured from a point 55 Å greater than Lambda and averaged over ± 17Å.
$S_{2,avg}$(Lambda ± 10)=average U2 continuum centered at Lambda averaged over ± 10Å.
a=a correction to derive $S_{1,avg}$(Lambda ± 10), comparable to $S_{2,avg}$(Lambda ± 10). a is plotted in Figure 9.
$S_{1,avg}$(Lambda ± 10)=$S_{2,avg}$(Lambda ± 10)/a

The stray light on U1 at Lambda in counts/14 sec on U1 is

S_t = 0.1 x C_1 x $S_{2,avg}$(Lambda + 55) where C_1 is defined below.

The scattered light is

S_c = 0.08 [$S_{1,avg}$(Lambda ± 10) - 0.1 x $S_{2,avg}$(Lambda + 55)]

To determine the state of occultation, compute the quantity Delta E = E_{U2}-E_{U1}, the wavelength difference of U2 and U1, in Å. Define the additional correction for occulted stray light as C1.

If Delta E < -170, C1 = 1.0.

If -170 < Delta E < -100, C1 ~ 0.75 - 1.0, a poorly defined effect which is not understood. This condition does not occur often.

If Delta E > 0, compute

z = Delta E - 0.143 Lambda_{U1} + 35
If $|z|$ <= 17, C1 =(17 + z)/35.
If $|z|$ > 17, C1 = 1.

The equation for z is derived using a measured wavelength dependence in the separation of U1 and U2 when half the stray light is occulted.

The above formalism applied to Lambda Ori observations of saturated lines gives predicted values within about 10% of those observed for residual signal at the center of saturated lines. For Tau Sco (B0 V), Gamma Ara (B1 Ib) and Delta Per (B5 III), the answers given by the formalism must be increased by 30%. With this addition, 10 to 15% accuracy is achieved. The background particle counts may vary from 15/14 sec to 80/14 sec, and the counts at the line centers for all but the shortest lines in Tau Sco are less than 2000/14 sec. These have not been taken into account and probably account for a part of the error.

The above statements of accuracy do not apply to the regions Delta E <= |17|, or in fact Delta E <= |25|. There is some evidence that the apparent size of the hole changes as U1 moves to shorter wavelength, as is shown by the comparison of stray light occultations in Figures 2 and 4.

The present results are probably acceptable for U1 wavelengths 1100 Å < Lambda < 1400 Å for all z. At shorter wavelengths they are acceptable for $|z|$ > 25, but for smaller $|z|$, they must be applied with caution. In particular, the features near 1036 Å are often affected by partial occultation of the stray light hole. L. Spitzer has obtained good predictions of background for these lines using the following corrections.

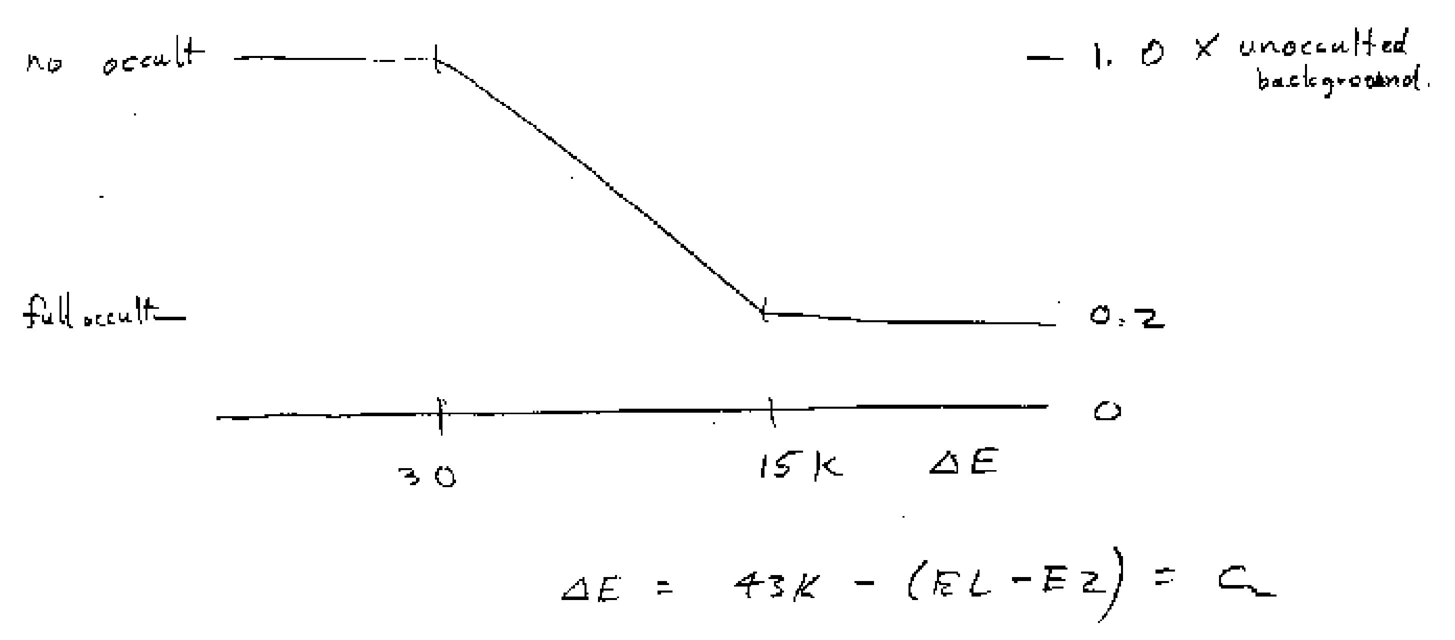
Compute EL - E2 where E2 = the Carriage 2 encoder reading for a particular observation on U1 and EL = the corresponding longward occultation point of the V1 slit. These numbers are available in the "LS" printouts.

Compute C_2 = 43000 - (EL - E2) = distance of C2 mirror from edge of U1 beam, in encoder bits.

If C_2 < 15 K, C1 = 0.

If C_2 > 30 K, C1 = 1.

If 15 K < C_2 < 30 K, C1 = (C2 - 15 K)/15 K.



Princeton University Observatory

Princeton, New Jersey

Stray Light in PEP, II

D. G. York, December 15, 1972

Pursuant to the derivation of extinction curves using U2 data, a formalism has been developed for deriving the stray light which contaminates the U2 spectrum.

The degraded spectra (5 Å and 10 Å resolution) of Zeta Oph (O9.5 V, E_{B-V} = .33) and Alpha Cam (O9.5 Ia, E_{B-V} = .32) are shown in Figures 1 and 2, respectively. Also shown is the stray light shifted 18 Å longward to show its approximate fit to the 5 Å resolution spectrum, discussed below.

The best way to derive the correct stray light values is from the saturated atomic and molecular hydrogen lines in reddened stars. As may be seen in Figures 1 and 2, the stray light has considerable structure, even over 3 Å (see the region near 1026 Å). Since this phenomenon is noted in virtually all reddened stars, it is plausible to assume that the structure is due to the molecular hydrogen lines, at least in part. The presence of this structure requires a narrow bandpass for the stray light aperture since our targets do not show structure on scales greater than 15 to 20 Å, and these large amounts only occur in supergiants showing mass loss.

Test results obtained at Goddard before launch are illustrated in Figure 3. The U2 cathode was incorrectly positioned, causing Lyman Alpha to appear when the U2 tube was 17 Å shortward of the true Lyman Alpha position. (The identification of the feature in Figure 3 is solid, based on the relative strength of another H_2 line at near 1218 Å, observed at the same time.) Presumably, dispersed light was getting in behind the longward edge of the U2 slit jaw, which is about 17 Å from the U2 slit, and hitting the U2 cathode which was not seated properly. The cathode was moved toward the slit jaws and the main light path was removed (dashed line in Fig. 3). However, some residual stray light does appear. Time did not allow for further investigation. The dashed line in Fig. 3 suggests that the present stray light path yields a resolution greater than 3 Å.

By trial and error, it has been found that the stray light may be represented as 60% (±10-15%) of the true stellar spectrum, expressed in U2 counts per 14 seconds, 20 Å longward of the point in question and integrated over 5 Å.

S_t(Lambda) = $S_{*,avg}$(Lambda + 20) x 0.6

where

S_t(Lambda) is the stray light at Lambda

S_*(Lambda + 20) is the U2 signal *averaged* over a 5Å band centered 20 Å longward of Lambda.

Since $S_{0,avg}$(Lambda), the observed average counts at Lambda in a 5 Å band is

$S_{0,avg}$(Lambda)=S_t(Lambda) + $S_{*,avg}$(Lambda) = S_*(Lambda + 20) x 0.6 + S_*(Lambda)
$S_{*,avg}$(Lambda)=$S_{0,avg}$(Lambda) - S_t(Lambda)
=$S_{0,avg}$(Lambda) - $S_{*,avg}$(Lambda + 20) x 0.6
=$S_{0,avg}$(Lambda) - $S_{0,avg}$(Lambda + 20) x 0.6 + $(0.6)^2 S_{*,avg}$(Lambda + 40)

Repeated substitution using the formula

S_*(Lambda + 20*i*) = S_0(Lambda + 20*i*) - S_*[Lambda + (*i*+1)20] x 0.6

leads to the formula

$S_{*,avg}$(Lambda) = $S_{0,avg}$(Lambda) - Sum$_{i=0 \text{ to } n} 0.6^{(i+1)} S_0$[Lambda + 20 x (*i*+1)]

or

S_t(Lambda) = Sum$_{i=0 \text{ to } n}$ $(-1)^i 0.6^{(i+1)} S_0$[Lambda + 20 x (*i*+1)]   (1)

For spectral distributions in reddened or unreddened OB stars, n = 5 is sufficient for convergence to occur.

For specific points in the U2 spectrum, equation (1) may be applied to derive the stray light to be subtracted from the observed U2 signal. If an entire spectrum is to be corrected, it is easiest to apply equation (1) at some long wavelength point and work one's way shortward, using the formula

S_t(Lambda) = S_*(Lambda + 20) x 0.6

where S_*(Lambda + 20) is computed at each point,

S_*(Lambda + 20) = S_0(Lambda + 20) - S_t(Lambda + 20).

Table 1 shows the results of applying these results to both reddened and unreddened stars at wavelengths greater than 1000 Å. The structure in the stray light is duplicated and agreement of observed and computed values is generally within 20%. The particle counts of 14 to 80 per 14 sec have not been subtracted from the observed stray light values quoted in Table 1.

This formation does not provide an *exact* fit to the stray light observed, and one wonders, additionally, what the other modes of stray or scattered light might be. We have assumed herein that the U1 stray light path (light from 50 Å longward) does not exist an U2, which may not be true. Separation of these various components remains a topic for later investigation. Addition of other components may force one to use a narrower bandpass for integrating the light 20 Å from the slit.

Table 1

Computed and Calculated Stray Light Levels On U2
U2 counts per 14 seconds are given

	Alpha Cam		Zeta Oph		Lambda Sco		Tau Sco	
	Obs	Calc	Obs	Calc	Obs	Calc	Obs	Calc
1000 Å	100	113	250	267				
1013	150	56	400	396				
1014	100	50						
1025	250	339	700	1079	45000	50400	22300	25950
1028	200	271						
1036	230	275						
1049	170	148	1200	1050				
1063	250	277						
1077	300	258	1000	986				
1108	350	373	1100	1178				
1216	80	64						

Princeton University Observatory

Princeton, New Jersey

Scattered Light in U1

W. Cochran

March 2, 1973

Saturated lines of several stars were examined to determine the amount of scattered light in the U1 spectra. Lines were selected in which the stray light was fully occulted. It was then assumed that any residual light in the bottom of saturated lines was purely a result of scattered light.

The counting rates in the bottoms of heavily saturated lines were measured. Following York*, the continuum level, averaged over ±10 Å, was measured on U2 and then divided by the quantity *a* (see Fig. 9 from York) to correct for the difference in counting rate between U1 and U2; i.e.,

$$S_{1,avg}(\text{Lambda} \pm 10) = S_{2,avg}(\text{Lambda} \pm 10)/a\ . \qquad (1)$$

The ratio of the counting rate at the bottom of the line to the average continuum level, $S_{1,avg}$(Lambda ± 10), plotted as a function of wavelength, is shown in Figure 1. The data shows a linear relationship, which can be described by

$$N_{min}/S_{1,avg}(\text{Lambda} \pm 10) = 0.047 + 0.000185(\text{Lambda} - 1000)\ , \qquad (2)$$

where Lambda is measured in angstrom units.

The ratio of the counting rate at the line bottom to the local continuum as measured on each U1 scan was also examined, but these data showed considerable scatter. Thus the above formula gives the best available representative for the scattered light in the U1 spectra. The average deviation of the plotted points from the mean line is 0.0059 of the computed U1 continuum.

* D. G. York, Stray Light in PEP, December 8, 1972

cc: Copernicus Astronomers

PRINCETON UNIVERSITY OBSERVATORY

Princeton, New Jersey

December 9, 1974

MEMORANDUM TO: Users of *Copernicus* data
FROM: D. York and A. Miller
SUBJECT: Background in *Copernicus* Data Tubes

I. INTRODUCTION

For some period of time we have had underway an extensive programming and data reduction effort with the goal of producing background predictions for use in correcting *Copernicus* data. In this memo we describe the present state of this work.

This report discusses the data reduction procedures (§ II); the results, including typical background count behavior for the six tubes (§ III); and the possible sources of the background counts in light of the characteristics of the individual tubes (§ IV).

Princeton University Observatory

Princeton, New Jersey

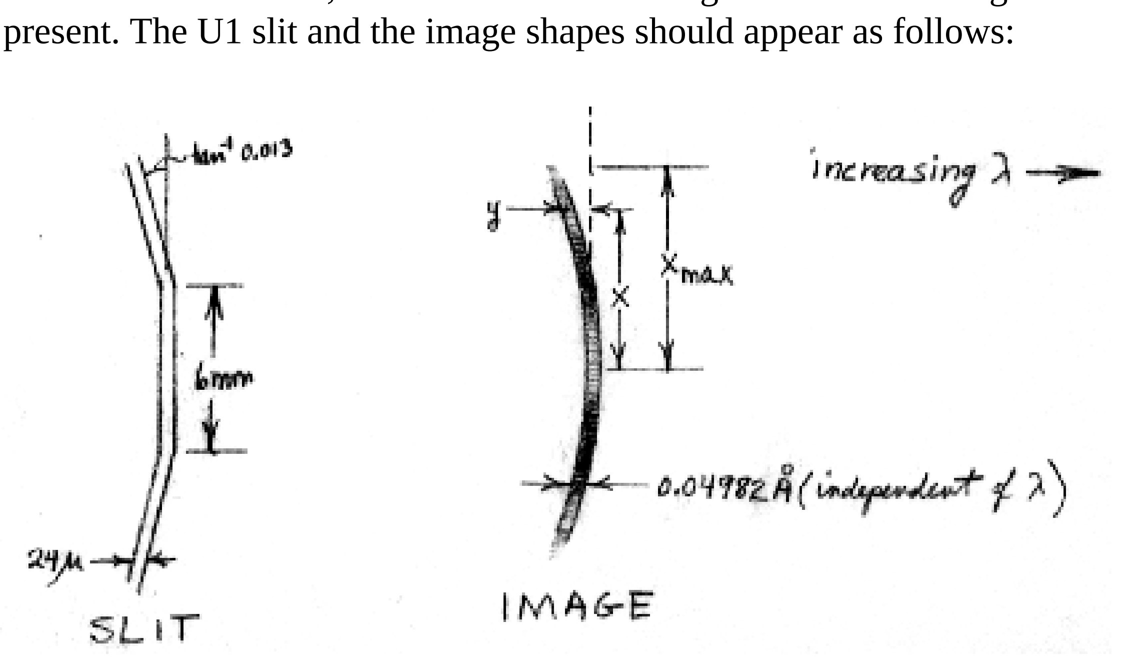
April 11, 1975

TO: Copernicus Astronomers and Guest Investigators
FROM: Edward B . Jenkins
SUBJECT:Computations of the U1 Instrumental Profile

---

a) Star Image

The shape of the instrumental profile for U1 has been computed under the assumption that the spectrometer is exactly in focus, the grating is perfect, the starlight illumination is uniform across the entrance slit, and no aberrations of higher order than astigmatism and coma are present. The U1 slit and the image shapes should appear as follows:



Note that the brightness of the image varies along its length; this is caused by uneven illumination of the grating. Occultation by the spectrometer and secondary spider casts a shadow on the grating which produces an intensity distribution

$\|x/x_{max}\|$	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$I(x)$	0.00	0.30	0.29	0.28	0.88	0.83	0.76	0.67	0.55	0.40	0.10

We assume the grating efficiency and telescope mirror efficiencies are uniform over their surfaces. The above numbers represent the illumination pattern along successively higher strips, from center to edge, which are perpendicular to the rulings. (We ignore a slight asymmetry in the pattern, which makes $I(x)$ slightly different from $I(-x)$ for $|x| \sim 0.4$.)

If R is the radius of curvature of the grating (and the diameter of the Rowland circle; this value is 998.8 mm), the height L of the illumination on the grating is $R(\cos i)/20$ for an $f/20$ beam with an angle of incidence i. The astigmatic image height is given by

$$2x_{max} = L \text{ Gamma}$$

where Gamma = $\sin^2 r + \sin i \tan i \cos r$ (r is the angle of diffraction). The curvature of this image follows the relation

$$y = -\text{Psi } x^2/2R$$

where

$$\text{Psi} = [\sin i \tan^2 i - \sin r + \{\tan r(1 - \text{Gamma})^2\}/\cos r] \text{ Gamma}^{-2}$$

For most wavelengths along the spectrum the segmented slit compensates for the curve. To ascertain the small smearing which results from the lack of a perfect match, we may define an offset

$$y'(x) = y(x) \text{ for } |x| <= 3.0 \text{ mm}$$

and

$$y'(x) = y(x) - 0.013(|x| - 3.0 \text{ mm}) \text{ for } |x| > 3.0 \text{ mm}$$

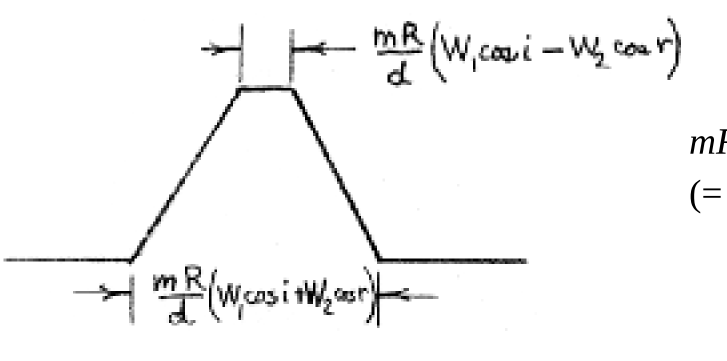
If the entrance and exit slits had infinitesimal widths, we would expect an instrumental profile whose shape follows the function

$$P(y') = \text{Sum } (dy'/dx)^{-1} I(x)$$

where the sum includes all points along the line from 0 to x_{max} where the function crosses y'. The conversion from y' to Delta Lambda is given by

Delta Lambda = $mR/d \cos r\, y' = 2.0858 \times 10^3 \cos r\, y'$ for y' in mm and Delta Lambda in mÅ

(m and d are the order and groove spacing, respectively). If one were to scan across any small piece of the curved image with the exit slit, one would expect to see the convolution of the two slits which results in a trapezoid,



$mR/d\, W_1 \cos i$ = 49.82 mÅ
(= $FWHM_1$ at all Lambda)

where W_1 and W_2 are the entrance and exit slit widths, respectively.

Although the face of the exit slit is always tangent to the Rowland circle, the effective width W_2 varies slightly with wavelength since the light strikes the jaws at the diffraction angle r from the normal, and the jaws are not perfectly thin. The projected widths as seen from the grating $W_2 \cos r$ has been measured by Perkin-Elmer and a functional fit to these data has been made by J. B. Rogerson.

A convolution of P(Delta Lambda) with the above shown trapezoid gives us the net instrumental profile, which includes the slit widths and the small lack of registration of exit slit shape with the image curvature. Some additional smearing should be caused by spherical aberration, giving an image diameter

$$A = L^3/(8R^2)\, (\sin i \tan i + \sin r \tan r) \cos r$$

which may be multiplied by $2.0858 \times 10^3 \cos r$ to give the value in mÅ. The above figure, however, is appropriate at the paraxial focus. The aberration may be substantially reduced (by about a factor of four, I am told), by viewing the line at the circle of least confusion, instead of the paraxial focus.

b) Diffuse Sources

If the entrance slit is illuminated uniformly over its entire length l (3.0 mm), the diffracted image is smeared vertically over a length $l \sec i \cos r$. However, for any point source off the grating centerline the displacement of the focused image is not exactly vertical, but rather occurs along an arc concave toward longer wavelengths (i.e. opposite to the curvature of the image) whose radius of curvature

$$r_e = R/\text{Phi}$$

where Phi = $(\sin i + \sin r)/\cos^2 r$. For the *Copernicus* spectrometer actual values of r_e are several times larger than the radius of curvature of the image R/Psi defined earlier. The net instrumental profile for a diffuse source can be evaluated by adding together the profiles for many single point sources arranged along the entrance slit.

c) Presentation of Results

The graphs show for 950 <= Lambda <= 1400 Å, in steps of 50 Å, three computed profiles:

1. Simple trapezoids from the slit convolutions.
2. Profile for a star imaged on the slit center,
3. Profile for a diffuse source illuminating the whole slit.

Because of the uncertainty of the actual focus condition of the spectrograph, no attempt was made to include the smearing from spherical aberration (we also have no firm way of knowing the effect of other sources of image blur or lack of registration). In addition to a slight broadening over (1), the mean Delta Lambda of profiles (2) and (3) are displaced (usually) toward shorter wavelengths. When the profiles were plotted, they were shifted so that their "centers of gravity" were coincident, to facilitate the comparison of shapes. The amount of these shifts for (2) and (3) in mÅ are shown as CG2 and CG3, respectively. Positive values for these quantities mean the centroid of the complete profile falls at shorter wavelengths than the simple trapezoid (on axis image). Also shown on the graphs are computed values for i, r, Gamma , Psi , Phi, and A. The values of A shows us the basic magnitude of the spherical aberration and its behavior for changing wavelengths.

It is of interest to compare the computed curves with actual observations in orbit. Two sources of information are available at present. First, W. Morton and L. Spitzer have measured stacked profiles of H_2 lines which are presumed to be quite narrow. They find a good fit for the region 1025 <~ Lambda <~ 1100 Å is a gaussian profile with a FWHM = 51 mÅ. This relation is plotted as a series of dots on the 1050 Å graph, and it is evident that no really significant source of additional smearing is at work in the spectrograph, except possibly in the wings beyond | Delta Lambda | = 40 mÅ. The other main source of observational material is the stack of geocoronal Lyman Alpha emission scans. Here, however, the emission profile is not so much smaller than the instrumental profile that we may ignore its effect in producing a slightly broader profile. In connection with research on the cometary Lyman Alpha observations, J. L. Bertaux has examined the geocoronal data and has also theoretically estimated the true Lyman Alpha profile shape. The observations give an approximately gaussian profile with FWHM = 67 mÅ while the emission profile is expected to be 38 mÅ wide. We therefore would expect to find the response of our instrument to a diffuse source of Lyman Alpha of infinitesimal width in Delta Lambda to be roughly a gaussian with FWHM = $(67^2-38^2)^{1/2}$ = 55 mÅ. The computed curve at 1200 Å has FWHM = 60 mÅ; perhaps the geocoronal emission width was overestimated by Bertaux or else the difference may be attributable to the fact that the instrumental profile is not really a pure gaussian distribution.

References

Texts which discuss in some detail the aberrations mentioned in the beginning of this writeup are as follows:

Samson, J. A. 1967, *Techniques of Vacuum Ultraviolet Spectroscopy* (Wiley, New York) pp. 5-19.

Welford, W. T. 1965, in Progress in Optics **4** ed. by E. Wolf p. 243.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND 20771

REPLY TO
ATTN OF:

FILE 5654
JAN 7 1976

TO: Don York, Ted Snow and Users of Copernicus Data at GSFC
FROM: W. Budich, R. Bohlin and J. Drake
SUBJECT: Corrections to the U2 Wavelength Scale Between 1026 and 1110Å.

To determine the correction to the U2 wavelengths several interstellar lines of molecular hydrogen between 1040Å and 1113Å were investigated in the spectra of 17 stars. The position of the lines were measured in the frame of the most prominent interstellar feature in the visible. Deviations of the H_2 velocities from the visible value and any other random shifts were assumed to average to zero for the 17 stars as a group. The average shifts were plotted and approximated by the two straight lines shown in Figure 1. The fit was drawn through the (1026, 0.18Å) point found earlier by Bohlin during a study of Lyman Beta. In the course of the Lyman Alpha survey work, no evidence for a systematic shift at 1216Å was found. The U2 wavelength scale at La is certainly well within the quoted error of ±0.05Å. The equations for the two straight lines are

Delta Lambda = -0.002425Lambda + 2.668 for Lambda < 1070Å

and

Delta Lambda = -0.00066Lambda + 0.779 for Lambda > 1070Å.

In the implementation of the shifts in the GSFC reduction, the equations are applied for all Lambda < 1180Å, where the correction is zero.

Table 1 shows the residuals between the actual and measured wavelengths after applying the above correction. The averages shown for each star are the combination of the actual difference between the H_2 and visual cloud velocities, random errors in the procedure, and temperature or other instrumentally caused shifts. The average residual shifts are applied to the data before attempting to derive H_2 column densities.

/Ralph/
Ralph C. Bohlin
Observational Astronomy Branch

Princeton University Observatory

Princeton, New Jersey

January 12, 1976

TO: Guest Investigators
FROM: D. G. York
Princeton University Observatory
SUBJECT: Possibility of spurious emission line detection

Some of you have been trying to detect weak emission lines using U1 or U2. This is to make you aware of the fact that it is possible to produce spurious emission lines, at the level of 5 cts/14 sec at arbitrary wavelengths. For a given program, the features are likely to occur at identical wavelengths for repeated scans, so that in stacked data, the features will appear to be statistically significant.

The cause of the spurious features is that U1, when slewed, will produce pickup in the U2 count registers (or associated electronics), and vice versa. We generally do not try to obtain U2 data or U1 data while either carriage is slewing. However, tube U1, when retracing, slews 2 steps further than the start position of a scan, and takes two antibacklash steps. The main retrace slew (-17 steps), occurs during the 2 second period used to store data, and hence any pickup produced never occurs in the count registers. However, the two antibacklash steps (2 sequential +1 steps) occur during a valid integration period, and thus will be stored in memory. In the process of reducing data, this quarter minute of data is discarded for U1 and never appears in any plots or on disc records of the U1 data. However, if U2 is moving, this frame is regarded as valid data for that tube and it is plotted and stored on disc. Thus, if U1 and U2 standard routines are started simultaneously, the first point of the U2 scan will include some pickup from U1. If a U2 standard routine is started, and a U1 standard routine is started 1 minute later, the 5th U2 point will include pickup, etc. Each subsequent U1 retrace will lead to a corresponding blip on U2. The effect would go unnoticed except in the case where there is very low continuum signal, several scans have been stacked together, and U1 is always retracing when U2 reaches a particular wavelength, as for instance occurs when one line is being looked for on U1, another on U2, and U2 is reversed after a fixed number of U1 standard routines. In this case the blip will be reinforced on all negative U2 scans at certain wavelengths, and at a different set of wavelengths for positive U2 scans. The effect can be easily recognized by stacking all positive scans only, and then all negative scans separately.

I thank Bill McClintock (Johns Hopkins) for calling this problem to my attention. I urge you to check that this effect has not compromised any published data, and to take this subtle pitfall into account in any further data reduction with which you are involved. In my experience, in testing and in orbital operations, the amplitude of the pickup caused by carriage slews is variable, and therefore may be weaker or stronger than the 5 cts/14 sec quoted here.

Princeton University Observatory

Peyton Hall
Princeton, New Jersey 08544

September 8, 1982

TO: J. B. Rogerson
FROM: L. Spitzer
SUBJECT: Sensitivity Loss in *Copernicus*

Summary. Comparison of *Copernicus* signals from a sealed photomultiplier tube (with a LiF window) with those from the open-face U1 photomultiplier shows that at least 80 percent of the large sensitivity loss observed at 1340 Å with U1 during the final few years of *Copernicus* operation must be attributed to degradation of the open-face tube, rather than to decrease in reflectance from the mirrors and grating.

In my memorandum of January 5, 1982, I summarized evidence that bombardment by atmospheric atoms produced the high voltage glitches and, to some extent, the sensitivity degradation experienced by *Copernicus*. The detailed mechanism of sensitivity degradation was not discussed.

Loss of sensitivity by far-UV open-face photoelectric detectors is potentially a very serious problem for the projected far-UV satellite, now designated as the FUSE program. Don York's request that I forward to Al Boggess any memoranda summarizing our *Copernicus* experience in this area has reawakened my interest in this problem.

Several years ago Walter Upson pointed out that the sensitivity loss of the closed U3 phototube through orbit 30,000 (March 1, 1978) was "significantly less than a factor two"; in contrast, the sensitivity of the U1 open-face photomultiplier, measured at 1340 Å, was about a factor two. As you know, the nominal wavelength of the U3 tube is about 1340 Å, and while the mirror directing light to this tube is covered with a metal disc (so that this tube can be used to measure the background produced by energetic particles), a weak additional signal is received by this tube when the telescope is pointed at a very bright star; the variation of this signal with stellar apparent magnitude and spectral type is consistent with the assumption that U3 is measuring stellar photons at about 1340 Å.

This effect pointed out by Walter is of great importance, since it suggests that the loss of sensitivity was not produced by the optical system --primary mirror, secondary mirror and concave grating --which feeds these two phototubes. Instead, the loss of sensitivity of U1 may be attributed in large part to degradation of this open-face phototube, presumably of the KBr coating on the photocathode; degradation of the BeCu dynodes in the multiplier section would not account for the increased sensitivity loss at the shorter UV wavelengths. Since the U3 photomultiplier is a conventional sealed unit, with a CsI photocathode and a LiF window, the presence of contamination vapours in the spectrometer would not be expected to degrade the performance of this tube, though other factors could produce degradation.

Since the U1 degradation by 1978 was not very large, this argument did not seem very decisive. To obtain more definitive data, I have now examined the U3 signal from the bright star Beta Cen as a function of time until orbit 41,000 (June 1980), and compared this with the normalized U1 sensitivity at 3,400 Å plotted in the Final OAO-C *Copernicus* Operations Report, 1982 (Fig. 2-1). The results are shown in the accompanying figure. Each U3 point represents the average 14-second count in a group of adjacent orbits (usually 2 to 5 in number), with 2 to 4 scans averaged in each orbit, and 16 individual counts averaged in each scan. The U1 points are based on smoothed representations of the observations.

Evidently the sensitivity at 1340 Å, near the end of the satellite's operational life at about orbit 44,000 (February 1981), amounted to about 15% of its initial value for U1, as compared to about 60% for U3, some four times as much. The data in the figure seem to show conclusively that degradation of the optical system cannot be responsible for most of the sensitivity loss observed with U1 at 1340 Å. Since the observed small degradation of U3 could be produced by increasing opacity of the LiF window on this tube, the sensitivity loss attributable to reduced reflectance of mirrors and grating cannot be determined, but at 1340 Å cannot exceed one fourth of the total degradation observed with U1.

At shorter wavelengths there is no firm evidence on the relative importance of mirror reflectance and photocathode sensitivity in the overall degradation noted. The degradation appears somewhat greater on U2 than on U1, suggesting that reflectance losses at the diagonal mirror in the U2 optical train are contributing significantly to the degradation. However, it is also possible that the difference between these two phototubes is a result of differences between the two photocathodes, possibly resulting from their different location and orientation in the spectrometer.

LS:vn

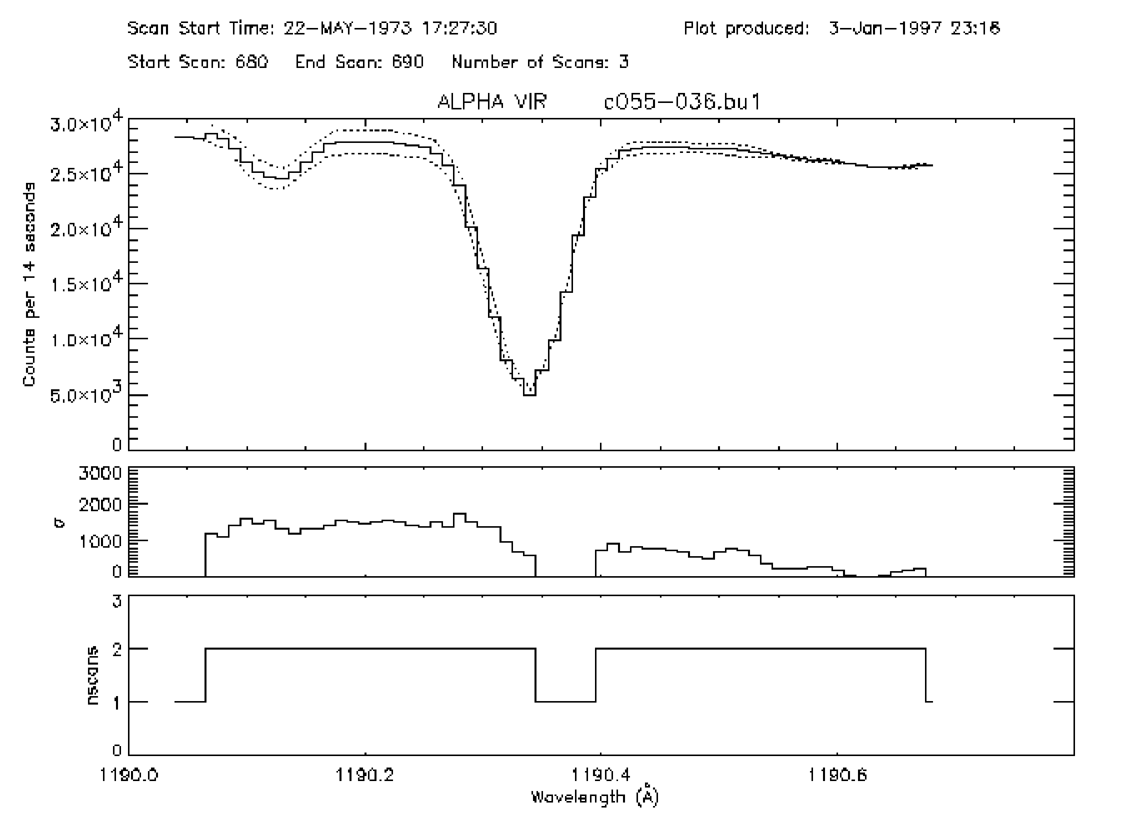
cc: A. Boggess
D. C. Morton
C. R. O'Dell
Copernicus astronomers

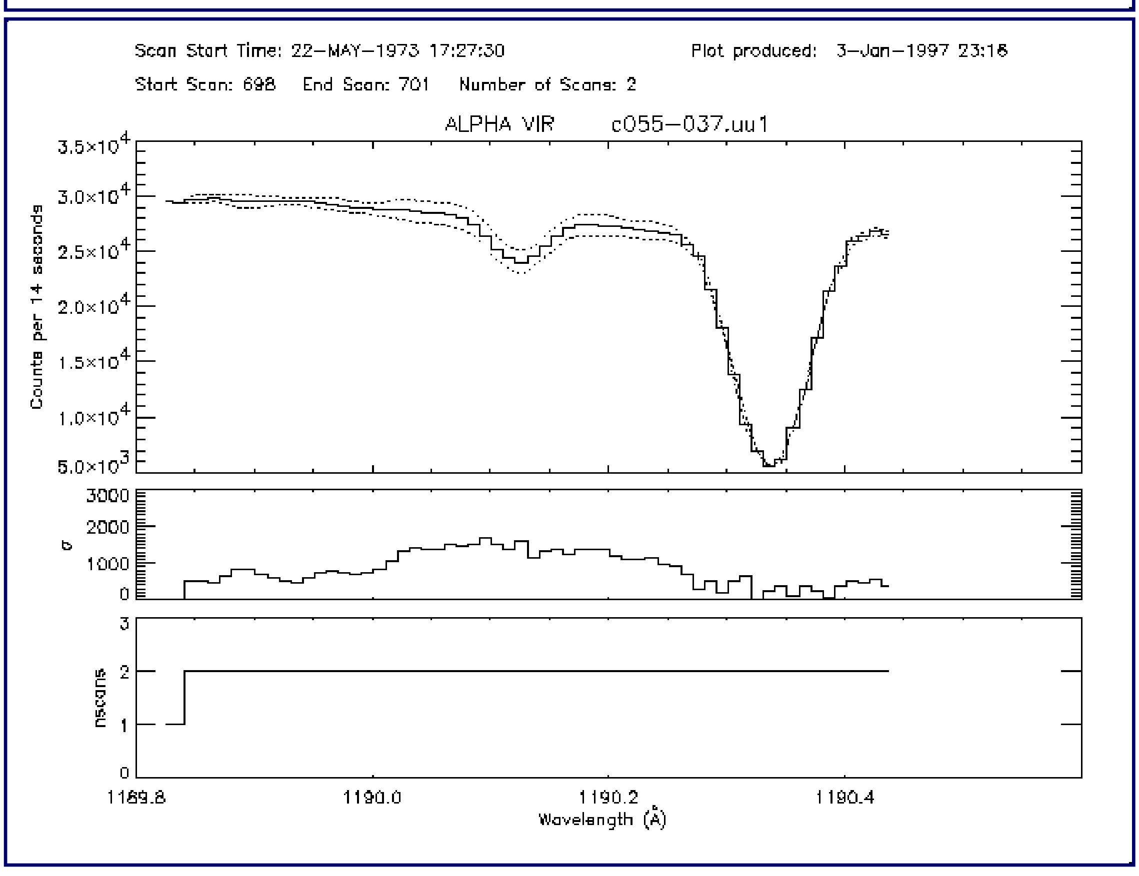
The Backgrounds - Particles, Stray Light, and Scattered Light

There are three sources of background counts for data taken with the *Copernicus* spectrometer - particles (cosmic rays), stray light, and scattered light. Each of these presents specific reduction issues which are briefly discussed below, users of the *Copernicus* archive are urged to consult the references mentioned below and other papers from the literature before using the data.

The particle background was routinely calculated for observations taken after the first eight months of operation as a function of spacecraft latitude and longitude at the time of observation. To allow for the correction to the extrapolated predictions of particle background flux, dark counts were measured about every four orbits. For the U1 and U2 tubes the counts due to particles was generally insignificant except when the spacecraft was in the South Atlantic Anomaly where observations were normally not taken (see also Rogerson *et al*. 1973 and the **Description of the Princeton Experiment** in Section 3 of the Guest Investigator's Guide). For many stars, the data from the *Copernicus* team at Princeton includes the background contributions due to charged particles for each scan. For data that does not include this information in the file a look-up table is consulted which gives the background count rate as a function of spacecraft position and time of observation. The particle background was removed during creation of the stacked scans.

Stray light reached the phototubes through out-gassing holes in the spectrograph. For observations taken using the U1 tube the stray light from the out-gassing holes was often blocked by positioning carriage-2 just longward of the U1 exit slit to cover the holes; however, not all data was taken with the out-gassing holes blocked. The Copernicus archive lists data as being either blocked or unblocked to denote whether carriage-2 was known to be in the correct position to block the vent holes. Some scans are marked as unblocked that actually were blocked, however the position of the U2/V2 tubes is not known so the scans are flagged as unblocked. For example, the following scans of the SIII and SiII 1190Å lines have the same background level (as judged by the level of the continuum and the depth of the core of the strong SiII line), but only the first set of scans have corresponding U2 scans to give the position of carriage-2:





Stray light was generally the dominant background source, so it is important not to mix blocked and unblocked data when stacking. An empirical correction for stray light for the U1 tube in any given (unblocked) scan can be derived in a manner similar to that used for scattered light below. The correction of U2 data for stray and scattered light is described by Bohlin (1975).

In addition to the particle and stray light backgrounds described above, there is a residual background of about 10 percent or more of the continuum for U1 observations using the U1 tube, this background is generally attributed to scattered light from the grating. In most cases the scattered light correction must be derived from residual counts in the bottom of saturated stellar or interstellar lines. The observing scheme usually used included the observation of strong interstellar lines (including the Lyman lines of HI, CII 1036 and 1334Å, CIII 977Å, NII 1084Å, OI 1302Å, and SiII 1260Å), the background was then empirically determined by assuming that some or all of these features were saturated, and thus should have no residual counts in the line cores (see Rogerson *et al*. 1973b; Morton 1975; Bohlin *et al*. 1983). In determining the background it is important to not mix blocked and unblocked scans as the background level varies widely between the two (although as mentioned above some scans were blocked but the necessary carriage-2 position information was not recorded, such &QUOTunblocked&QUOT can be combined with the blocked scans after one has determined the scans were blocked by the continuum and background levels).

One additional consideration in determining the scattered and stray light backgrounds is the fact that the *Copernicus* spectrometer varied in sensitivity both as a function of wavelength and time. For this reason, one cannot use the ratio of the background to the local continuum level determined for one scan (or set of scans) to calculate the background for scans of the same wavelength range taken at a much different time. Instead, one must determine the background for each set of scans using only scans taken at approximately the same time.

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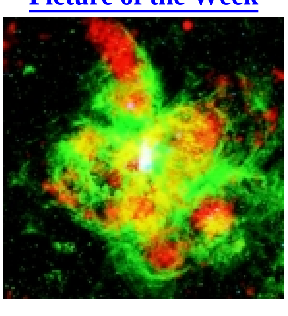

Astronomy Picture of the Day

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IRSA NEWS

IRSA Announces Release of ISO Visualizer

IRSA announces the release of v1.0 of the ISO Visualizer service, a tool for displaying ISO observations on the sky and for providing links to the ISO postcard server, housed at Vilspa, Spain. Data downloads should still be made through the ISO archive interface.

IRSA Announces Release of SIRTF First Look VLA Ancillary Data

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Feb. 19, 2002 - ISO Visualizer v1.0

Feb. 5, 2002 - SIRTF First Look Survey: Ancillary VLA Data v1.0

Jan. 30, 2002 - SWAS Spectrum Server v1.0

Jan. 29, 2002 - SCANPI v5.0

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- NSSDC 2001 Annual Report
- NSSDC Archive Plan
- Disposition of original IUE data tapes
- New Multiwavelength Milky Way web pages

Other Resources

- AAS (American Astronomical Society)
- ADF (Astrophysics Data Facility)
- AMASE (Astrophysics Multi-spectral Archive Search Engine)
- AstroWeb
- CDS (Centre de Donnees astronomiques de Strasbourg)
- FITS Support Office
- IPAC (Infrared Processing and Analysis Center)
- LASP (Laboratory for Astronomy and Solar Physics, GSFC)
- LHEA (Laboratory for High Energy Astrophysics, GSFC)
- NOAO (National Optical Astronomy Observatories)
- NRAO (National Radio Astronomy Observatory)
- SIMBAD
- SkyView
- STScI (Space Telescope Science Institute)
- XDF (eXtensible Data Format)

General Information

- NSSDC Frequently Asked Questions (FAQs)
- Search
- Feedback
- Help Desk

Other Home Pages to Visit

- NSSDC home page
- GSFC home page
- NASA home page

Questions or feedback about this page or astronomy and astrophysics data/services at the NSSDC?
Please contact:
Dr. Beth A. Brown, beth.brown@gsfc.nasa.gov, +1-301-286-4132
Code 633, NASA Goddard Space Flight Center
Greenbelt, MD 20771, USA

NASA Official: Dr. Joseph H. King, Head, NSSDC (joseph.h.king@gsfc.nasa.gov)
Version 4.3, 22 March 2002

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Last updated: 4 April 2001

Links to Mission Pages

Active Missions / Projects

HST	**FUSE**

Legacy Missions

IUE	**EUVE**	**Copernicus**	**ROSAT**
ASTRO -->	**HUT**	**UIT**	**WUPPE**
ORFEUS -->	**BEFS**	**IMAPS**	**TUES**

Catalogs & Surveys

DSS	**VLA-FIRST**	**GSC**	**SDSS**

Version 7.0
June 1999

STScI Archive Manual

SPACE
TELESCOPE
SCIENCE
INSTITUTE

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Preface

ST-DADS History

In the beginning, the archive system used at the Space Telescope Science Institute (STScI) was the *Data Management Facility*, or DMF. The DMF was developed by STScI in collaboration with the Space Telescope European Coordinating Facility (ST-ECF). Only a limited amount of data could be kept online, and the data were stored in the VAX-specific GEIS format.

The permanent, more capable archive system—the *Space Telescope Data Archive and Distribution Service* (ST-DADS)—was installed September 1994. Developed by Loral and STScI, ST-DADS stores HST data on its optical jukeboxes, provides quick access to data, and distributes those data in the standard astronomical format FITS (Flexible Image Transport System). ST-DADS is now able to deliver data directly to a user's home computer over the Internet.

What's in this Manual?

The *STScI Archive Manual* provides information a user needs to know to access the HST archive via its two user interfaces: StarView and a World Wide Web (WWW) interface. It provides descriptions of the StarView screens used to access information in the database and the format of that information, and introduces the user to the WWW interface. Using the two interfaces, users can search for observations, preview public data, and retrieve data from the archive. Using StarView one can also find calibration reference files and perform detailed association searches. With the WWW interface archive users can access, and obtain information on, all Multimission Archive at the Space Telescope Science Institute (MAST) data, a collection of mainly optical and ultraviolet datasets which include, amongst others, the *International Ultraviolet Explorer (IUE) Final Archive*. Both interfaces feature a name resolver which simplifies searches based on target name.

This manual is organized as follows:

- Chapter 1, "Introduction to the STScI Archive," provides a basic introduction to the archive, describing the data in the archive, the archive system and interfaces, and the support provided by STScI for those using the HST archive.

- Chapter 2, "Getting Started on the Archive System," describes how to access the STScI archive, how to register, how to retrieve data, and how to obtain relevant documentation.
- Chapter 3, ‘‘The World Wide Web Archive Interface at STScI’’, provides hints on how to search and retrieve data from the HST and MAST archives via the WWW interface. It also describes briefly the various MAST datasets.
- Chapter 4, "StarView Tutorials" provides two basic tutorial sessions. The first shows you how to use StarView to select observations and how to retrieve that data. The second describes the use of the calibration reference screens in StarView which allow you to retrieve the best available HST calibration reference files. A short description of some commonly-used screens is also provided.
- Chapter 5, "Archive Search Strategies," offers effective approaches to find information and datasets in the archive.
- Chapter 6, "Advanced Queries", explains how to create custom screens and use Standard Query Language (SQL) to create your own methods of locating archival information.
- Chapter 7, "Additional StarView Topics", describes how to customize the user interface and defaults. It also discusses On-The-Fly Calibration.
- Chapter 8, "HST Catalog Screens," displays snapshots of all the screens in the StarView system together with descriptions of the types of data accessed by each.
- Chapter 9, "Data in the HST Archive," describes the types of files and their contents for HST datasets.
- Two appendices contain a list of archive-related acronyms and a description of the database structure of the HST Archive. The latter will facilitate the construction of custom queries.

What's New in this Manual (v7.0)?

Since the previous incarnation of this User Manual, StarView has been updated and the new WWW interface is now fully functional. The terminal version of StarView (designed for vt100 terminals) has been discontinued and StarView can no longer be run by logging into the guest account on the archive host machine. On-The-Fly Calibration is a reality. The STScI Archive has also expanded by providing access to non-HST datasets, with the creation of MAST. Moreover, two new instruments, NICMOS and STIS, are now on board HST. Some new features of this Manual include:

- The previous manual (v6.0) contained several references to the terminal version of StarView. These have all gone.
- A whole new Chapter 3 describes the WWW interface to access HST and MAST data. It also describes briefly the various MAST datasets.
- Most StarView screens have been rearranged and modified and the updated version is now described. In particular, NICMOS and STIS screens are now available. (Chapter 8.)
- On-The-Fly Calibration (OTFC) screens are discussed. ("On-The-Fly Calibration Screens" on page 185.)
- Chapter 9, ''Data in the HST Archive'', has been completely updated.
- Two of the four Appendices which appeared in v6.0 have been deleted because they were out-of-date. What is now Appendix B "HST Archive Database Description" is an updated, reduced version of that previously available, since most of the information is now on the WWW.
- A version of this manual that will contain minor updates will be available on the WWW at `http://archive.stsci.edu/manual`.

1 Introduction to the STScI Archive

In This Chapter..

Archival research is an important component of the Hubble Space Telescope (HST) program. Calls for proposals for funded archival research (by U.S. investigators) occur regularly with the HST Call for Proposals. However, research utilizing the HST Archive does not have to be funded by the archival research program. The archive is available to any individual with the interest and hardware capabilities required to analyze HST data. The archive is not a repository of pretty, heavily processed pictures; press releases can be downloaded from the World Wide Web (WWW) site maintained by the Office for Public Outreach (OPO) at `http://oposite.stsci.edu/`.

Data in the Archive

The Hubble Data Archive (HDA) contains science data from all completed HST observations and calibration files, such as flat fields, which are used to reduce these data. As of June 1999, the archive contains over 6.4 Terabytes of data, for a total of more than 180,000 science exposures. In addition to all the science data sent to observers and all the calibration reference files, the archive contains engineering files that may be useful for diagnosing some questions about observations. The archive also contains the raw science data stream from HST. While the raw stream is not generally useful to astronomers, STScI can use it to regenerate the Space Telescope Science Data Analysis System (STSDAS) files containing uncalibrated science data. As data are archived, information about observations and the targets is extracted from the headers of the data files and stored in an online catalog.

HST data become available to the astronomical community upon the expiration of a proprietary period. Most general observer (GO) and guaranteed time observer (GTO) observations have proprietary periods of a year, but some observations have shorter or longer proprietary periods. Nearly all calibration observations are made public immediately upon receipt. The archive catalog contains information about all observations that have been made with HST. All public data can be retrieved from the HST archive. Proprietary datasets may be retrieved by GOs and GTOs with the appropriate authorization (contact the archive hotseat at `archive@stsci.edu`).

The Multimission Archive at the Space Telescope Science Institute (MAST) was created in 1997. Taking advantage of its existing archive infrastructure, the STScI archive was expanded by providing access to (mostly ultraviolet) non-HST datasets. The data available through MAST, in addition to those in the HDA, include now the following archives: International Ultraviolet Explorer (IUE), Extreme Ultraviolet Explorer (EUVE), Copernicus (OAO-3), Ultraviolet Imaging Telescope (UIT), Hopkins Ultraviolet Telescope (HUT), Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE), Digitized Sky Survey (DSS), and Very Large Array (VLA) Faint Images of the Radio Sky at Twenty-centimeters (FIRST). STScI plans to incorporate additional ultraviolet and optical data sets into MAST in the future including, among others, data from the Far Ultraviolet Spectroscopic Explorer (FUSE). Support for MAST for non-HST data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contacts. A more detailed description of MAST is given in Chapter 3.

STScI archive users should consult our WWW page at `http://archive.stsci.edu` for up-to-date archive information. MAST also publishes a newsletter, which is distributed electronically via a mailing list, to provide the latest information about its activities. STScI archive users are encouraged to subscribe to it by sending an e-mail message to `archive_news-request@stsci.edu`. The single word SUBSCRIBE should be included in the body of the message. The newsletter can also be read on the WWW at `http://archive.stsci.edu/archive_news/archive_news.html`.

STScI Archive System

The Space Telescope Science Institute has an archive system called the Space Telescope Data Archive and Distribution Service (ST-DADS). ST-DADS handles HST and FIRST data (and will also archive and deliver FUSE data). In 1998, between 4 and 6 Gigabytes of HST data per day have been archived, while 3 - 4 times as many data have been retrieved by archive users. Under ST-DADS, archived science data are stored and retrieved in the standard astronomical format, FITS.

Other optical-UV data are instead stored in CDROM jukeboxes. Their retrieval is handled by a WWW-based system independent of ST-DADS, under the auspices of the Multimission Archive at the Space Telescope Science Institute.

Other Archives Containing HST Data

Copies of the HST data and the archive catalog are maintained at the Space Telescope European Coordinating Facility (ST-ECF) in Garching, Germany (WWW page at `http://ecf.hq.eso.org/`) and at the Canadian Astronomy Data Centre (CADC) in Victoria, Canada (WWW page at `http://cadcwww.dao.nrc.ca/`). The Astronomical Data Analysis Center at the National Astronomical Observatory of Japan (NAOJ; WWW page at `http://adac.mtk.nao.ac.jp/`) will also soon hold copies of HST data and of the archive catalog. There is a significant amount of collaboration and coordination between the ST-ECF and the CADC to assure that the data and the basic services provided are similar. However, the archives are not identical. Therefore, European and Canadian astronomers should consult the ST-ECF and CADC WWW pages or contact the ST-ECF (`stdesk@eso.org`) or CADC (`cadc@hia.nrc.ca`) for information about using their archive systems.

Publication of STScI Archival Research Results

The results of investigations with HST archive data are generally published in the scientific literature. All publications based on these data should carry the following footnote:

> *"Based on observations made with the NASA/ESA Hubble Space Telescope, obtained from the data archive at the Space Telescope Science Institute. STScI is operated by the Association of Universities for Research in Astronomy, Inc. under NASA contract NAS 5-26555."*

If the archival research was supported by a grant from STScI, the publication should also carry the following acknowledgment at the end of the text:

"Support for this work was provided by NASA through grant number ________ from the Space Telescope Science Institute, which is operated by AURA, Inc., under NASA contract NAS 5-26555."

Please send one preprint or reprint of each refereed publication based on HST archival research to the following address:

Librarian
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218 USA

Publications based on non-HST MAST data should carry the following acknowledgment:

"Some/all of the data presented in this paper were obtained from the Multimission Archive at the Space Telescope Science Institute (MAST). STScI is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555. Support for MAST for non-HST data is provided by the NASA Office of Space Science via grant NAG5-7584 and by other grants and contract"

The User Interfaces

There are two different ways to access data in the STScI archive: XStarView and a WWW interface.

XStarView

As part of the ST-DADS effort, STScI developed the StarView interface to the HST archive. Using StarView, one can ask common questions about the data in the archive, determine whether the data are public, and retrieve the data of interest. Starview was originally available in two versions, a CRT version designed for vt100 terminals and emulator screens (called StarView) and an X-Windows version (called XStarView). Only XStarView is currently available.

XStarView not only provides a very intuitive way of accessing the HST Archive Catalog, but also allows one to preview a compressed version of the public data in the archives. XStarView runs on various platforms and can be installed at one's home site. (More details on the client-server software can be found in "Distributed StarView" on page 11). Some non-HST MAST data files can also be accessed through the XStarView interface, namely the Digitized Sky Survey and the FIRST survey.

WWW Interfaces

The HDA can also be accessed via our WWW interface at `http://archive.stsci.edu`. Most users will find the WWW interface more convenient to use, as it does not require any client-server software installation and can be accessed by any Web browser. Note however that the WWW interface does not provide all the functions of XStarView as regards HST data. A Java based, WWW interface is currently under development (StarView II). This will include all of XStarView capabilities and will replace XStarView altogether.

Various WWW interfaces, all accessible via the main MAST WWW page available at `http://archive.stsci.edu/mast.html`, are the only option for most non-HST MAST data.

Retrieving Data

If you want to retrieve HST data, you must be a registered archive user (see "Registering as a User" on page 10). Once you have an archive password, you can retrieve data by using XStarView or our WWW interface to select datasets and choosing where you want the data written—on the archive computer staging disk from which you can copy using anonymous FTP (HOST option), on a magnetic tape that we mail to you (TAPE option), or directly to your home computer (NET option).

If a user wants to retrieve a large number of datasets it is better to submit several smaller requests than one large one. So one should try to keep the number of datasets in each request under 100 - 200.

Users with a large volume of data to retrieve, a very slow electronic connection, and access to an 8mm or DAT tape drive should choose the TAPE option. A tape can be generated and mailed on the same business day.

No registration is required to access non-HST MAST data.

User Support Services

The Archive Branch (AB) at STScI is committed to providing outstanding and timely support to archive researchers. We provide assistance and advice on methods and strategies for finding information in the archives and provide a hotseat staff for researchers who have specific problems or questions about using the archive. Archive researchers who need extensive advice on search strategies or help analyzing their astronomical data can visit STScI.

Support for Archival Research

The Archive Branch (AB) at STScI is responsible for the management, scientific and technical oversight, and operation of the HST archive. AB staff also support astronomers who wish to use public data from the HST archive for their own research. To provide assistance for archive researchers, the AB staff includes archive specialists (with bachelor or masters level degrees in physics or astronomy) and archive scientists (Ph.D astronomers). The support provided by the AB includes:

- Answering specific questions about data in the archives and methods for retrieving those data.
- Maintaining a WWW site for archive services (`http://archive.stsci.edu/`).
- Providing advice on strategies for searching the archives.
- Responding to problems identified by users.
- Setting up accounts for users who wish to retrieve data.
- Authorizing GOs and GTOs who wish to retrieve their own proprietary data.
- Writing data tapes for users.
- Providing support for users who visit STScI.

Archive Branch staff will not normally do an astronomer's archive search, generate requests for data, or reanalyze data from the archive. Archive Branch staff will provide assistance and documentation so that archive researchers can perform these tasks.

Archive Hotseat

You can obtain help or answers to any questions that you may have about the HST archive by sending e-mail to `archive@stsci.edu`, or by phoning (410) 338-4547 Monday through Friday, 9 a.m. to 5 p.m. Eastern time.

The hotseat staff will respond to questions concerning the StarView and WWW user interfaces, the archive and archive databases, and data tapes provided by STScI. Hotseat personnel establish the accounts needed to retrieve data from the archive. The hotseat staff will also provide advice concerning basic strategies, and will investigate and document all problem reports. The archive hotseat staff may not always know how to solve a problem, but they are responsible for finding out who does know the answer and for continuing to work with you until the problem is resolved. All initial communication from the user community to the archive—both inside and outside of STScI—should be directed to the archive hotseat.

Visits

Archive researchers who need extensive advice on search strategies or help analyzing their archival data may visit STScI. To make sure that the Archive Branch is able to provide the help needed during a visit and to set up the appropriate computer accounts, archive visits must be approved by the AB branch chief at least two weeks in advance. To arrange a visit, contact the archive hotseat. The number and duration of visits is limited by the staff that we have available. If a conflict arises, funded researchers will have priority over those who are unfunded.

Questions and Comments

We welcome your comments and questions about the archive in general or about archive user support. As discussed above, communication to us regarding all aspects of the archive should normally be directed to the archive hotseat (e-mail: `archive@stsci.edu`, or phone (410) 338-4547). This will allow Archive Branch staff to respond to your requests even when individual members of the group are away. If you feel your needs are not being adequately addressed through the hotseat however, please contact the Archive Branch Chief, Marc Postman (send e-mail to `postman@stsci.edu` or phone (410) 338-5072).

2 Getting Started on the Archive System

In This Chapter..

This chapter describes how to access the STScI archive via *XStarview* and the World Wide Web interface, how to register as a user, how to retrieve data to your home system, and how to obtain relevant documentation.

Accessing the Archive

As described in Chapter 1, there are two ways of accessing the STScI Archive: through the program *XStarView* and through a WWW interface. Both ways let the user browse the Archive for data of interest and preview publicly available data. After you register as an archive user, *XStarView* and the WWW interface will also let you retrieve data from the Archive.

STScI used to maintain an archive host computer from which one could run StarView by logging in as a guest. For security reasons this service has been discontinued. All users need to install the distributed version of StarView directly on their local machine (a ten minute task on Sun workstations). You may find that another member of your department has already installed StarView on your cluster, in which case, you should be able to start examining the STScI Archive simply by typing the command:

```
% xstarview &
```

Be sure to read the welcome screen when you start *XStarView*. The welcome message is retrieved from STScI, and we use it to post news items. More information on distributed StarView can be found on page 11. Chapter 4 of this manual is a tutorial to using the archives with *XStarView* and provides the user with all the basic information one needs to access the STScI archive.

Alternatively, one can use our WWW interface at `http://archive.stsci.edu/mast.html` to access all the HST and non-HST data available from MAST, the Multimission Archive at the Space Telescope Science Institute. The WWW interface can be accessed by any Web browser from a range of hosts, including PCs and Macintoshes. Chapter 3 of this manual provides more information on this interface.

Our WWW site contains also the most up to date information regarding the Archive, including documentation, recently added features, forms for user registration, and other archive services.

Registering as a User

A guest user has full access to the HST catalog and previews of public data. However, *only registered users can retrieve HST data*. You can register as an HST Archive user by using our WWW form at `http://archive.stsci.edu/registration.html` or by sending e-mail to `archive@stsci.edu`. You will be notified by e-mail of your registration as an archive user within two working days of the time when your request is received and you will be provided with a username and a password. If your archive account is idle (i.e., no data have been retrieved) for more than one year, it will be deactivated. Reactivate expired accounts by contacting the archive hotseat.

Registration is not necessary to access non-HST data which are not delivered by ST-DADS. This includes all MAST data (apart from FIRST data retrieved via *XStarView*).

Authorized Users and Proprietary Data

HST GOs and GTOs can retrieve their proprietary data from the archive. To do so, they must be registered and authorized users. GOs and GTOs desiring this option must register with the archive and send e-mail to `archive@stsci.edu.` Only PIs may authorize anyone to access their data. If a co-I wishes access to their HST data, they must have the PI on the proposal send the archive e-mail stating the proposal ID number and the identities of anyone who should be able to retrieve the data. (Other authorization pathways may be in effect in the future, but this method will always be available.) We note that for security reasons, proprietary data cannot be retrieved to the staging disk even by authorized users. All proprietary data must be either directly retrieved to the user's machine or to tape. Either of these options can be specified from *XStarView* or the WWW interface.

Distributed StarView

The client-server version of StarView runs on your local machine and sends a request to our data base server when it needs information. The distributed version is the only one currently available, as users can no longer log in on the archive host computer. Distributed StarView is available for Unix for Sun SparcStations running SunOS 4.1.3, SunOD 5.5.1, and DEC Alpha systems running Digital UNIX V4.0 (Rev. 386). It typically takes only a few minutes to install StarView on Sun workstations. Installation on VMS systems (VAX or DEC Alphas running OpenVMS) is more time-consuming, but it is possible if you are already running the following software:

- OpenVMS, VAX or Alpha V6.2.
- DECWindows Motif Version 1.2-4 for OpenVMS
- CISCO MultiNet V4.0 Rev A-X

Instructions for ftp'ing the relevant software or automatically downloading it over the World Wide Web can be found in the Archive WWW page `http://archive.stsci.edu/dist_starview.html.` This site will contain the most recent installation instructions appropriate to the current version of *XStarView*.

Getting Your Data

HST Data

Registered users can retrieve HST data from the STScI Archive by submitting a data retrieval request through *XStarView* or the WWW interface. Users will be asked to specify whether to retrieve data directly to their home machine (NET), to the Archive staging disk (HOST), or to tape (TAPE; default is Exabyte). For *every* request you will be asked for your archive username and password. (Note that the password that you were given when you registered can be changed from the Commands pull-down menu in

XStarView.) For a NET retrieval, you will also be required to give your home username and password so that data can be written to your disk.[1] For large data requests (more than 500 Megabytes) and slow Internet connections, consider requesting a tape of the data.

After you have submitted your request, the archive system will process it. You will be notified immediately by e-mail when ST-DADS has accepted the request and again when ST-DADS has completed processing the request, indicating whether or not the transfer was successful. The messages will go to the e-mail address that you specified on your archive account registration form.

How long a retrieval takes depends on a variety of factors, including: the type of data in the request (some kind data are stored offline and requires an operator's intervention), the size of the request (the larger the request the longer it takes, both to move the request up the queue, and to retrieve the data), the number of requests in the system at the time, and the destination of the request (the internet connections between STScI and some sites, especially those overseas, is sometimes a significant source of delay).

If everything is running smoothly, one should expect a median turn around time of a few hours. If it takes more than one day, and you do not think any of the factors listed above are playing a significant role, please contact us.

If you choose to retrieve the data to the archive host machine (HOST option), the data will be written to a subdirectory of the Archive staging disk[2]. Each data retrieval request will be in its own subdirectory, identified by the request ID number (which will be included in the notification message). To find your data, from your home account type:

```
% ftp archive.stsci.edu
% login: anonymous
ftp> ls (to find your directory, e.g. USER0123)
ftp> cd USER0123
ftp> ls
```

After locating your data on the archive host, you can transfer it across the Internet using FTP (as described in the next section). Alternatively, you may specify a data location at your own site, or for large requests, ask for an Exabyte tape, which will be sent to the address you specified when you registered.

The following section explains how to transfer your data. Because we have many users, the disk space available to each user

1. External users may prefer to specify an anonymous incoming ftp site at their institution. Notice however that, when using our WWW interface, we protect your destination information with the same kind of secure Web mechanism that is used by commercial sites.

2. Note that proprietary data cannot be retrieved to the host machine archive.stsci.edu even by authorized users.

within the data directory is limited. The files you create in the data directory are temporary and are deleted automatically after two days. However, we would appreciate notification that you have completed copying over your retrieved files so that we may delete them. (Send email to `archive@stsci.edu`.)

MAST Data

Non-HST MAST data can be obtained via the MAST WWW pages, all accessible from `http://archive.stsci.edu/mast.html` by selecting the data of interest. Most MAST data can be currently retrieved via FTP by ‘‘clicking’’ on the file names. More information on MAST searches and retrievals is provided in Chapter 3 of this manual.

Using FTP

If you have used the HOST option to retrieve your data to the archive host computer (archive.stsci.edu), you must then transfer your files to your local computer via anonymous FTP *from your own computer*. You can also use FTP to acquire any of the ASCII files, such as the PostScript versions of the *HST Archive Manual*. See Table 2.1 for examples of ftp sessions.

Sample Function	Unix Commands

Retrieve HST data (*registered* users only) from the data directory as named in the acknowledgement e-mail - in this case, “dir0129”	`%ftp archive.stsci.edu (or stdatu.stsci.edu)`
	`(login as “anonymous”)`
	`ftp> cd dir0129`
	`ftp> ls`
	`ftp> binary`
	`ftp> mget x*`
	`ftp> bye`

Retrieve PostScript and/or text versions of manual, abstracts, catalogs, general information. Those files that end in .Z can be uncompressed with the unix command “uncompress” and those that end in .gz require the command “gunzip”. The uncompressed files are also available.	`ftp archive.stsci.edu`
	`(login as “anonymous”)`
	`ftp> cd pub/manuals (or pub/forms or pub/hdf etc.)`
	`ftp> ascii`[a]
	`ftp> ls`
	`ftp> mget *.ps.Z` *(or whatever)*
	`ftp> bye`

a. As appropriate. In the case of the Hubble Deep Field images, “binary” would be the appropriate datatype.

Table 2.1: File Access Commands for Archive Users

Documentation on the Telescope, Instruments, and Data

You can obtain a wide range of technical documentation on the telescope, its instruments, and HST data from the Science Support Division helpdesk at STScI. The Science Support Division Help Desk, serves as a central contact point between the scientific community and STScI and central clearinghouse for hotseat questions. All documentation requests and data/instrument questions should be directed to `help@stsci.edu`.

Science Support Division Help Desk
Space Telescope Science Institute
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Some of the documentation available includes the following. These documents are also distributed to astronomical libraries.

- *HST Archive Manual*
- *HST Data Handbook (I & II)*
- *STSDAS User's Guide*
- *FOC Instrument Handbook*
- *FOS Instrument Handbook*
- *GHRS Instrument Handbook*
- *NICMOS Instrument Handbook*
- *STIS Instrument Handbook*
- *WF/PC Instrument Handbook*
- *WF/PC 2 Instrument Handbook*
- *FGS Instrument Handbook*
- *OTA Handbook*
- *Target Acquisition Handbook*s
- *Calibration Status and Plan*s
- *The GO and GTO Observing Programs*
- *STEIS instructions*

HST Data Handbook

The *HST Data Handbook* provides a comprehensive guide to all major aspects of HST data reduction and analysis. The handbook describes the contents of each dataset, how to display HST images and spectra, ways to identify and correct problems in your HST data, and instructions for doing common analysis and image reconstruction tasks. The handbook assumes no prior knowledge of HST data, the IRAF or STSDAS systems, or any specific knowledge of HST instruments, other than that required to have prepared an observing proposal.

The latest version (3.0, October 1997) of the handbook adopts a modular organization that lends itself to frequent updates. Individual chapters may be updated at any time as new information becomes available.

The HST Data Handbook is now split into two volumes:

- Volume I, Current Instruments: Includes those instruments currently active (1997) on the telescope; FOC, FGS, NICMOS, STIS, and WFPC2;
- Volume II, Heritage Instruments: Includes instruments removed from the telescope; FOS, GHRS, HSP, WF/PC-1.

The *HST Data Handbook* can be requested through the archive hotseat (`archive@stsci.edu`) or the SSD help desk. It is also available on-line at `http://www.stsci.edu/documents/data-handbook.html`.

Finding Documentation

By using anonymous ftp to access archive.stsci.edu and exploring the `pub` directory, the user will find subdirectories that contain files of interest, including special HST data collections from some Key Projects, special HST-related user-generated data, and the Hubble Deep Field, documentation and forms. These files are available to anyone with access to the Internet and ftp software. For example, to get a copy of the most recent archive manual:

```
>ftp archive.stsci.edu
>login: anonymous
>passwd: your e-mail address
ftp> cd pub
ftp> ls [Lists the available directories]
ftp> cd manuals
ftp> ascii
ftp> mget archive_manual*.ps.Z
ftp> bye
```

Example: How to use anonymous ftp to get archive manuals.

If the files have a capital Z appended to their names (as in the above example), you will need to run a Unix utility called `uncompress` to expand the files to their original form, e.g. `uncompress archive_manual01.ps.Z` will restore the file `archive_manual0l.ps`. Those files that end in .gz were compressed with the utility `gzip` and can be uncompressed with the utility `gunzip`.

Most of the HST and Archive documentation is also available on the WWW. For example, many documents are accessible at `http://www.stsci.edu/ftp/documents/html/documents.html`.

Manuals

PostScript files of the latest version of the *HST Archive Manual* are kept in the `pub/manuals` directory accessed by anonymous ftp to stdatu.stsci.edu.

The *HST Archive Primer* used to provide all the basic information needed to search the HST catalog and to retrieve HST data using the STScI archive host computers. The *Primer* is not available anymore, as all the information it provided is now given in the first three Chapters of this manual. This document, the *HST Archive Manual*, provides more detailed information about StarView and its higher level functions, and about the design of the HST Catalog and Archive.

On-line access to this document is also available at `http://archive.stsci.edu/hst/documentation.html`.

Forms

Forms related to archival research, such as the *HST Archival Data Request*, *HST Data Distribution*, *HST Archive Account Registration*, and *HST Archival Research Visit Request*, are maintained as PostScript files in the `pub/forms` directory accessed by anonymous ftp to stdatu.stsci.edu. Some of these forms can also be found in electronic format on the Archive WWW pages.

Exposure Catalogs

The Archived Exposures Catalog (AEC) and the Planned and Archival Exposure Catalog (PAEC) are located in the `pub/catalogs` directory. Both the AEC and PAEC come in two versions—one that contains all targets and is ordered by RA and one that contains just solar system targets and is ordered alphabetically by target name. This directory also contains the catalogs of the text in proposal abstracts and proposal titles.

The AEC is updated monthly. The AEC is an ASCII list of observations in the HST Archive and contains information such as the target name, position, instrument, mode, and date on which the data become non-proprietary (publicly accessible). Information provided in the AEC is a selected subset of the keyword information stored in the HST catalog. The AEC is produced through an automated search of the catalog. For more information, see “ASCII Catalogs” in the Archive Manual. The AEC is also available on the WWW at `http://archive.stsci.edu/hst/aec.html`.

The PAEC is an ASCII listing of all HST targets approved for observation including all general observer (GO) and guaranteed time observer (GTO) observations. Thus, the PAEC includes information for all executed and planned HST observations. The PAEC is also stored as a table in the HST archive database and can be examined from within *XStarView* using the <Duplication Checking> search screen.

Target RA and Dec in the AEC and PAEC are in J2000 coordinates.

Using STSDAS/IRAF to Analyze Your Data

You can analyze or recalibrate HST datasets using STSDAS, which can be installed under IRAF. A comprehensive discussion of STSDAS and IRAF features or a tutorial on how to use the software is beyond the scope of this manual. Contact the STSDAS hotseat `(help@stsci.edu)` for answers to any STSDAS-related questions that you may have. To learn how to use this data analysis package, you can request copies of the documentation by sending e-mail to `help@stsci.edu`. Various STSDAS and software related documentation is also available on-line at `http://www.stsci.edu/ftp/documents/html/documents.html`.

When a Retrieval Fails

Occasionally, a retrieval fails because of a network timeout, disk space inadequacy, or other reasons. The staff at `archive@stsci.edu` are available for any questions about the request. (See page 5 for full help desk information.) If after checking with the support staff you find that the retrieval request itself was sound, you can resubmit a retrieval request without having to go through StarView. The program **sv_dads_retrieve** allows you to retrieve files directly from DADS. It is, in fact, the program that StarView calls during a retrieval request.

You invoke **sv_dads_retrieve** on a .req file from a previous request. These files are written by StarView into the directory `.svdata` on Unix systems or into `[.svdata]` under sys$login in VMS. (These directories are by default written into the home directory; they can be redirected by setting a local environment variable SV_DATA_DIR. See Hint on page 30.) The .req files are named after the date and time when the request was sent; for example, 940926_163536.req was sent on 26 Sep 1994, at about 4:35 pm EST. Alternatively, you could construct a `.req` file from scratch, using a previous req file as a template. If the passwords are left out, **sv_dads_retrieve** will ask for them.

The following examples show how to start up **sv_dads_retrieve** on different operating systems.

On Unix systems:

```
% source /usr/local/cmo/starview/svinit.csh
% sv_dads_retrieve
```

On the VMS Science Cluster at STScI:

```
$ @DISK$ABELL:[DMFOPS.STARBASE.STARVIEW]SVINIT
$ SV_DADS_RETRIEVE
```

On STOSC (the Institute operations support cluster):

```
$ @DISK$ZARDOZ:[STARBASE.STARVIEW]SVINIT
$ SV_DADS_RETRIEVE
```

3 The World Wide Web Archive Interface at STScI

In This Chapter..

This chapter describes the World Wide Web interface to the STScI archive and provides hints on how to search and retrieve data from the HST and Multimission Archive at the Space Telescope Science Institute (MAST). It also describes briefly the various MAST data sets. Readers should be aware that the archive WWW pages are still evolving so the description given here will be of a general nature. The HST page is available at `http://archive.stsci.edu`, while the MAST page is available at `http://archive.stsci.edu/mast.html`.

The HST WWW Interface

The HST WWW archive interface is one of the two user interfaces to the Hubble Space Telescope data archive (the other one being StarView). It provides a fast way of doing relatively simple searches for existing data in the archive. Using the WWW interface one can:

- Browse the contents of the archive;
- Select observations of interest;
- Preview public data;
- Retrieve data from the archive for scientific analysis.

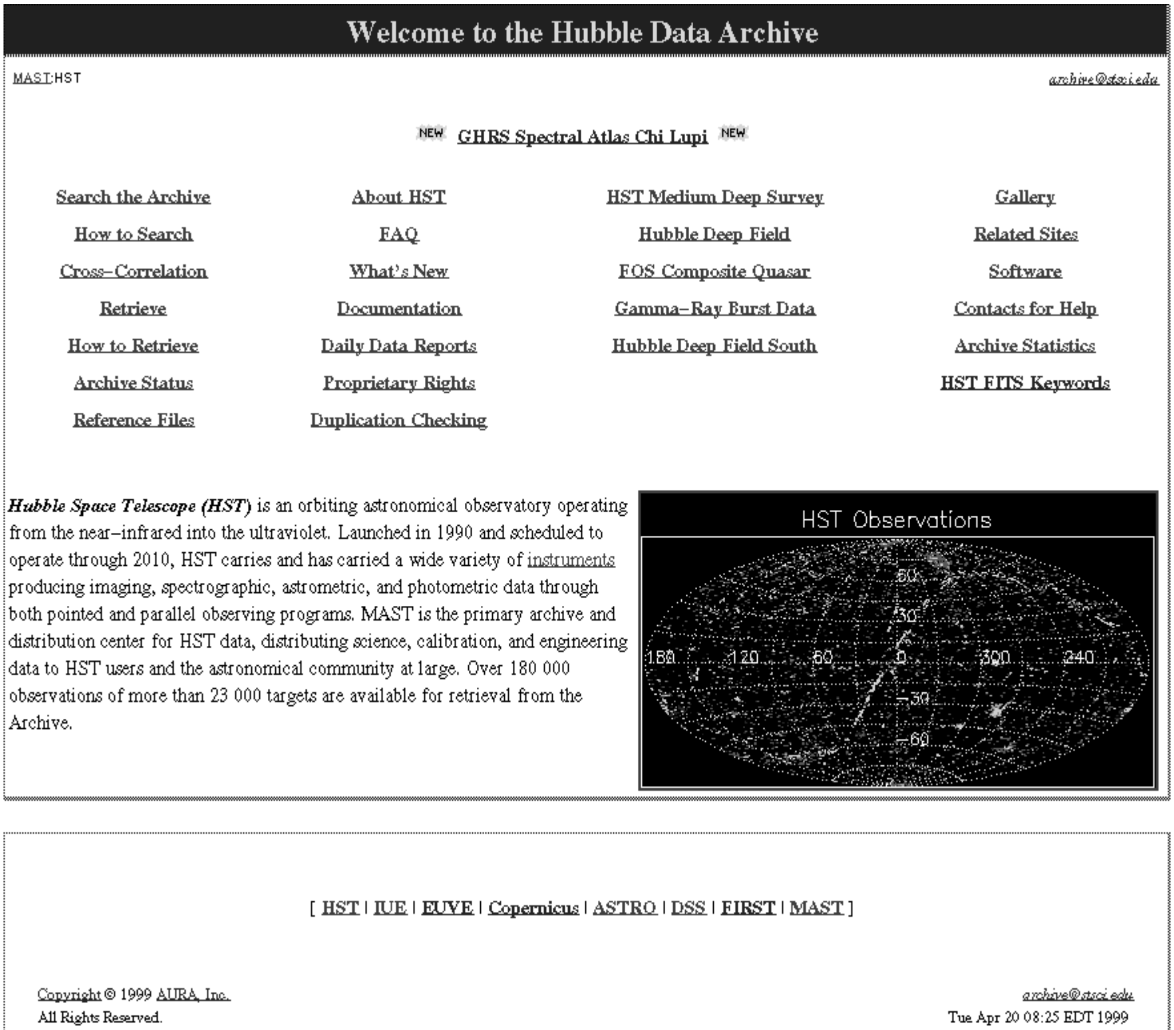


Figure 3.1: The main HST WWW page at `http://archive.stsci.edu.`

The main HST WWW page is shown in Fig. 3.1. The page not only provides access to the archive interface but also allows users to access a variety of up-to-date archive information, ranging from archive status, reference files, latest developments, on-line documentation, etc. A list of frequently asked questions is also available.

We now describe the main features of the HST WWW interface.

Searching the HST Archive on the Web

The search page, accessible from the main HST page (**[Search the Archive]**), allows the user to search the HST archive on a variety of parameters, ranging from object name and position, to observation date, observer's name, and program ID, to instrument and observation band. The name of the astronomical object can be resolved using either the NASA/IPAC Extragalactic Database (NED) or the Set of Identifications, Measurements and Bibliography for Astronomical Data (SIMBAD) for the resolver, by using the **[Resolve]** button. The search form will then be redrawn with the object's right ascension and declination entered as defaults in the RA and Dec fields. Resolving an object name will not change any other choices made in the form. (One does not have to hit the **[Resolve]** button. If one enters an object name, selects either SIMBAD or NED, and then hits the **[Search]** button, the script will get the coordinates before doing the search.)

Archive users should always use object-name resolution to find observations of fixed targets in the database. This is the most reliable way to look up observations, because the observer could have specified any name at all. The SIMBAD and NED object name resolvers can only resolve the names of fixed astronomical object. In the case of objects with variable coordinates (planets, comets, etc.) the search should be done by typing the source's name, embedded in wild card delimiters (e.g., *MARS*), in the object name field, selecting at the same time the **[Don't Resolve]** button.

Archival researchers interested in finding HST observations of a particular class of sources should use the ‘‘Target Description’’ field. This includes a short description of the target, supplied by the observer during the Phase II (planning) process. Although these descriptions may not always be accurate (one observer's CLUSTER OF GALAXIES may be another's ELLIPTICAL), they are usually a good starting point. However, care should be taken in their use: for example, specifying *QSO* in this field will find all targets with this description but will not find the *QUASAR* ones. (To do that one should specify ‘‘*QSO* *QUASAR*’’.) Users are strongly encouraged to check the up-to-date list of all target descriptions currently in use. This is generated automatically every day and posted on the WWW at `http://archive.stsci.edu/hst/daily/target_descriptions.html.` Datasets matching a given description and a particular instrument can be found simply by ‘‘clicking’’ on the hyperlinks in the page. The cross-correlation page, described below, provides a more reliable way to search for specific (selected) classes of astronomical objects.

Some fields can take ranges as input. Namely: the radius, observation date, exposure time, release date, and archive date fields. For example, one can search in a region between 3 and 10 arcminutes from a target by entering “3..10” in the radius field. Or by typing “> Dec 9 1998” in the observation date field one will get all observations obtained after that date.

Users can obtain help on a particular field by ‘‘clicking’’ on the link above that field. A **[Help]** link for the whole search page is also available.

Previewing and Retrieving Data

After filling out the search page and ‘‘clicking’’ on the **[Search]** button, the search interface returns a list of datasets matching the query submitted by the user. (The default is 100 records but this can be changed by using the **[Maximum number of hits]** button on the search page.)

The list includes various columns with target parameters namely target name (as given by the proposer), coordinates, instrument, operating mode, dataset name, etc. The default output columns can be modified by pressing the **[Custom]** radio button and selecting the columns of choice from the list underneath ("Mark" is pre-selected). The output columns will be in the order in which they appear in the list.

The user might want to have a ‘‘quick look’’ at the data before retrieving them. If the target name is hyperlinked, then a preview image or spectrum is available for that observation. Clicking on the target name in that case will bring up the preview form (which lets the user select the format of the preview). Occasionally, one will see target names like PAR, UNKNOWN-TARGET, and so on; these are (most likely) parallel observations, which are observations done by one instrument while another one is making the primary observing of the telescope's visit. Previews are obviously not available for proprietary data.

The **|More info|** column provides links to other pages to obtain additional information on the target. Namely, the Digitized Sky Survey (**DSS**) link displays an image of the field of the target overlaid with the HST field of view, the **[NED]** link searches NED, which provides basic data and references for extragalactic sources, the **[IUE]**, **[EUVE], [HST]**, and **[FIRST]** links start a search for the same target in these archives (see next section).

All datasets have a **[Mark]** button for retrieval (records with a @ character next to the button are proprietary and may only be retrieved by authorized users). The user can mark the datasets of interest to submit them for retrieval to DADS. This will produce a screen with a list of only the marked datasets. The list can then finally be submitted to DADS by filling in a WWW form with the archive username and password, delivery option (NET, HOST or TAPE), and type of files requested. As described in detail in Chapter 2, the archive system will use e-mail to first acknowledge acceptance of the request and then to inform the user when the request has been completed.

Cross-Correlations

Another WWW interface, available from the main HST page (**Cross-Correlation**) and accessible at `http://archive.stsci.edu/search/`, enables the cross-correlation of an Active Galactic Nuclei (AGN) catalog, a galaxy cluster catalog, and a star catalog, plus any user-supplied list of positions, with the HDA. Individual HST instruments, each with a different correlation radius, can be selected.

This is meant to facilitate archive searches for specific classes of astronomical sources. Using this interface, for example, one can select AGN by class, redshift, magnitude, and 6 cm radio flux from a catalog based on Véron-Cetty & Véron (1996), ESO Scientific Report n. 17. The same tool allows one to cross-correlate these catalogs with other MAST missions, as described below.

A user-supplied file can be used to cross-correlate a list of sky positions with the HDA. The input file needs to have one entry per row, with each row containing columns delimited by either tab, comma, pipe, semicolon, or colon.

Duplication Checking

This interface was designed to facilitate duplication checking by proposers who are writing their Phase I, or initial, proposals to apply for HST time. An observation is defined as duplicating a previous one if it is on the same astronomical target, with the same or similar instruments, a similar instrument mode, and a similar spectral range. Proposers must check their proposed observations, identify possible duplications and justify them. Available at `http://archive.stsci.edu/hst/duplication_checking/`, this interface allows a user, by simply entering her/his proposal ID or name, to check for duplications amongst cycle 7, 8, and 9 proposals. (This is especially useful for cycle 6 and 7 PIs, who are now *required* to check for programs conflicting with their own observations.) For more complex duplication-checking one should use the interface at `http://archive.stsci.edu/cgi-bin/duplication.` Note that because these interfaces find duplication candidates by position, they are not appropriate for finding duplications of solar-system observations. In that case, observers can use the Planned and Archived Exposures Catalog (PAEC), in particular, the solar system version, available at `http://archive.stsci.edu/hst/paec.html.`

PDF “Paper Products”

This interface allows users to search for, and display, the HST observation summaries now offered in Portable Document Format (i.e., PDF). These documents, formerly available only in hardcopy form and referred to as the HST "paper products", provide a quick first look at the data, drawing on information in the PDQ file. The WWW interface is available at `http://archive.stsci.edu/hst/pdf_home.html`.

The page can be used to select various search criteria to locate particular PDF files. Submitting the form without entering any criteria will return the entire list of available documents. By default, up to 100 entries are returned. Each row of the search result table describes one PDF file. To see a summary of the observations contained within each file, click on the **contents** entry. The search page also contains links to the requested PDF files. Clicking on the file names will display the PDF file using Adobe Acrobat Reader. The PDF documents are password protected (unless the proposal is a calibration program) and you will need your archive name and password to access documents. We note that this interface is not intended for general archive users but specifically for PIs of HST programs.

The MAST Data Sets

The Multimission Archive at STScI has been developed to support a variety of astronomical data archives, with the primary focus on scientifically related data sets in the optical, ultraviolet, and near-infrared parts of the spectrum. MAST is funded by NASA's Office of Space Science through a grant from NASA and other grants and contracts. Initially set-up to hold, with the Hubble Data Archive, the International Ultraviolet Explorer archive, MAST has evolved by holding, or providing links to, many other missions or projects. These can be accessed through the MAST page at `http://archive.stsci.edu/mast.html`. MAST data, in addition to those in the HDA, include, as of June 1999:

- *International Ultraviolet Explorer (IUE) Final Archive*. This contains over 104,000 spectral images of approximately 10,000 individual astronomical sources (covering the 1,200 to 3,350 Å range) obtained by IUE over the course of its lifetime (from 1978 to 1996). Experienced IUE staff members are also available at MAST to assist researchers working on IUE data.
- *Copernicus Archive*. This includes individually scanned and averaged far- (900 - 1,560 Å) and near- (1,650 - 3,150 Å) ultraviolet spectra of 551 sources, primarily bright stars, obtained by the Copernicus satellite, otherwise known as the Orbiting Astronomical Observatory 3 (OAO-3), from 1972 to 1981.
- *Extreme Ultraviolet Explorer (EUVE) Archive*. At present, this contains spectroscopic observations (in the 70 - 760 Å range) of about 400 sources, mostly galactic. EUVE, launched in 1992, is still operational.
- *Ultraviolet Imaging Telescope (UIT) Archive.* This contains about 1,600 images of more than 200 targets (covering the 1,200 - 3,300 Å range) obtained by UIT as part of the ASTRO-1 and ASTRO-2 Space Shuttle missions.
- *Hopkins Ultraviolet Telescope (HUT) Archive*. This includes about 500 ultraviolet spectra (in the 825 - 1,850 Å range) of more than 300 targets obtained by HUT as part of the ASTRO-1 and ASTRO-2 Space Shuttle missions.

- *Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) Archive*. WUPPE was designed to obtain simultaneous ultraviolet spectra and polarization measurements from 1,400 to 3,200 Angstroms. It collected about 400 observations of roughly 200 targets during the ASTRO-1 and ASTRO-2 Space Shuttle missions.
- *Digitized Sky Survey (DSS)*. The Catalogs and Surveys Branch of the STScI has been digitizing the photographic Sky Survey plates from the Palomar and UK Schmidt telescopes in order to support HST operations and provide a service to the astronomical community.
- *Faint Images of the Radio Sky at Twenty-centimeters (FIRST) Archive*. The FIRST project is designed to produce a radio survey at 20 cm (1.4 GHz) of over 10,000 square degrees down to a flux of 1 mJy. STScI provides access to the radio images and the source catalog, which currently includes about 437,000 entries.

STScI plans to incorporate additional ultraviolet and optical data sets into MAST in the future, including, among others, data from the Far Ultraviolet Spectroscopic Explorer (FUSE), currently scheduled for launch in mid 1999.

The MAST WWW Interface

The MAST WWW interface represents the only way to access most non-HST data (DSS and FIRST data are also available via StarView). Using this interface one can:

- Browse the contents of MAST;
- Select observations of interest;
- Preview data;
- Retrieve data from the archive for scientific analysis.

The main MAST WWW page is shown in Fig. 3.2. The page not only provides access to the MAST archive interfaces but also allows users to access a variety of up-to-date information, ranging from latest developments, on-line documentation, and data analysis software. A list of frequently asked questions is also available.

A simple form allows users to match the desired data parameters, in terms of wavelength range (from radio to extreme UV) and type of data (images, spectra or other, which include polarimetric and astrometric data), with the relevant archive(s)/mission(s). (For example, a search on “Near UV Images” returns WF/PC, WF/PC2, UIT, and STIS.) Additionally, every MAST mission has its own WWW page, which provides access to the search interface and also gives information about the mission.

We now describe the main features of the MAST WWW interface.

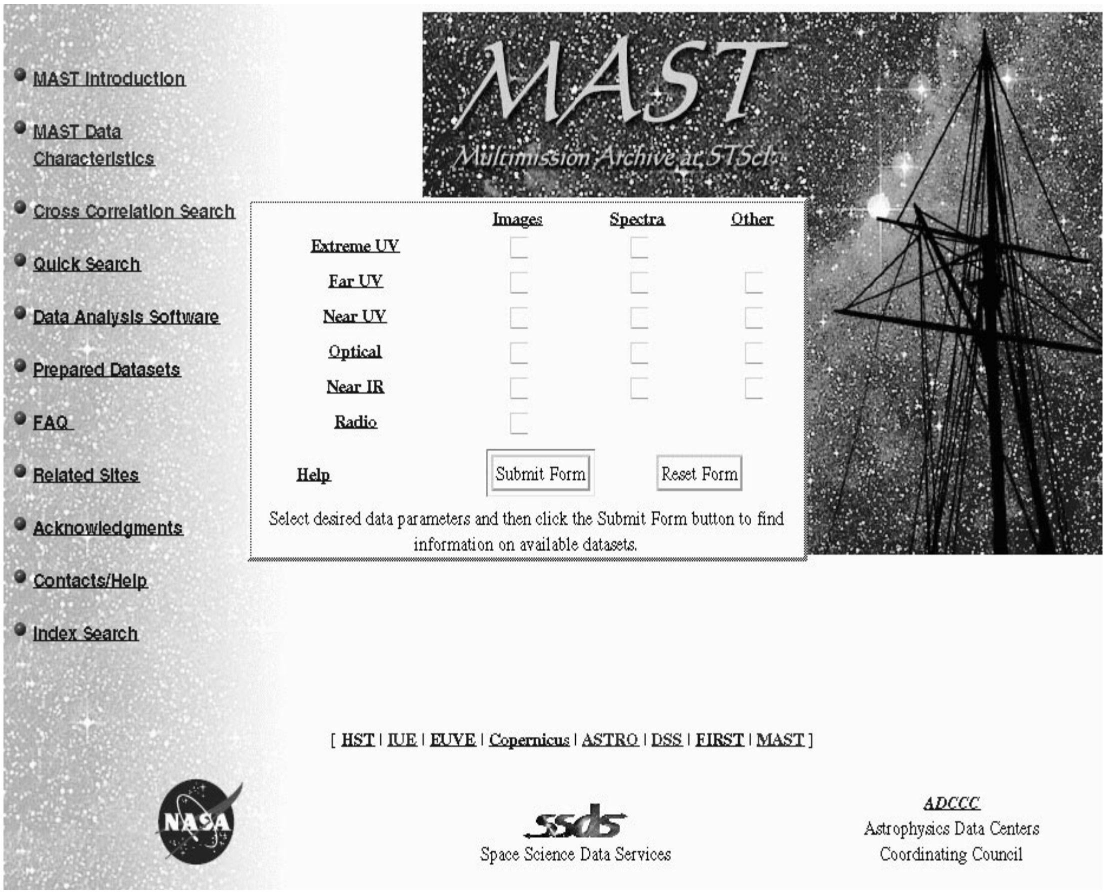


Figure 3.2: The main MAST WWW page at `http://archive.stsci.edu/mast.html`.

Searching the MAST Archive

A simple search of all MAST archives can be done using a "quick search" tool at `http://archive.stsci.edu/quick_search.html/`. By entering the name of a fixed target to be resolved, or the J2000 right ascension and declination separated by a comma, the user is returned with a list of all observations of that source in the MAST archives. Clicking on the mission (or HST instrument) link opens up another window with the specific search page already filled out with the coordinates of the object.

Every MAST mission, in fact, has its own search interface, with mission specific fields, but most interfaces are modeled after the HST one so STScI archive users should find them relatively familiar.

All pages allow the user to search a given archive on a variety of parameters, ranging from object name and position, to observation date, observer's name, and instrument. As for the HST interface, the name of the astronomical object can be resolved using either NED or SIMBAD.

Some fields, like observation date, can take ranges as input. Users can obtain help on a particular field by ‘‘clicking’’ on the link above that field. A **[Help]** link for the whole search page is also available. Archival researchers interested in finding MAST observations of a particular class of sources can use the **Object Category** field. This is more specific than the ‘‘Target Description’’ field available for HST observations and provides a detailed target classification. Its reliability depends on the mission but is normally relatively high. Only for IUE, in fact, the object class was provided by the Guest Observer, while for EUVE and the three ASTRO missions (UIT, HUT, and WUPPE) the categories were chosen by the project (for Copernicus data the classification was done at STScI based on the IUE classes).

Previewing and Retrieving Data

Retrieval of non-HST MAST data is simpler and faster than for HST data. No registration is in fact necessary (no username and password are required) and retrievals of most data require only to ‘‘click’’ on the file or target names (without going through ST-DADS). The following description applies to most MAST data.

The typical MAST search page returns a list of datasets matching the query submitted by the user. (The default is 100 records but this can be changed by using the **[Maximum number of hits]** button on the search page.)

The list includes various target parameters namely target name, coordinates, exposure time, etc. The user might want to have a ‘‘quick look’’ at the data before retrieving them. Previews are available for most missions and can usually be accessed directly by ‘‘clicking’’ on the object name. The **|More info|** column provides links to other pages to obtain additional information on the target. Namely, the **[NED]** link searches NED, which provides basic data and references for extragalactic sources, while links to other MAST missions start a search for the same target in these archives.

Retrievals can be initiated by marking the datasets of interest and then submitting the request (this is the default MAST retrieval procedure). In most cases this will result in the data files to be saved to the directory of choice on the user's computer[1]. Datasets may be downloaded as .tar, .tar.gz, .tar.Z, or .zip files. For some missions, files can be retrieved by simply ‘‘clicking’’ on

1. For a subset of IUE data (and for a limited time) the retrieval request will submit an e-mail to the NASA's National Space Science Data Center (NSSDC), located at Goddard Space Flight Center, where the request will be processed by the NASA Data Archive and Distribution Service (NDADS). Once the files have been retrieved an e-mail message will be sent to the user, who will be able to retrieve them via FTP. Ultimately all MAST data will reside at STScI and will be retrieved with a simple ‘‘click’’.

the file names (or on the EVT or IMG links for EUVE). Retrievals for all missions will be handled in the same way when all MAST data will be ingested in the MAST juke-boxes (and will all then be physically stored at MAST).

DSS and FIRST represent two somewhat different cases. The DSS interface returns a FITS file of the specified area of the sky (or around a specified astronomical source) the user is interested in. This can be displayed directly (if the browser is configured appropriately) or saved to disk. Similarly, the FIRST (**[Retrieve Image Cutouts]**) interface returns a radio image centered around a specified region of the sky (if covered by the FIRST survey). The source catalog can also be accessed from the FIRST WWW page (**[Search the FIRST Catalog]**) and provides detailed information on source parameters (positions, fluxes, size, etc.).

Cross-Correlations

The cross-correlation interface described above for HST currently also allows users to cross-correlate an Active Galactic Nuclei (AGN) catalog, a galaxy cluster catalog, and two star catalogs, plus any user-supplied list of positions, with the MAST archives. Individual missions (and HST instruments), each with a different correlation radius, can be selected. This is meant to facilitate archive searches for specific classes of sources spanning a given range of parameters. Multiple missions can also be selected, with the option to show only those sources that cross-correlate with *every* selected mission. For example, the user might be interested in finding all AGN that have been observed both with HST and IUE, or to find AGN observed with either HST or IUE.

We are planning to expand the choice of catalogs available for cross-correlation and thereby increase further the utility of this interface.

Prepared Data Sets

The MAST archive also contains (or points to) a number of ‘‘highly processed’’ data sets, which are typically spectra or grayscales (and in the future perhaps images) calibrated to a degree not permitted by routine pipeline processing. For example, the GHRS atlases include both lab and measured wavelengths of visible lines. These data have been published by various authors and have been made available generally both in the form of plots and ASCII data. They may be downloaded by simply ‘‘clicking’’ on corresponding links.

4 StarView Tutorials

In This Chapter...

StarView is one of the two user interfaces to the Hubble Space Telescope data archive (the other one being the WWW interface). Using StarView, you can:

- Browse the contents of the archive.
- Select observations that interest you.
- Preview public data.
- Retrieve data from the archive for scientific analysis.
- Select and retrieve calibration files to recalibrate HST data.
- Get information about planned but not yet executed observations.

StarView is fairly intuitive so many users find they can navigate the program using only the online help (use the **[Strategy]** button on any screen or the pull down **|Help|** menu in the menu bar). But we know you prefer reading informative and entertaining manuals over straining your eyes trying to make out tiny text on-line help screens. That knowledge gives documentation writers courage to carry on.

STScI used to maintain an archive host computer from which one could run StarView by logging in as a guest. For security reasons this service has been discontinued. As a consequence, StarView is now available in only one form, a distributed X-windows version running on the user's local system that sends requests for data to the server at STScI.

If you have any questions or problems using the archive, contact the HST archive hotseat via e-mail, `archive@stsci.edu`, or phone (410) 338-4547.

In this Chapter we present two tutorials designed to guide you through StarView and its principle uses. These tutorials include:

- A complete StarView session, including selecting observations and retrieving data.
- A description of commonly-used screens.
- A tutorial on selecting and retrieving calibration reference files.

Tutorial: Running Starview

In this section, a whole StarView session is presented. A second tutorial on selecting and retrieving calibration reference files is provided on page 51.

If Distributed StarView is installed on your system, and you are running X-windows, you should be able to start StarView by typing the command:

```
xstarview &
```

Running out of space during StarView searches? When running StarView you should make sure to set the StarView data directory to a disk with plenty of space prior to starting up StarView. StarView requires lots of scratch space for the file .svdata. If this space fills or is very near quota, the file can be truncated and cause StarView to act oddly: give segmentation errors and more rarely, flaky StarView screens. The default location of .svdata is your home directory. For Unix systems, include the following line in your .cshrc file, with a directory name (be sure to include the closing slash!):

```
setenv SV_DATA_DIR /myplace/bigdisk/name/
```

In VMS, put the appropriate version of this line into your login.com file:

$ DEFINE SV_DATA_DIR DISK$SCRATCH:[JOE]

Welcome Screen

The StarView <Welcome> screen (Figure 4.3) will appear. Upon start-up, messages in a little status screen say the system is “Loading the SQL query generator...”, etc. When the initial load is complete, the Welcome screen appears. If there is any urgent archive news (e.g., a message about possible system downtime), it will appear at the top of the welcome text. While the loading takes place, any input from your terminal keyboard will be ignored.

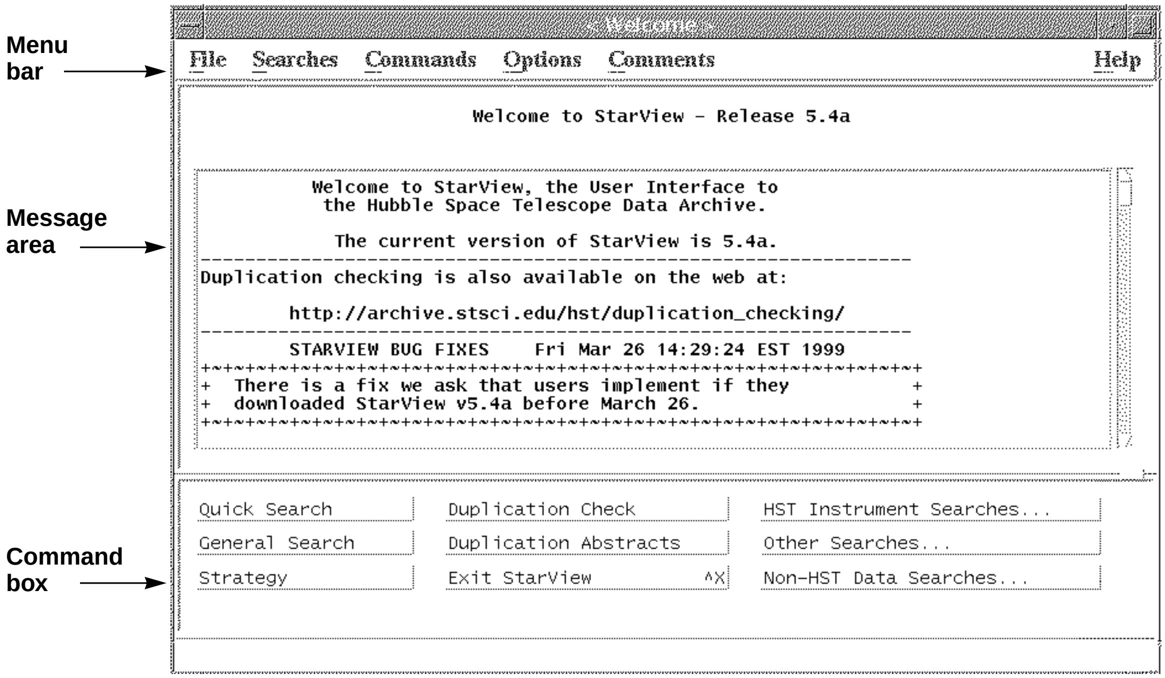


Figure 4.3: Welcome Screen

You can scroll through the text and read any additional information below the display area by using the scroll bar on the X-windows version of StarView.

Command Usage and Screen Interaction

- Use the mouse to select all functions.
- Choose options by positioning the mouse pointer over the command button or menu and pressing the left mouse button.
- Use keyboard shortcuts (listed on the menus) for faster performance.

Searching the Catalog

To search the catalog:

1. Choose a search screen.
2. Specify your search criteria, such as position and a release date before today's date so that you get public data.
3. Start the search by clicking on the **[Begin Search]** button.
4. Step or scan through all observations matching your criteria.

In this example we use the <Quick Search> screen to search the HST catalog.

The <Quick Search> screen is useful for most basic searches of the HST catalog. An extensive set of more detailed search screens is also available. To choose one of these, click on **[Other Searches]** or pull down the **|Searches|** menu from the menu bar. Figure 4.4 shows the <Other Searches> screen.

The Quick Search Screen

Choose the <Quick Search> screen by clicking the **[Quick Search]** button. Clicking in StarView is done by moving the cursor to the command button and pressing the left mouse button. The <Quick Search> screen is shown in Figure 4.5. We will use this screen to search for WFPC2 images of galaxy clusters.

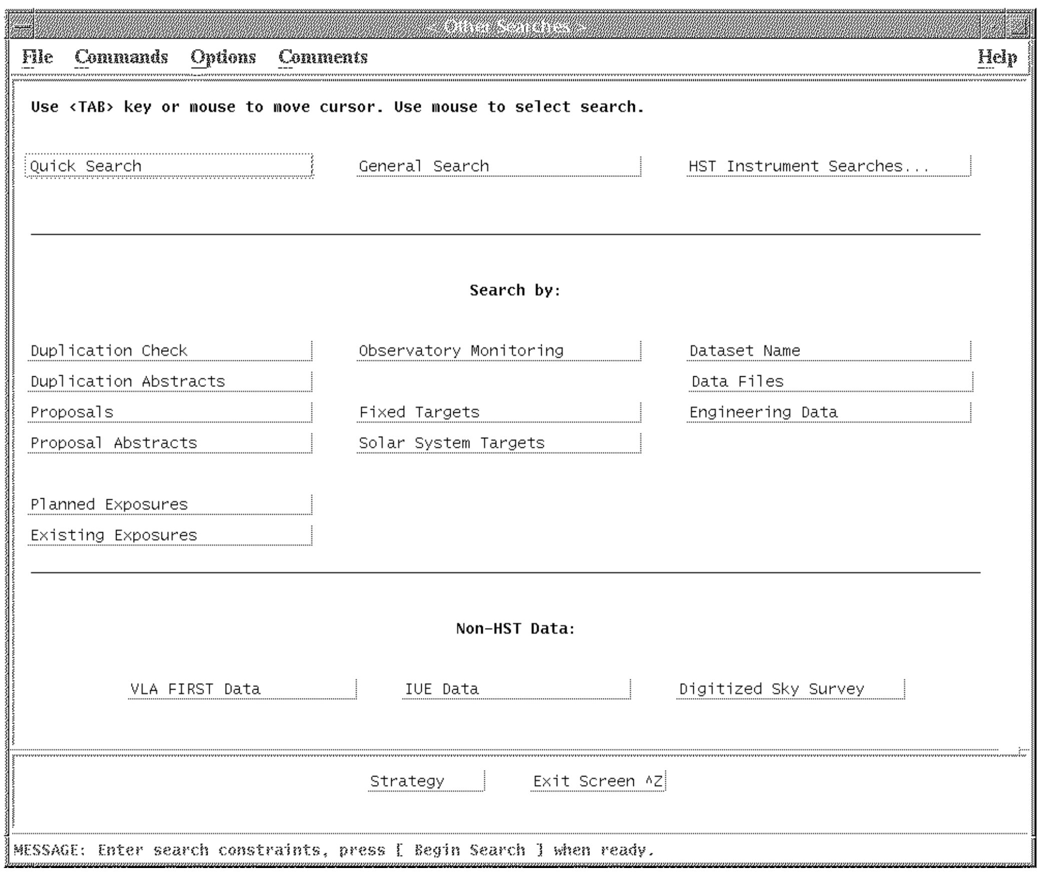


Figure 4.4: Other Searches Screen

Other Screens

All StarView screens can be accessed from the “Searches” pull-down menu or directly from the Welcome screen by clicking the **[Other Searches]** button. A subset of those screens is listed below:

- The <General> screen provides an expanded set of fields beyond those found in the <Quick Search> screen, including the filters and apertures used, exposure start time, and proposal type.
- The <HST Instrument Searches> screen provides access to the various instrument specific screens, which include reference, calibration, association, and On-The-Fly Calibration (OTFC) screens.
- The <Planned Exposures> screen can be used to check on the schedule dates and completion status of an HST proposal or to search for planned HST observations for a given target. This screen looks at tables made from the proposal entry and scheduling database at STScI.
- The <Proposal Abstracts> screen allows you to search on proposal-specific information, such as proposal title and keywords.
- The <Engineering Data> screen provides information on ephemeris data, engineering and engineering subset data, as well as mission schedules and mission time lines.
- The <Duplication Checking> and <Duplication Abstracts> screens are views of the complete lists of observations and potential observations. For checking conflicts or GTO plans, observers should use these screens (or the WWW interface at `http://archive.stsci.edu/cgi-bin/duplication`.)
- The <Digitized Sky Survey> screen, brought up from a button on the Other Searches screen, can access and retrieve images of the digitized Schmidt survey plates (Palomar Observatory Sky Survey in the north and the SERC Southern Sky Survey in the south) as stored on a collection of 102 CD-ROM disks in a jukebox. This screen also has a Preview facility with an option to overlay the HST field of view. The user specifies the FOV orientation angle and configuration (pre-launch or post-COSTAR).
- The <FIRST VLA> screen can be used to obtain VLA B-configuration, 20 cm images from a sky survey centered on the North Galactic Cap.

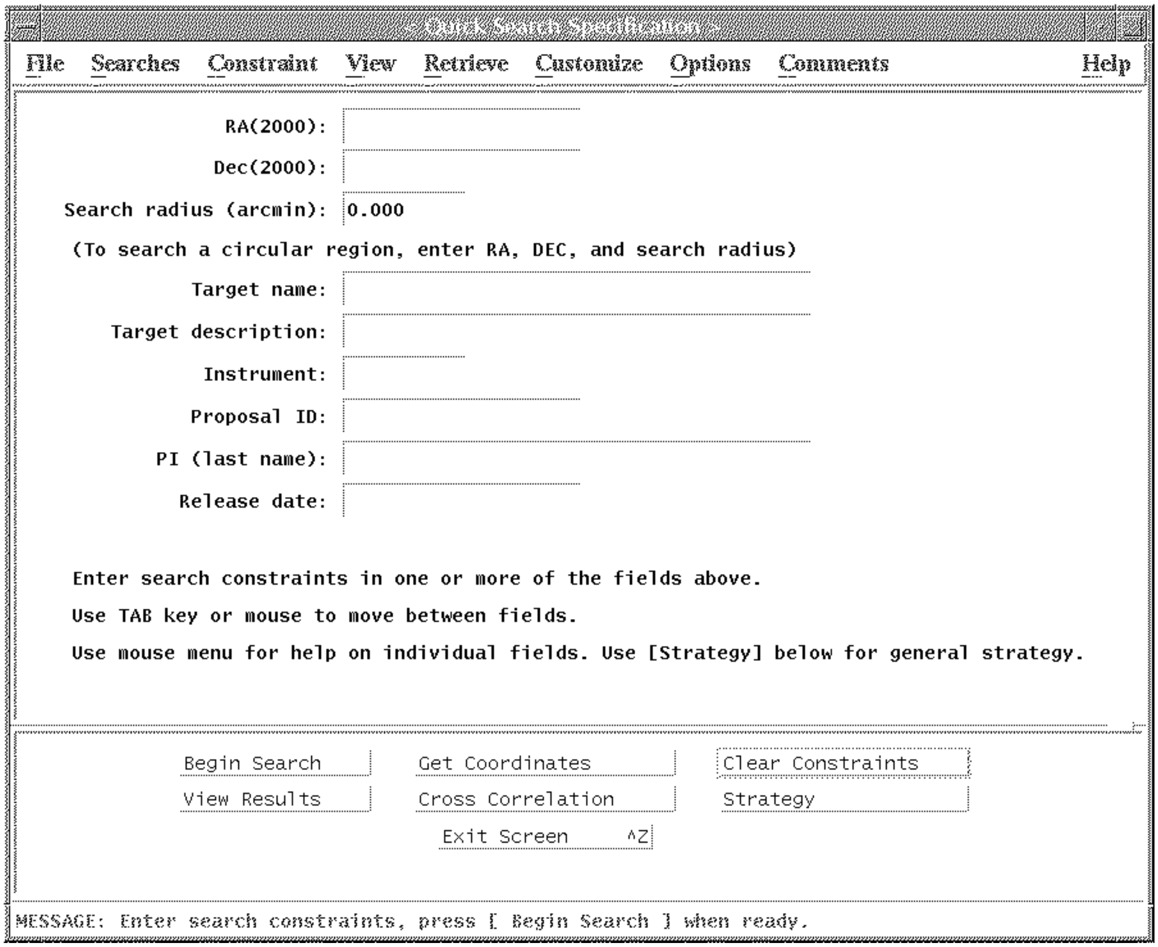


Figure 4.5: Quick Search Screen

Specifying Search Criteria

There are various ways to search for observations of a particular target in the catalog. The most reliable way to find a solar system target is to enter the name embedded in *qualifiers*, or wildcard characters, (e.g., *MARS*) in the target field.

The most reliable way to find fixed targets is by position. Because observers do not necessarily use the same convention to name sources, searching by name often will not return all observations of a given source. To be certain you retrieve *all* observations of a given stationary targets, search for observations within a given radial distance of your source's position by entering constraints in the RA, Dec, and search radius fields on the <Quick Search> Screen. Cross correlation is useful when you have an ASCII textfile, with a list of object coordinates in J2000 epoch, one object per line. For example, a file of the coordinates of the central galaxies in all Abell galaxy clusters with z>0.1 could be obtained by using NED (the NASA/IPAC Extragalactic Database) and with minor modifications, the same list could be used by StarView to search the archives. Consult the on-line help on cross-correlation for the proper format of the coordinate list.

If you do not know the RA and Dec of your target, you can click on the **[Get Coordinates]** button to connect to the SIMBAD or NED coordinate resolver from within StarView. The name resolver automatically determines the target's position. It then populates the RA and Dec fields on the search screen. If you are generally interested in extragalactic objects, you may wish to set the **[Get Coordinates]** button so that it connects to NED rather than SIMBAD. To change the name resolver from SIMBAD to NED, use the **|Options|** menu. To save your preferences from session to session, invoke **|Save Options|** from the Options menu.

Another way to search is by target description or class, as we do in the following example. Here we will search for all WFPC2 observations of galaxy clusters.

To find the STScI convention for a particular class, pull down the "Help" menu from the top right corner of the screen and look at the "Targets" entry. There you will find that the proper target description is "cluster of galaxies". Because an observer may have added other information to the description (redshift, for example) we use wildcard characters before and after the pattern of characters for which we are searching. In this particular example, over 5000 entries will be found. Be sure that your SV_DATA_DIR has adequate room for the storing the temporary disk records StarView creates during a session. (See page 30 for more information.)

We want WFPC2 observations, so click on the "Instrument" field and type "WFPC2". Other valid entries for the "Instrument" field are:

- Fine Guidance Sensors (FGS).
- Faint Object Camera (FOC).
- Faint Object Spectrograph (FOS).
- Goddard High Resolution Spectrograph (HRS).
- High Speed Photometer (HSP).
- Wide Field/Planetary Camera (WFPC).
- Wide Field Planetary Camera 2 (WFPC2)
- Near Infrared Camera (NICMOS).
- Space Telescope Imaging Spectrograph (STIS).

If you had wanted images from either WF/PC or WFPC2, you would type `wfpc,wfpc2`—StarView interprets the commas to be "or".

If you want to find only publicly-available data, you would constrain the "Release Date" field, for example, by typing `<1-MAY-1999` to find only data sets released before May 1, 1999.

Figure 4.6 shows how the <Quick Search> screen looks at this point.

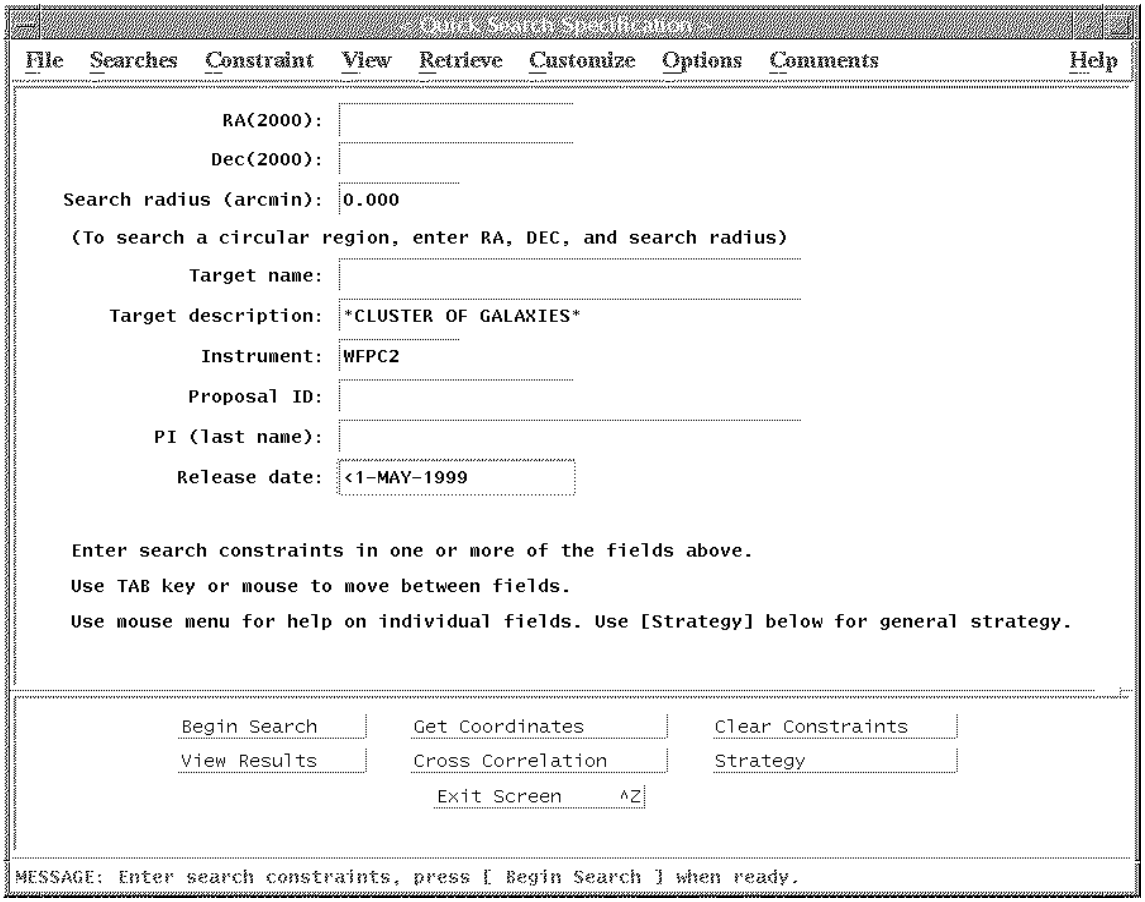


Figure 4.6: Quick Search Screen With Constraints Entered

A complete list of relational operators is provided in Table 4.1 (relational operators are the qualifiers for constraining a search). Some of these operators apply only to certain fields.

To determine which operators can be used in a given field, move the mouse over the field and press the right mouse button. A pop-up window provides information about the field, including a list of valid operators.

Operator	Function
=	Equal to
!=	Not equal to
>	Greater than
>=	Greater than or equal to
<	Less than
<=	Less than or equal to
..	Range
, (comma)	List
*	Wild card
!	NOT
&	AND
;	AND
|	OR
,	OR

Table 4.1: Relational Operators for Constraining Searches

Some Allowed Date Formats[a]
Jan 2 1999
2 Jan 1999
1/2/99
1-2-99
1.2.1999

a. Do not use commas in dates. StarView treats commas as an OR operator.

Table 4.2: A Subset of Allowed Date Formats in StarView

Text Searches

Text searches of abstracts, titles, and other text-based contents in the database can be useful. Usually one should embed words in the wildcard symbol '*', e.g., "*MARS*." Operators such as an OR (comma or a vertical bar), an AND (a semicolon or an ampersand), and a NOT (an exclamation point) can be used in simple Boolean searches. If the NOT or AND operator is used, all strings are automatically wildcarded. The former is useful for excluding targets like "BIAS" or "FLAT" from the results. StarView text searches are not case sensitive.

Getting help in StarView

Use the **[Strategy]** button to get information about using any StarView screen, or use the pull down **|Help|** in the menu bar to see all the available StarView help. To get help on the valid ranges for any field, use the *field help*. That is, move the cursor to the field and press the right mouse button (or press the Help button of your keyboard).

Starting the Search

Click on the **[Begin Search]** button to search the catalog for the observations satisfying your search criteria. If none are found, a message will appear at the bottom of the screen, and you will need to enter different search constraints. If at least one observation is found, the screen will change to the <Quick Search Results> screen. The <Quick Search Results> screen (Figure 4.7) shows the results of your catalog search. The first record that matches your search criteria will be displayed.

Viewing Found Observations

If you want to scan the full list of your search results:

- Click the **[Step Forward]** button to view one record at a time.
- Click **[Scan Forward]** to see all of the found records in rapid succession. Press any key to stop the scan. By scanning forward to the end, you physically complete your query. Depending on your search criteria, you could find a large number of records.
- To go back to previous records, use **[Step Back]** or **[Scan Back]** buttons.

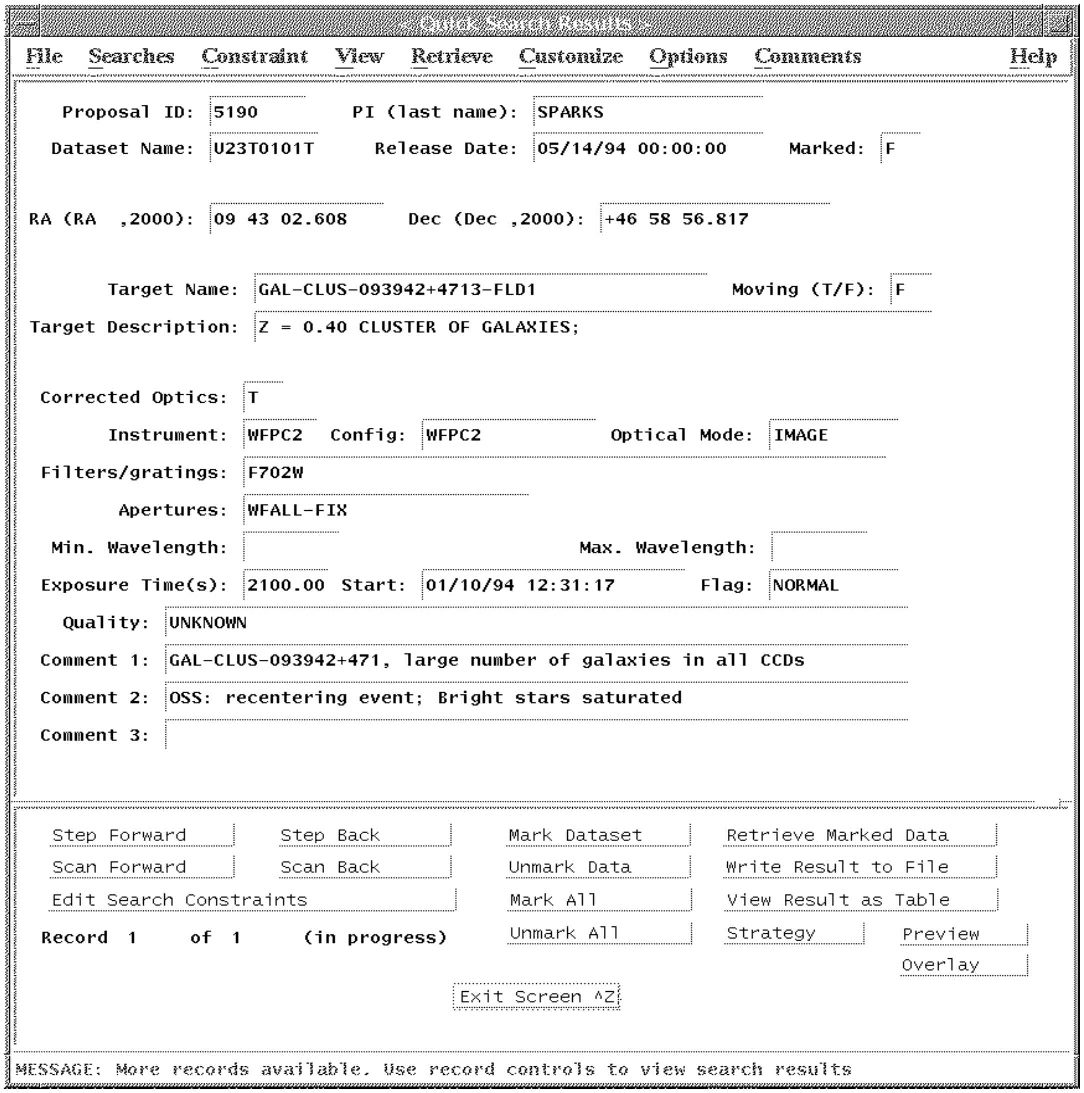
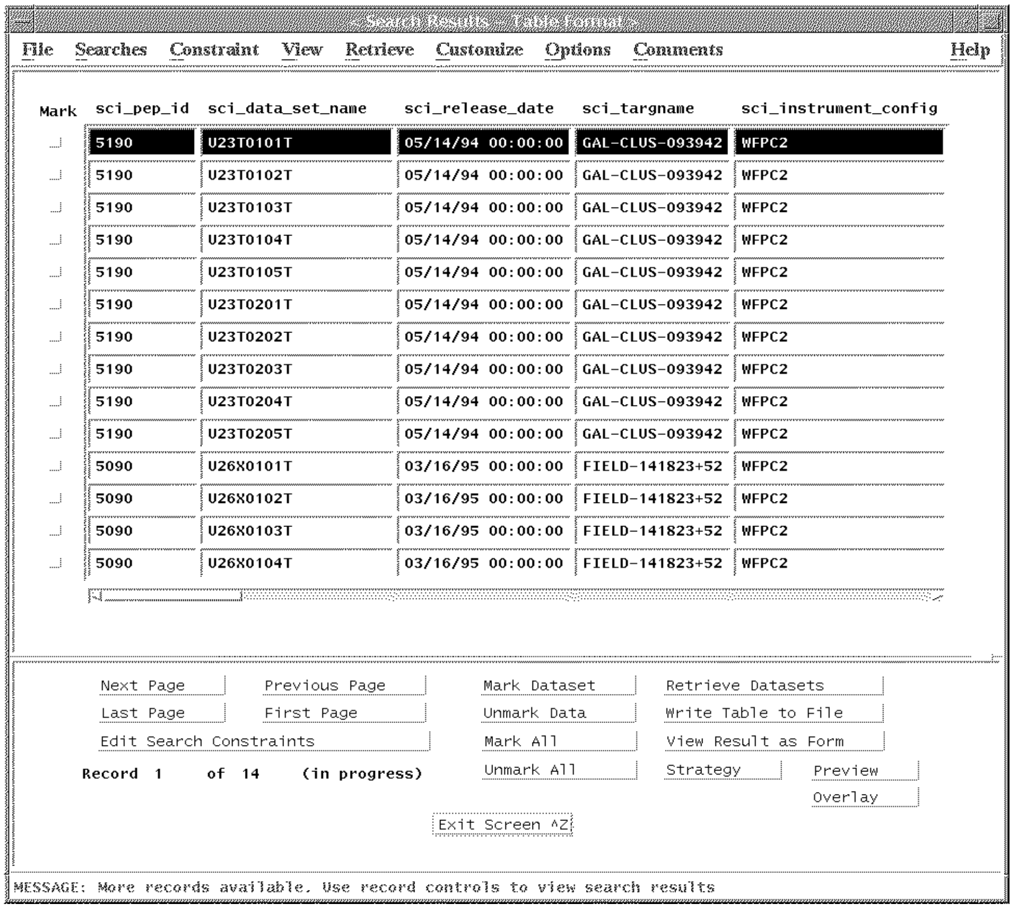


Figure 4.7: Quick Search Results Screen With Record Display

View your completed search results in a table with StarView's <Table Format> screen. Press **[Scan Forward]** to complete the query. Click **[View Result as Table]** to see a page of catalog records at the same time (see Figure 4.8). Select**[View Result as Form]** to return to the single-record screen format.



Mark	sci_pep_id	sci_data_set_name	sci_release_date	sci_targname	sci_instrument_config
	5190	U23T0101T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0102T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0103T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0104T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0105T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0201T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0202T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0203T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0204T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5190	U23T0205T	05/14/94 00:00:00	GAL-CLUS-093942	WFPC2
	5090	U26X0101T	03/16/95 00:00:00	FIELD-141823+52	WFPC2
	5090	U26X0102T	03/16/95 00:00:00	FIELD-141823+52	WFPC2
	5090	U26X0103T	03/16/95 00:00:00	FIELD-141823+52	WFPC2
	5090	U26X0104T	03/16/95 00:00:00	FIELD-141823+52	WFPC2

Figure 4.8: Quick Search Results Displayed on the Table Format Screen

Preview

The **[Preview]** button brings up a quick look at the data. Preview displays compressed HST images (not suitable for science analysis), as well as spectra. Most public data are available with previews[1]. Figure 4.9 shows an example of two datasets—one from a spectrograph, the other from the WFPC2 camera—viewed with the **[Preview]** command; spectra and images are displayed differently, so the figure shows both an FOS spectrum and a WFPC2 image. Images are displayed using SAOimage. Spectra are plotted using ACE/gr. These programs are publicly available and included in the distributed version of StarView .

1. The Canadian Astronomy Data Center is responsible for the production of data previews.

Previewing spectral data (sample is FOS data)

Previewing image data (sample is WFPC2 data)

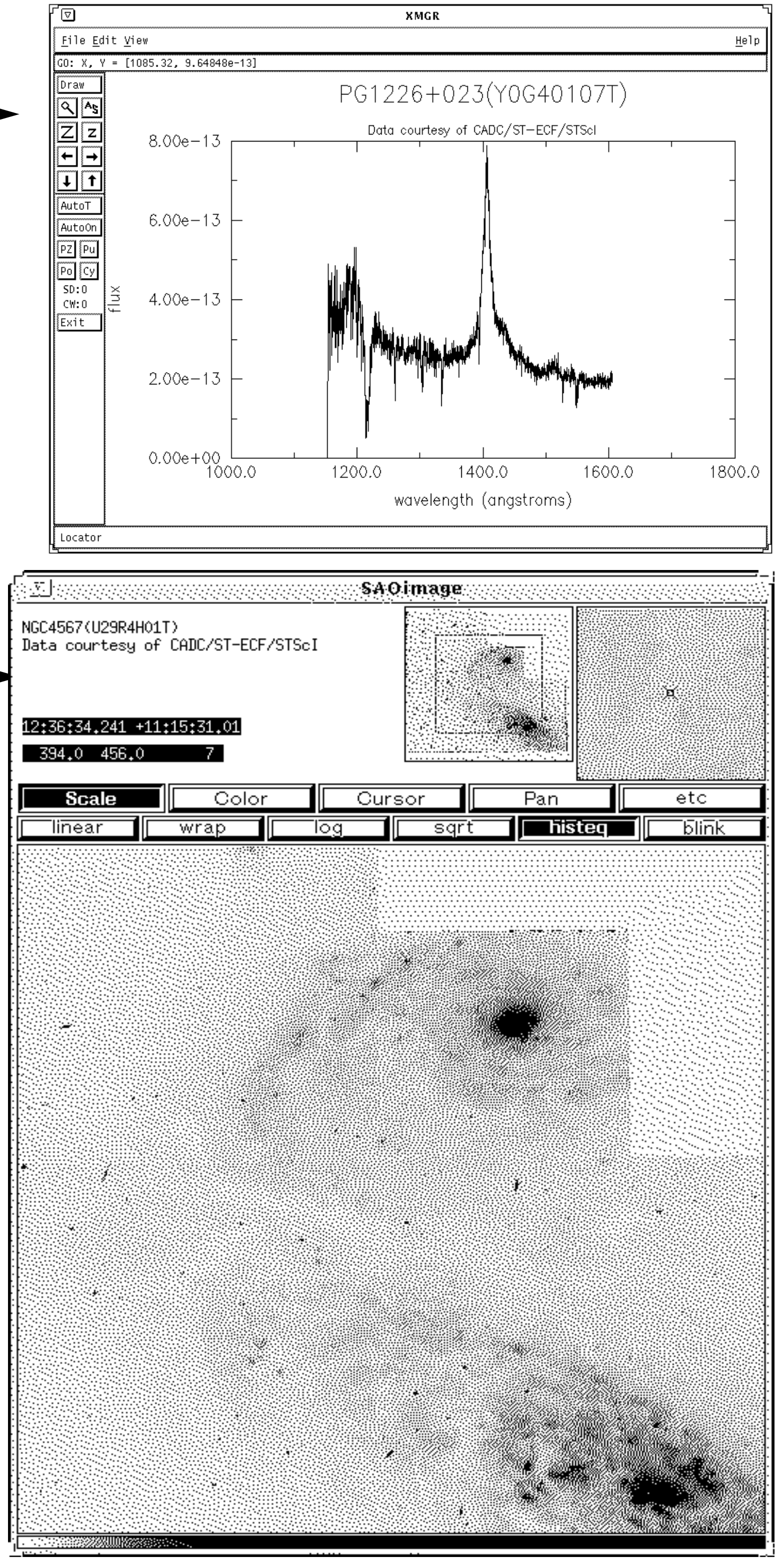


Figure 4.9: Previewing a Dataset

SAOimage will display the full intensity range of the previewed image, which in the case of WFPC/2 images includes substantial numbers of high intensity cosmic ray hits. To see low surface brightness features, you may find a log or sqrt scaling useful. For more information see the SAOimage help.

Saving Search Results to a File

You can save the values of any fields on the screen to an ASCII text file. To save a tabular version of results to a file:

1. Press **[Scan Forward]** to make sure that the query is complete.
2. Click on the **[View Result as Table]** button to see a table of all the cataloged records. The tables are usually larger than the screen. You can use the vertical and horizontal scrollbars to view the entire table.
3. Customize your output file in two ways:

A.••Click on the **[Write Table to File]** button. This will display the <Table Export> screen, shown in Figure 4.10. By clicking on **[Select Output Columns]**, you can write out data from selected fields only (Figure 4.11) with their *default widths*. This option has the advantage that you can save the attribute list, and retrieve that list rather than individually select the columns every time you make a table.

B.••Alternatively, clicking the *right mouse button* on a table column brings up a pull-down menu to delete or resize the column. The *middle mouse button* is used for reordering columns by clicking on the label of the column to be moved, dragging it to the desired column position (staying in the label area), and releasing it. When done, select **[Write Table to File]**. When the <Table Export> screen appears, do NOT click on **[Select Output Columns]** or you will remove all restrictions and settings you inserted with the mouse commands!

3. Check the optional settings, then click **[OK]**.
4. Specify the name of the file in which results are to be stored on the File Selector screen (Figure 4.12).
5. Click **[OK]**.

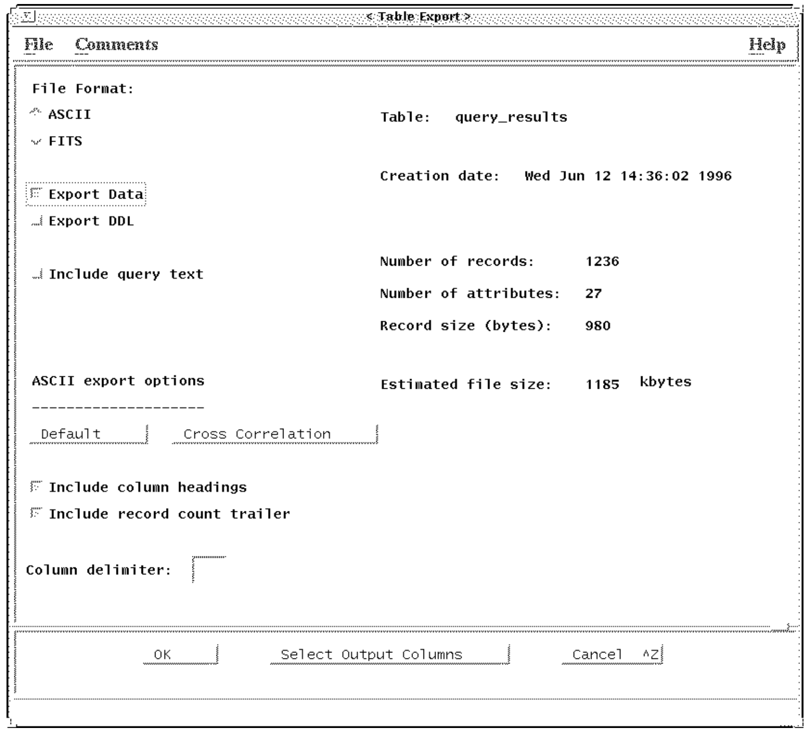


Figure 4.10: Options on Table Export Screen

In the <Table Export Attribute Selection> screen (Figure 4.11), you can select only a few fields to be saved to your output table. To select a field, click on its name; the attribute will be moved from the "Available Attributes" column to the "Selected Attributes" column. For example, you may want to see only the target name, position, dataset name, and operating mode. You can save and retrieve your table column preferences in an attribute file.

WARNING: Do NOT press the button **[Select Output Columns]** if you have already selected and resized columns in the <Search Results - Table Format> screen, because doing so will wipe out your careful work.

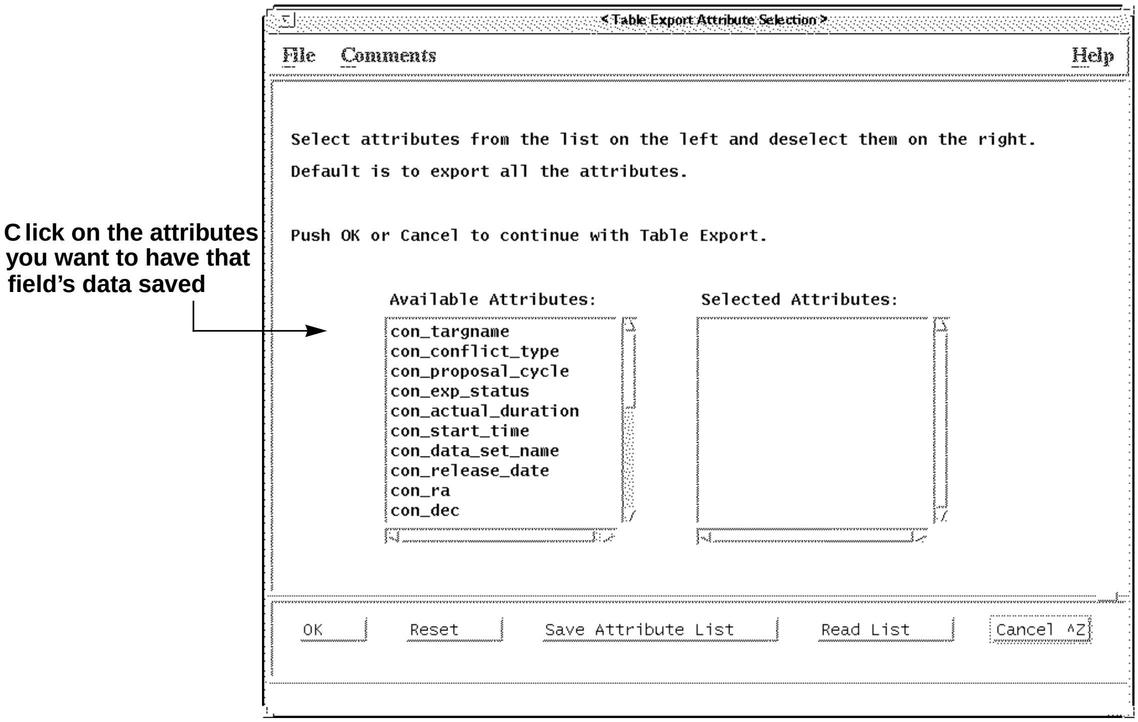


Figure 4.11: Selecting Attributes (Fields)

The File Selector screen shows the names of all files and directories matching the template given on the "Filter" line. To change directories, alter the "Filter" line and then click the **[Filter]** button. To change the name of the file to be saved, edit the "Selection" line.

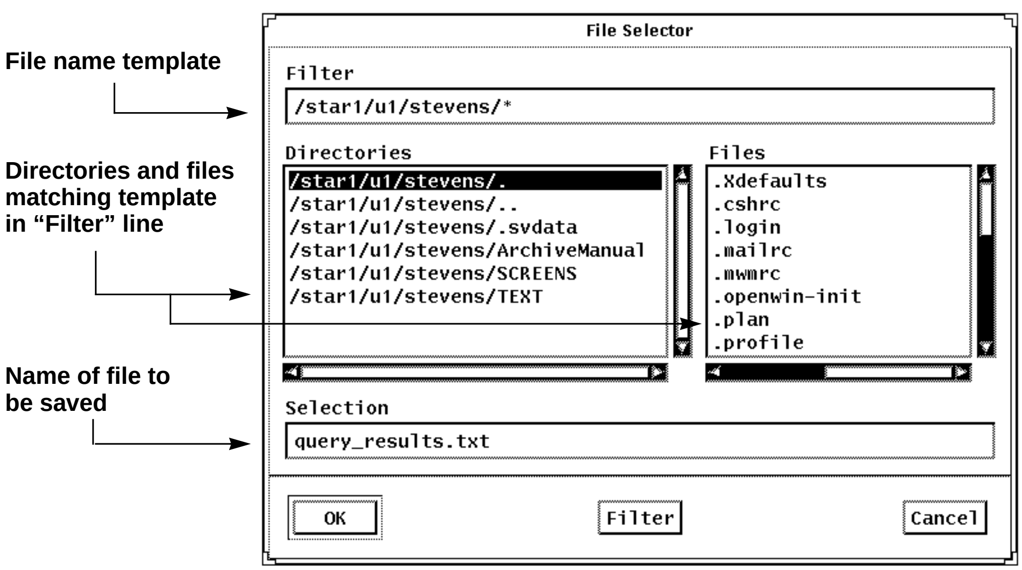


Figure 4.12: Specifying a Filename and Directory

Retrieving Datasets From the Archive

We now want to retrieve the datasets (see Chapter 9, Table 9.1 for how datasets are defined) that the catalog has identified. To do this, you will mark the data for retrieval and then do the retrieval. There are several steps in this process:

1. Mark the observations that you want to retrieve; you can mark them either individually or as a group.
2. Display and review the list of datasets to be retrieved.
3. Specify the file formats and media to be used in the retrieval process.
4. Submit the request. DADS will send you e-mail when the request is accepted for processing. (See “Getting Your Data” on page 11).
5. Check the request status, if desired. (You must wait until you receive the e-mail from DADS before checking a request.)

If you do not have an archive account, then you will not be able to retrieve data until you have registered with STScI. For information about how to register, see page 10.

Marking Observations for Retrieval

To mark for retrieval the dataset displayed on the screen, click the **[Mark Dataset]** button. This action will be confirmed by a message at the bottom of the screen. Also, the “Marked” field, in the upper right corner of the screen, will display “T” (True) indicating that the dataset has been marked for retrieval.

You can mark datasets for retrieval in either the table-row format display screen, in which case the highlighted record is marked, or on the <Quick Search Results> screen with the record displayed.

If you want to mark for retrieval *all* of the records matching your search criteria, click on the **[Mark All]** button. This could be a large volume of data. As of May 1, 1999, the complete set of datasets found for “clusters of galaxies” total 5,030 WFPC2 images, about 130 GBytes of data! Alternatively, step through your search results records by clicking on the **[Step Forward]** button and only click on the **[Mark Dataset]** button for a few of the observations.

Reviewing the Retrieval Request

Once you have marked records for retrieval, you begin the retrieval process by displaying and reviewing a list of datasets to be retrieved. To do this:

1. Click on the **[Retrieve Marked Data]** button to exit the <Quick Search Results> screen and to begin the retrieval process by bringing up the <Archive Retrieval> screen.
2. Review the list of datasets.

The <Archive Retrieval> screen lists all of the datasets that you have marked for retrieval. In this case, you would see something like Figure 4.13.

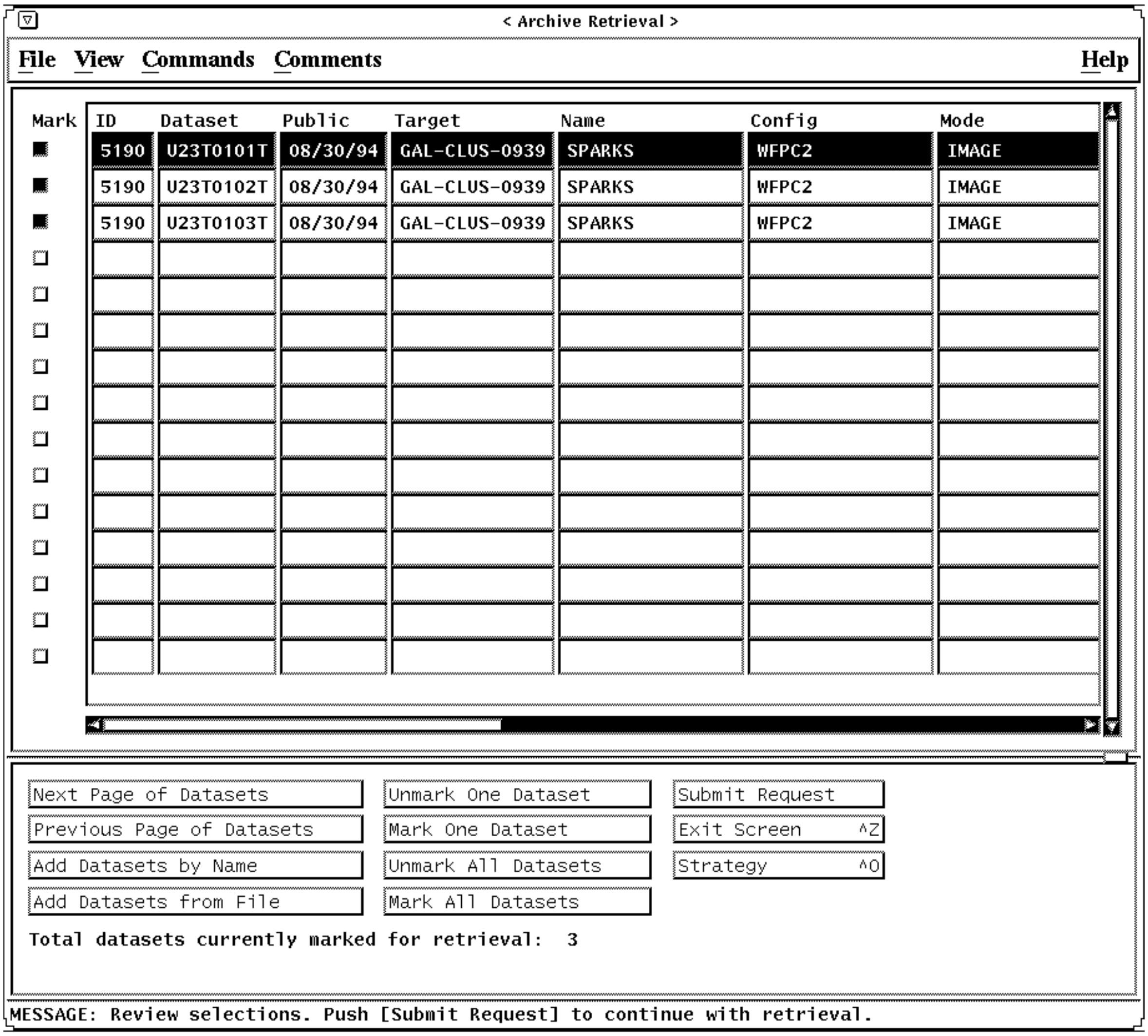


Figure 4.13: Archive Retrieval Screen (with 3 Datasets Selected)

Review the list of datasets that you have marked for retrieval. If you have marked several datasets, you may need to click on the **[Next Page of Datasets]** button to see additional screens of marked records. The total number of datasets that you have marked for retrieval is shown near the bottom of the screen.

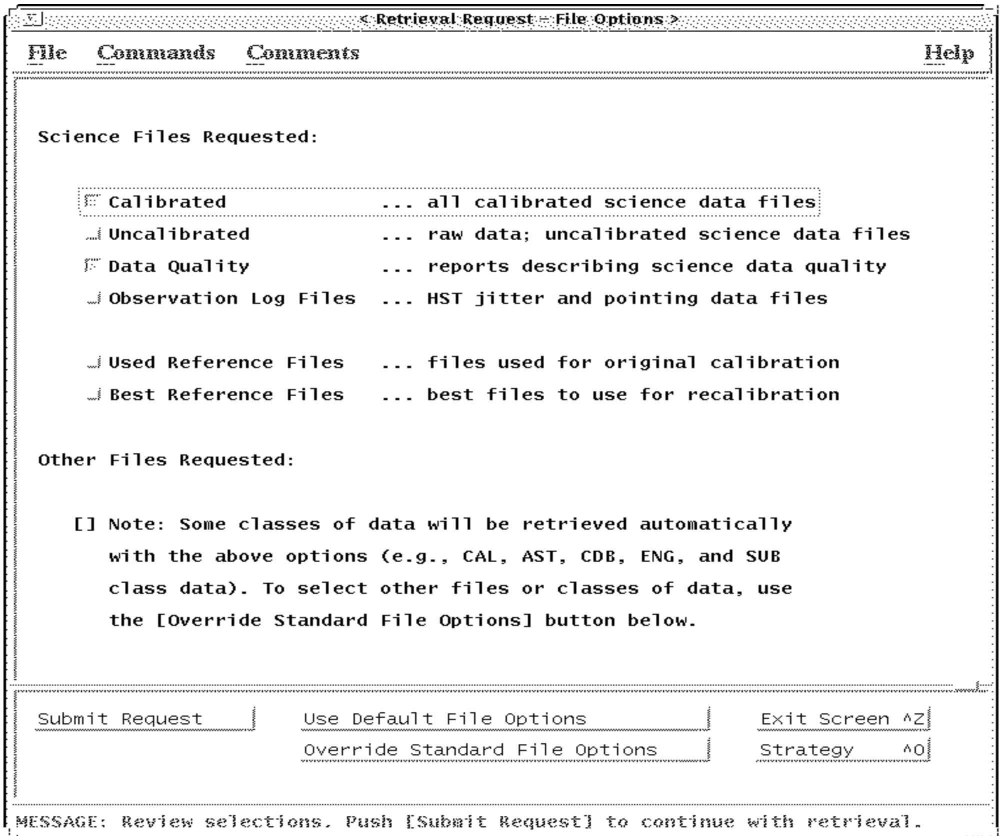


Figure 4.14: Retrieval Request - File Options Screen

Specifying Formats and Media

1. Continue with the data retrieval process by clicking the **[Submit Request]** button.
2. Specify the files that you want to retrieve.
3. When you click the **[Submit Request]** button, the <Retrieval Request - File Options> screen is displayed (Figure 4.14).

The <Retrieval Request - File Options> screen[2] indicates the kinds of files that will be retrieved, in this case the calibrated science data files and the data quality report files will be retrieved. These defaults are acceptable.[3] Click the **[Submit Request]** button to continue with the retrieval process. To help you determine the amount of data that you are requesting, Table 4.3 lists typical file and dataset sizes for calibrated data from each instrument.

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2. With the external release of On-The-Fly Calibration (OTFC), the <Retrieval Request - File Options> screen will be as described on page 186.

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3. You can override the defaults and provide your own file extension selection by using the **[Override Standard File Options]** button.

You may also request the calibration files that were used for the original calibration (the archived version in most cases) or the currently recommended “best-ref” calibration files for the most recent versions of the calibrations. The calibration files can be used to calibrate uncalibrated data with standard STSDAS tasks.

Instrument	Mode/File	CAL Class Size
FOC	normal 512 x 512	~4 MB
	zoom 1024 x 512	8–10 MB
FOS	normal	<500 KB
	rapid readout	>10 MB
GHRS	normal	< 500 KB
	rapid readout	>10 MB
HSP	normal	~500 KB
	occasional	>1 GB
NICMOS	CAL file	~ 1 MB
	IMA file	~ 0.75 MB/readout
STIS	CCD/MAMA image	> 10 MB
	CCD/MAMA spectrum	> 14 MB
WFPC, WFPC2	normal (full mode)	26 MB
	area mode	7 MB

Table 4.3: Average Calibrated Data File Size per Instrument

The <Retrieval Request - Media Options> screen is then displayed (Figure 4.15). You will need to enter your archive user name and password, pressing Return after each entry.

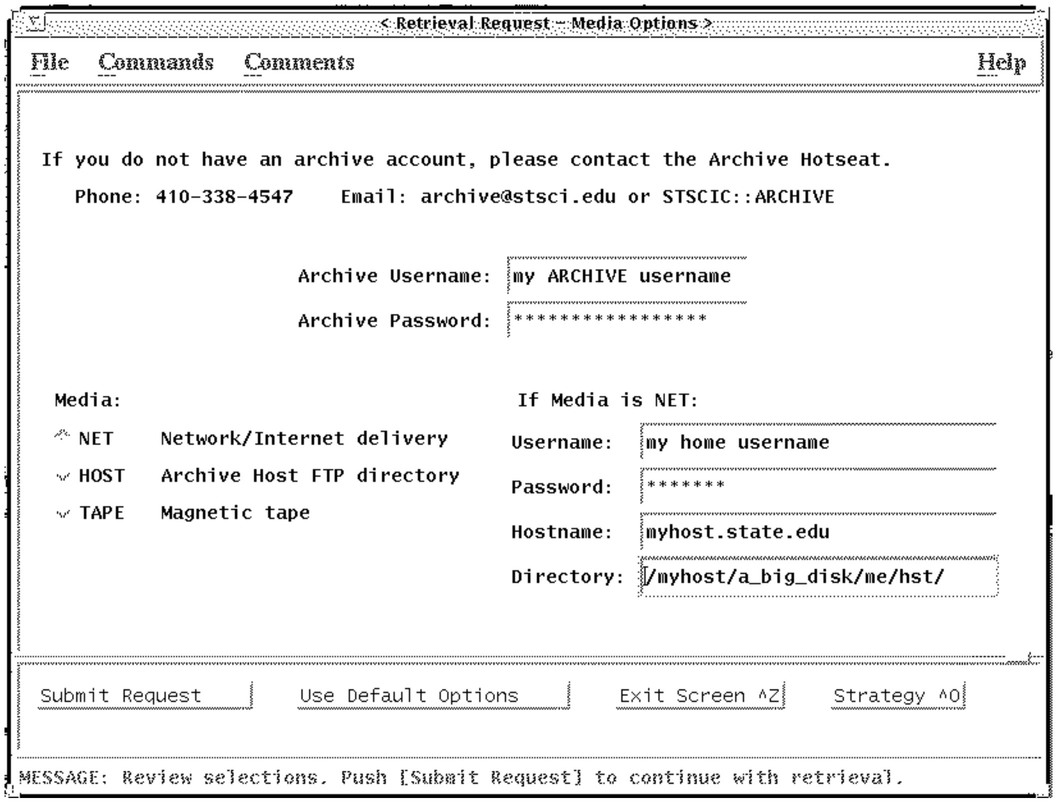

Figure 4.15: Retrieval Request- Media Options Screen

You may need to select the media option (the default will be NET). When HOST is the retrieval media, the data will be placed on the archive host staging area from which you can retrieve using FTP. You can also select the TAPE option. In this case, an 8mm tape will be mailed to you. Selection of the NET option (Network/Internet delivery) will require you to enter your home username, password, full host name (including your workstation name, e.g. nemesis.stsci.edu) and the full pathname of the directory where you want to receive the data. Make sure that you have room in this disk or the retrieval will fail.

After you select the appropriate options, click the **[Submit Request]** button to begin the data retrieval process. StarView will check to make sure that your archive username and password are correct and will then submit your request. A copy of the request file will be placed in the directory `.svdata` (as specified in the environment variable SV_DATA_DIR) on Unix systems or `[$HOME.svdata]` on VMS systems, where `$HOME` is your home directory. The file name is of the form *date_time*.req, for example, `940901_122510.req` is a file created on September 1, 1994 at 12:25 pm.

Checking Request Status

To check the status of your retrieval request do this:

1. Click on the **[Retrieval Status]** button from within the **|Retrieve|** menu on most StarView search screens, or click on the **|Commands|** menu from the <Welcome> screen.
2. You will be asked to enter your request ID (as displayed in the previous steps). Type the request ID.
3. Press [Return] to continue with your StarView session. Figure 4.16 shows a sample retrieval status screen.

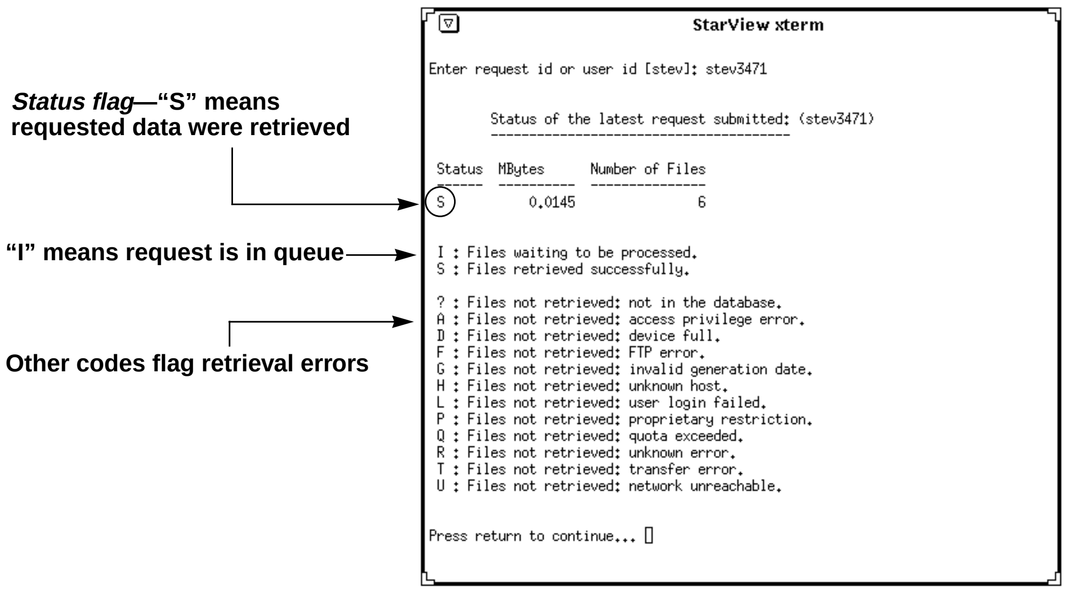

Figure 4.16: Sample Retrieval Status Screen

Note that until you receive e-mail from ST-DADS saying that your request is queued, the <Retrieval Status> screen contains no information about the status of your request.

Exiting StarView

Press [Control]-[X] to exit StarView. A dialog box will appear asking you to confirm that you really want to exit. Click on **[OK]** to exit.

Completion Notification

DADS will notify you by e-mail when it has finished processing your request. The notification will tell you the final status of your retrieval and the location of your data on the archive host's staging disk if you specified a HOST retrieval.

Getting Your Data

If you chose to have your files written to a disk on the archive host systems (the HOST option), you will need to log in using FTP and copy the files to your local machine. A directory containing your files will have been created; this directory will be a subdirectory of the `data` directory. Figure 4.17 shows an FTP session (you can ftp to either archive.stsci.edu or stdatu.stsci.edu, because they are the same machine.)

Connect to archive host using anonymous ftp

Find your data directory

Move to correct directory

Set transfer mode to binary

Transfer files

Close connection

```
% ftp archive.stsci.edu
Connected to archive.stsci.edu.
220 archive.stsci.edu FTP server (Version 5.86) ready.
Name (archive.stsci.edu): anonymous
Password: your email address
.
<message of the day displayed here>
.
ftp> ls
<list of directories appear, find the one with your
name and request ID number, e.g. NAME0123>
ftp> cd NAME0123
250 CWD command successful.
ftp> binary
200 Type set to I.
ftp> prompt
Interactive mode off.
ftp> mget *.fits
200 PORT command successful.
50 Opening BINARY mode data connection for
x0la0101t_c0d.fits
226 Transfer complete
.
.
ftp> bye
221 Goodbye.
```

Figure 4.17: Retrieving Files Using FTP

You are now ready to begin analyzing your dataset. Remember, if you have any problems or questions, contact the archive hotseat at `archive@stsci.edu`, or phone (410) 338-4547.

Tutorial: Retrieving Calibration Reference Files

Often, archive researchers would like to re-calibrate their HST data. For several of the instruments, improved calibrations are possible with newer calibration files. See the HST Data Handbook for more information about processing the data. You can retrieve the calibration files necessary to calibrate the raw data via several means: simultaneously request them with the raw data, find and request them via the instrument screens, and request them by dataset name.

Note that with the external release of On-The-Fly Calibration (see page 135) the user will have the option of retrieving data calibrated ‘‘on the fly’’ with the best available reference files, at least for STIS and WFPC-2 data. The OTFC screens are described on page 187 (STIS) and 188 (WFPC-2).

Retrieving Calibration Files Simultaneously with the Science Files

The easiest way to retrieve calibration files for archival data is to retrieve them at the same time you retrieve the raw, uncalibrated science data. All of the relevant calibration files can be downloaded in concert with the raw science data if you select the option “Best Reference Files” or “Used Reference Files”. See Figure 4.14: on page 47 for a figure of the screen.

Retrieving Calibration Files via the Calibration Reference Screens

StarView provides calibration reference file screens for each instrument. These screens let you see which calibration files and tables were used to calibrate a given dataset by the OPUS pipeline and which files and tables are currently recommended. You can mark either the used or the recommended reference files and tables for retrieval and retrieve them through StarView.

In this example, we use a StarView reference file screen to retrieve both the *used* and *recommended* calibration files for a 3C273 dataset.

1. Start StarView as described in “Tutorial: Running Starview” on page 30. This will bring up the <Welcome> screen (Figure 4.6).
2. Click the **[Other Searches]** button. (We want to find the appropriate search screen for calibration reference files.) The <Other Searches> screen will be displayed (Figure 4.4), with the cursor highlighting “Quick Search”.
3. Click the [**HST Instrument Searches**] button. The <HST Instrument Searches> will be displayed (Figure 4.18)[4].

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4. With the external release of On-The-Fly Calibration (OTFC), the <HST Instrument Searches> screen will include two additional OTFC buttons, one for STIS, the other for WFPC-2.

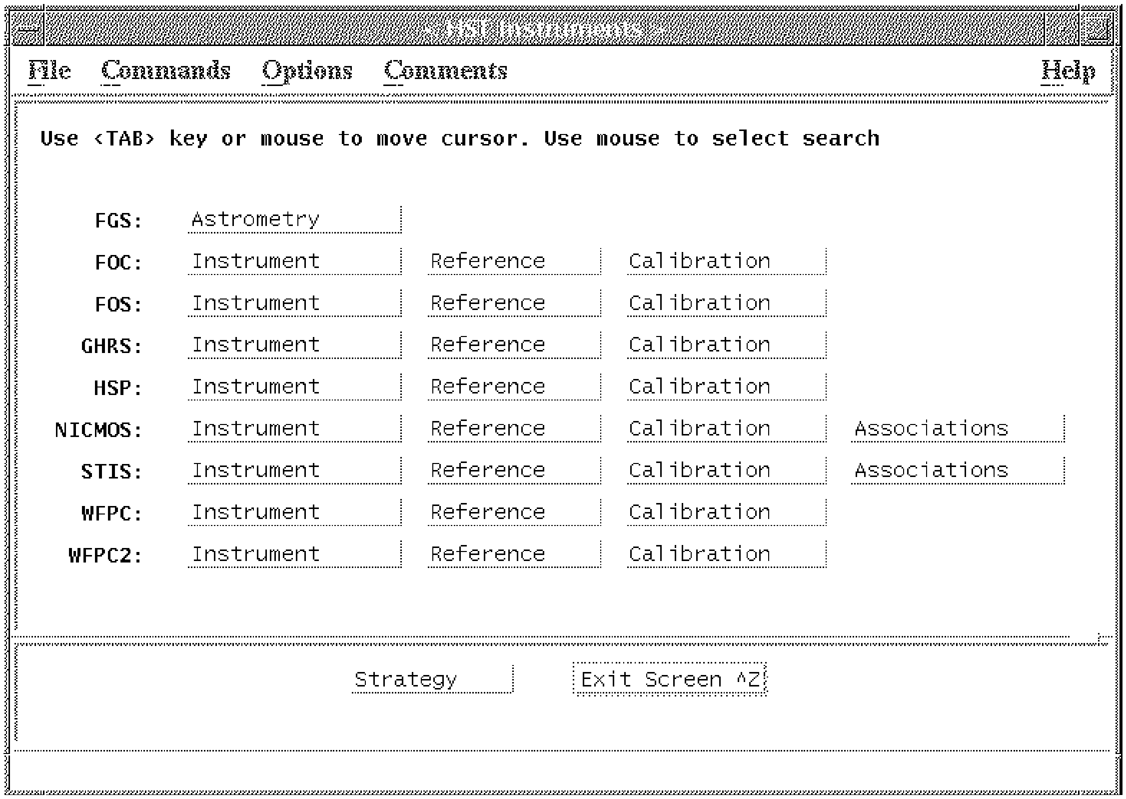

Figure 4.18: HST Instrument Searches Screen

4. Click on the WFPC [**Reference**] button because we will retrieve calibration files for a WF/PC observation. The <WFPC Reference Files - Search Specification> screen will be displayed. (Note that if you had just completed a search using another screen and had a list of datasets in front of you, the opening of this screen will close all other search screens, along with their results!)

5. Specify criteria. We want to specify a particular dataset, so press the arrow keys until the cursor moves to the “Dataset Name” field, and then type the dataset name for the observation whose calibration files will be retrieved. For example, enter `W19C0101T` (see Figure 4.19).

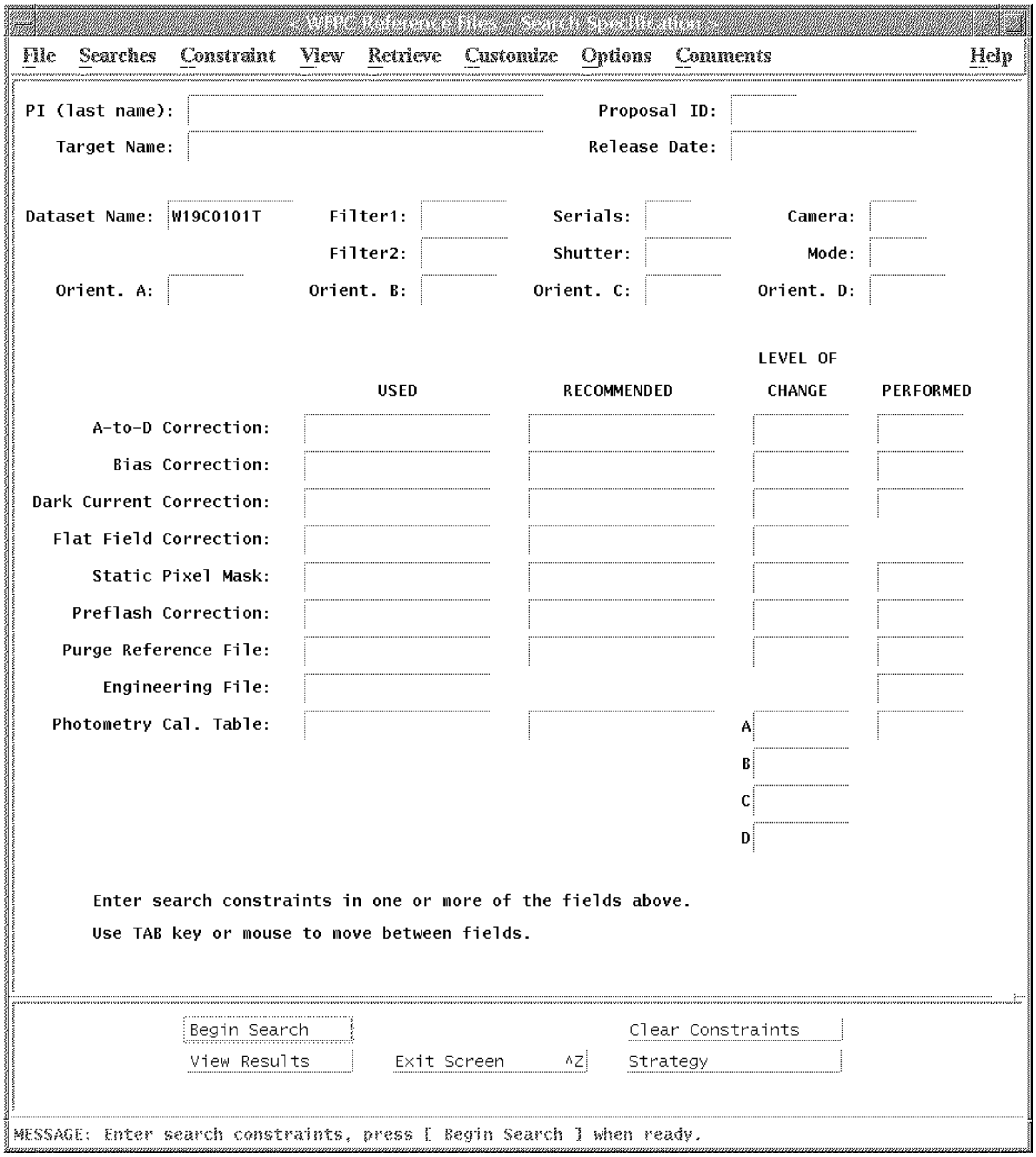

Figure 4.19: WFPC Reference Files - Search Specification Screen (Constrained)

6. Click on the **[Begin Search]** button to submit your catalog search request. The <WFPC Reference Files - Search Results> screen will be displayed for the observation that you specified (Figure 4.20). This screen will contain a scrollable view of the list of calibration sets for each dataset.

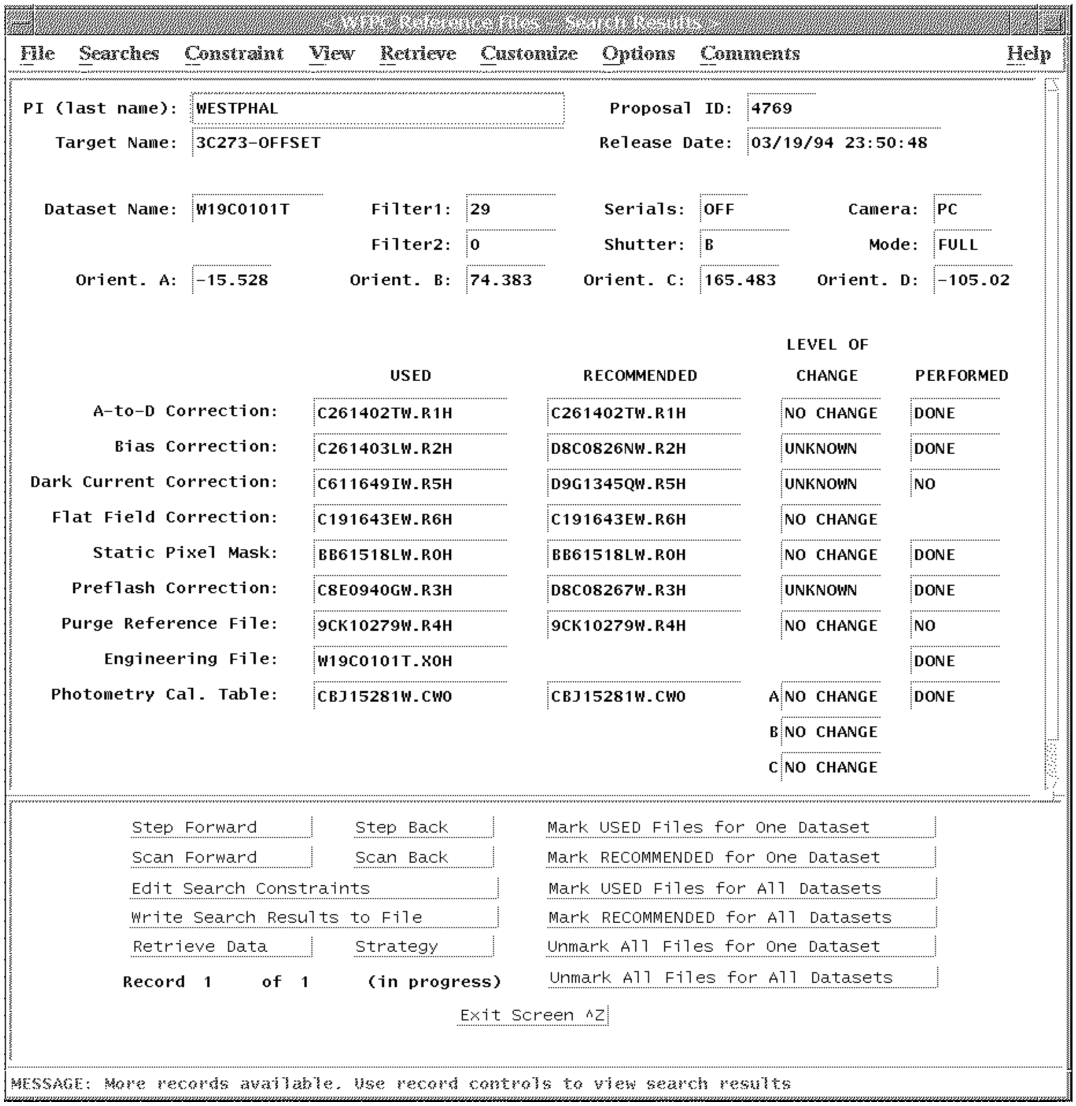

Figure 4.20: WFPC Reference Files - Search Results Screen (With Results Displayed)

7. Click **[Mark USED Files for One Dataset]** to mark for retrieval those calibration files actually used to calibrate the dataset. If the files listed in the RECOMMENDED column differ from those in the USED column, then you can click on **[Mark RECOMMENDED for One Dataset]** to retrieve the calibration files that are now recommended for calibrating the data.

8. Click the **[Retrieve Data]** button to begin the retrieval process for the marked reference files. Continue with the data retrieval procedures as outlined in “Retrieving Datasets From the Archive” on page 45.

The defaults on the <Retrieval Request-File Option> screen, i.e., calibrated, will return the correct files for the specified calibration reference files and tables. You do not need to specify an extension.

Retrieving a File By Name

If you already know the name of a file or dataset that you wish to retrieve from the archives, you can retrieve it directly using the **[Add Datasets by Name]** button from the <Archive Retrieval> screen. To get to this screen from the <Welcome> screen, pull down the **|Commands|** menu in the menu bar (see Figure 4.3) and choose the “Retrieve Marked Datasets” option. This will place you in the <Archive Retrieval> screen.

Click on the **[Add Datasets by Name]** button from the <Archive Retrieval> screen (or use **[Add Datasets from File]** if you have a list of dataset names). Enter the rootname (*no extension*) of the calibration reference file or science file you wish to retrieve. When you have added all the rootnames for the files you wish to retrieve, click on **[Submit Request]** and proceed with the retrieval process as described on page 45.

Another way of retrieving individual datasets is to use the <Dataset Name Search Specification> screen (see page 190).

5 Archive Search Strategies with StarView

In This Chapter...

This chapter describes the type of information that you can find on StarView screens and offers some approaches that you can use to find information and datasets in the Hubble Space Telescope (HST) Archive. Refer to Chapter 8 for a complete presentation of the available StarView screens.

Choosing the Right StarView Screen

StarView includes many predefined screens with which to query the HST catalog. StarView screens are organized in groups that provide a particular type of information. Each screen was designed to facilitate a certain kind of inquiry, spanning a range of customers from engineers and instrument scientists to general observers. These screens do not list the only kinds of searches that can be done on the archive. Advanced users may wish to construct customized queries. The archive hotseat will accept suggestions for modifications to current screens or suggestions for new ones. Below, a brief outline of the different screen groupings and a brief description of their contents are presented. A description of the <Quick Search> screen is also provided here, since this screen will typically be the starting point for most archival searches. Refer also to Chapter 8 for a more in-depth description of each screen.

The following screens and screen groupings are described below:

- <Quick Search> screen
- Planned observation screens (information on planned exposures)
- Science data screens (primarily containing exposure-level information)
- Instrument screens
- Association screens
- Calibration (reference file) screens
- On-The-Fly Calibration screens
- Archived files and engineering and timeline screens
- Data Files screens
- Observatory Monitoring Screens

The descriptions below should help you plan your catalog search strategy and in determining which StarView screens you should use to obtain the catalog information that you seek.

<Quick Search> Screen

The <Quick Search> screen is the most basic search screen for archival research. It is usually the best screen for a new user to begin with when searching for archival data. This screen provides you with a view of both exposure-level and proposal-level information in the HST catalog. You can use the <Quick Search> screen to search for HST observations at a given position in the sky (using the "RA" and "Dec" fields), in a particular region of the sky (using the "RA," "Dec," and "Search radius" fields), for a specific target (using the "Target name" field), or for a given type of source (using the "Target description" field). You can also use the <Quick Search> screen to search for observations taken with a given instrument or with particular proprietary release dates.

After a search request has been submitted from this screen, the <Quick Search Results> screen is displayed. The <Quick Search Results> screen provides additional exposure-level information, such as the archived dataset name, the exposure start time and duration, detailed instrument parameters (e.g., optical configuration, operating mode, filters, gratings, and apertures), the moving target flag, the exposure flag, and the Post Observation Data Processing System (PODPS, now known as OPUS[1]) Data

1. In order to streamline operations and software development, OSS (Observing Support Systems) and PODPS (Post Observation Data Processing System) were merged into OPUS (OSS/PODPS Unified System) on December 5, 1995.

Quality (PDQ) comments (see page 75). You can use this information to judge the usefulness of the exposure for a given line of research. See also “Assessing Data Quality” on page 74.

The date on which the dataset became or will become public (i.e., available for archival research) is also displayed on the <Quick Search> screen in the “Release date” field.

<General Search> Screen

The <General Search> screen is similar to the <Quick Search> screen, except it includes more exposure- and instrument-specific parameters. Using the <General Search> screen requires more familiarity on the part of the user with the Hubble Space Telescope and its data conventions. However, there are some searches which are quicker to do with the <General Search> screen than with the <Quick Search> screen. Searching by “Dataset name” is quicker than searching by “Instrument” because of the way the science table is indexed. If you know how the dataset names are coded for instrument, you can use the prefix plus the wildcard character * to constrain a query to search for only certain instrument outputs. (See Table 9.1 on page 215 for a list of conventions.)

Planned Observations

StarView contains a set of screens that provide users access to information about exposures and planned exposures. This information is derived from the Phase II proposals submitted for each program.

The <Planned Exposure>, screen provides users with information on future fixed target (non-solar system) exposures. This screen is updated with further information after exposures are completed; however, if you are only interested in images already taken, the <General Search> screen will usually prove more useful. The <Solar System> screen provides users with Phase II planning information on moving targets.

The <Proposal Abstract> screen contains the scientific abstract of the proposal and may provide insight into the planning of the observations. The abstract is now searchable as one, continuous text field. Use wildcards to embed all of your text searches; the commercial SQL software in use attempts to make perfect matches otherwise. The <Proposal> screen contains administrative information that is likely to be of interest mainly to STScI staff.

Science Data Screens

StarView provides a few screens that display a variety of exposure-level information about executed HST observations. The <Quick Search> screen (described above) is one of the screens in this group. The others are the

<General>, <Exposure Search>, and <Target Search Specification> screens.

StarView's exposure-level observation screens provide the main mechanism for learning about the actual executed parameters of each HST exposure. In addition to the searches described above for the <Quick Search> screen, you can use the observation screens to obtain specific information about various exposure parameters for HST observations, to search for observations that used a specific set of instrument parameters, to search for observations of specific targets or classes of targets, to search for observations within a specified range of proprietary release dates, or to obtain observation parameters for specific datasets. If you need to know some of the more particular instrument parameters for the exposures, you should use one of the specific instrument screens (described below).

You can use the <Exposure Search> screen not only to obtain the usual exposure parameters (e.g., target name and position, exposure start time and duration) for HST observations, but also to find the various Sun-Earth-Moon angles pertaining to the observations and to find the proposal line numbers and mission scheduling unit numbers corresponding to the displayed dataset records. Archival researchers can use these parameters to find scientifically complete sets of observations that were obtained at nearly the same time, often with essentially the same instrument setup.

Instrument Screens

StarView provides a set of screens that include more complete information about the instrumental parameters used in HST observations. There is one screen for each scientific instrument on the HST. Each such screen displays information specific to the exposures taken with that instrument, including the instrumental setup and readout parameters used for the observations.

You can use these screens to determine precise instrumental parameters for a preselected observation (e.g., readout format, wavelength ranges, preflash times, acquisition modes) or to search the HST catalog for all observations in the archive that have observing parameters similar to those used in the observations that you are specifically interested in analyzing. The latter is useful if you want to compare your data with similarly acquired data, or if you simply want to find out how many observations used similar instrument parameters. For example, you may want to determine if an instrument configuration was rarely or commonly used. Commonly used instrument configurations are probably better calibrated and better understood.

Association Screens

StarView provides a set of screens that allow the user to search the Archive for detailed information about the association status of NICMOS and STIS observations. For STIS and NICMOS, in fact, the combination of data from two or more exposures is often necessary to create a scientifically useful data product. Associations simplify the use of HST data by identifying a set of exposures that belong together and depend upon one another. By default, complete associations of data are retrieved via the <General> or <Quick Search> screens. The association screens, on the other hand, permit exposures to be retrieved individually rather than as a set of observations.

Calibration Screens

StarView provides a set of screens that let you identify and retrieve the calibration tables and files that are recommended to calibrate specific HST observations. There is one screen for each scientific instrument on the HST (except the FGS). Each such screen displays the calibration information specific to the exposures taken with that instrument. These screens will help you in determining whether a dataset needs to be recalibrated. In particular, you can use one of these screens to list, on a per-dataset basis, the files that were used to calibrate a given dataset (the USED list) and, at the same time, to list the files that are now considered to be the best files to use in calibrating that dataset (the RECOMMENDED list).

A dataset’s recommended calibration files may change if, in retrospect, a more appropriate file could have been used than the one which was originally used. Commonly, the best calibration data is taken contemporaneously with the science data, and has not been processed into calibration sets until several weeks after the science data has been archived. However, even if this is true, recalibration is not always necessary. Whether or not you recalibrate depends on which file or table was changed and whether that kind of correction is likely to affect your analysis. The *HST Data Handbook* explains the different calibration corrections and the files or tables that each type of correction uses (see page 14).

These screens are not necessary if you plan to retrieve the calibration reference files at the same time you retrieve the science data.

On-The-Fly Calibration Screens

The On-The-Fly Calibration (OTFC) system will allow users to retrieve the most recent version of calibrated HST data. OTFC screens go beyond the Calibration Screens described above and allow users to view which reference files will be used by the OTFC service and the settings of various switches that govern the calibration software to retrieve science data.

The OTFC service should be released externally to STScI by Fall 1999. The OTFC Pipeline accepts raw datasets from DADS and returns updated raw and calibrated datasets. OTFC updates the headers of the raw data files, then processes them through the current OPUS software. Users do not have to go through these screens to request OTFC service - that option will be available on the <Retrieval Request - File Options> screen. These screens allow the user a view into the OTFC process. Currently only WFPC-2 and STIS data will be processed in the OTFC pipeline. Eventually OTFC will be applied to NICMOS and future instruments data

Data Files Screens

StarView provides screens that display accounting information about the datasets and files stored on the optical disks that comprise the HST data archive. They include the <Dataset Name>, <Files>, and <Engineering> screens. In general, archival researchers should not need to access the any of these screens unless they want to know if a particular type of file has been created for a given dataset, want to retrieve a specific individual file for a given dataset, or need to determine the size of a given file. The <Engineering Timeline> screen searches for ephemeris data, engineering and engineering subset data as well as mission schedules and mission timelines. Typically, you will wish to find a specific type of data corresponding to a typical time period.

Observatory Monitoring Search

The Observatory Monitoring Search Screen facilitates searches based on telescope configuration, such as Roll Angle, Earth Limb Angle, and Sun Angle. It also allows queries on jitter limits. If you are interested in characterizing how an instrument behaved when the telescope was in certain angles, or if you would like to know the telescope alignment during a specific observation, this is the screen for you.

Search Strategies

Two frequent types of archival searches are:

- Searching for HST observations of a specific source (e.g, 30-Doradus or the jet of M87)
- Searching for observations of a given class of source (e.g, all observations of SNR or O stars)

Suggested strategies for carrying out such searches are described below.

Searching for Specific Sources

There are two ways to search for observations of a specific source:

- Search on positional coincidence
- Search on the basis of source name

The source or target name is generally an observer-entered designation. Therefore, for fixed targets, searches based on positional coincidence are much more reliable than searches based on source name. With the growing number of parallel observations with no specified targets, searching by coordinates is the only way to check for conflicts and duplications.

Positional Searches: The Best Way

There are three ways to search for positional coincidences with observations in the HST catalog using StarView. You can constrain the target RA and Dec, specifying a range of permissible values. This defines a search rectangle. You can also specify an RA, Dec, and search radius on either the <Quick Search> or <General> screen. You can also specify a common name for the target and let SIMBAD or NED provide the target position and search radius (see page 35).

Searching on Source Name

Most of the StarView screens have a field for the target name. In addition, the <Target Search Specification> screen contains both the target name and alternate names or aliases. The archival researcher can constrain and search on the basis of source name using these fields. When using the <Target Search Specification> screen to search for a given source name, you must perform two separate searches:

1. First, constrain the target name. Then, press **[Begin Search]**.
2. Next, clear the search constraints for target name and constrain only on the alias. Then, press **[Begin Search]** again.

When constraining, the source name should always be embedded in wild card delimiters (e.g., `*MARS*` or `*NGC1068*`) because the name will frequently be embedded in additional text (see below).

Since an astronomical source typically has many names, to understand how best to constrain the target name and alias fields, it is useful to know how target names and aliases are assigned. Target names are used to provide unique designations for targets within a given proposal. They are entered by the observer during Phase II of the proposal process. There are three different classes of targets—fixed targets, solar system targets, and generic targets. Observers are encouraged to use a specific convention when naming fixed and solar system targets.[2] The next three pages provide a brief summary of the

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2. Refer to the *Phase II Proposal Instructions* (accessible from `http://www.stsci.edu/observing/observing.html)` for a detailed list of these conventions, including the conventions for naming uncataloged targets.

conventions for each class of target, which should help you design search strategies based on source name.

- **Fixed Targets**. When providing a target name for a fixed target, the observer must specify one catalog name that will become the target name (e.g., `HD124897`). The observer is encouraged to provide one or two common names that will become the target aliases (e.g., `ALPHA-BOO` or `ARCTURUS`). The preferred order for catalogs to be used to designate the target name is summarized in Table 5.1 below. Observers may also append a qualifier to the catalog name to indicate the location in the source where the observation is centered (e.g., `NGC4486-JET`, `LMC-R136A`, or `NGC224-004012+40548`, where the name of the parent body is followed by rounded J2000 coordinates). Finally, a code designating the target purpose must be appended to the target name when a target is observed specifically to be used as an external calibrator (`-CALIB`), as an astrometric reference star (`-REF`), or as an offset for target acquisition (`-OFFSET`). For example:

```
BD+284D4211-CALIB, 3C273-OFFSET
```

Object Type	**Preferred Catalog Order**
Stars	*Henry Draper Catalog* (e.g., `HD140283`) *Durchmusterung* (BD, CD, or CPD) (e.g., `BD+30D3639`) *General Catalog of Variable Stars* (e.g., `RR-LYR`)
Star Clusters and Nebulae	*New General Catalog* (e.g., `NGC6396`) *Index Catalog* (e.g., `IC418`) Perek-Kohoutek designation (e.g., `PK208+33D1`) Sharpless catalog number (e.g., `S106`)
Galaxies and Clusters of Galaxies	*New General Catalog* (e.g., `NGC4536`) *Index Catalog* (e.g., `IC724`) *Uppsala Catalog* (e.g., `UGC11810`) *Abell Catalog* (e.g., `ABELL2029`)
Quasars and Active Galaxies	See Veron-Cetty and Veron, *ESO Report No. 18*, 1998 (e.g., `3C273`)

Table 5.1: Preferred Catalogs for Object Classification

- For targets with common catalog names, it is usually best to use StarView's NED- or SIMBAD-assisted search feature (see page 35) to find all instances of that target in the HST catalog.

- **Solar System Targets**. The target name for solar system targets can either be chosen from the standard list of solar system targets reproduced in Table 5.2, or the observer can define a name. As with fixed targets, qualifiers can also be appended to the name (e.g., `MARS-FEATURE1`). Therefore, to find all observations of Mars, one must embed Mars in wild card delimiters: *MARS*.

- **Generic Targets.** Generic targets are usually given names by proposers that describe either the astronomical characteristics of the targets (e.g., SUPERNOVA or COMET) or the general location of the targets on the sky (e.g., HIGH-LATITUDE). Though observations of specific targets are the final outcome of such proposals, the proposed observations themselves do not include specific target names or specific target coordinates. Targets of Opportunity and Parallel target observations are typical examples of generic targets. It is therefore not generally useful to search for observations of generic targets in the HST catalog using specific target names. It is better to search for such targets either by using the target category or target description keywords (see the next section) or by searching for observations in an area of the sky that is likely to contain HST targets of interest to you (see "Search Strategies" on page 62).

Level 1 Objects	Level 2 Objects		
Sun	Moon	Adrastea (1979J1)	Janus (1980S1)
Mercury	Phobos	Thebe (1979J2)	Epimetheus (1980S3)
Venus	Deimos	Metis (1979J3)	Helene (1980S6)
Earth	Io	Thethys	Telesto (1980S13)
Mars	Europa	Dione	Calypso (1980S25)
Jupiter	Ganymede	Rhea	Pandora (1980S26)
Saturn	Callisto	Titan	Prometheus (1980S27)
Uranus	Amalthea	Hyperion	Atlas (1980S28)
Neptune	Himalia	Iapetus	Cordelia (1986U7)
Pluto	Elara	Phoebe	Ophelia (1986U8)
	Pasiphae	Ariel	Bianca (1986U9)
	Sinope	Umbriel	Cressidea (1986U3)
	Lysithea	Titania	Desdemona (1986U6)
	Carme	Oberon	Juliet (1986U2)
	Ananke	Miranda	Portia (1986U1)
	Leda	Triton	Rosalind (1986U4)
	Mimas	Nereid	Belinda (1986U5)
	Enceladus	Naiad	Puck (1985U1)
	Pan	Thalassa	Despina
	Charon	Galatea	Larissa
	Proteus		

Table 5.2: Solar System Target Names

Searching for a Class of Objects

Archival researchers may be interested in finding all (or most) HST observations of a given class of objects (e.g., observations of elliptical galaxies or Wolf Rayet stars). There are several ways to carry out such searches:

- Search on the target description.
- Search on proposal title, proposal keywords, or proposal abstract.

- Cross-correlate the contents of the HST catalog with a catalog or personally created list of sources on the basis of position. See "ASCII Catalogs" on page 79.

StarView may not execute text searches in the manner to which you may be accustomed in other text search algorithms. The fields, for example, the target description or the abstract, are saved in a database as one continuous text string, not word by word. In general, text searches for a single keyword should be embedded in wild card delimiters. A list of keywords, e.g. *STAR*,*CEPHEID*, should individually be embedded. This list is treated as STAR OR CEPHEID. If you would like a search to reveal abstracts where *both* those keywords appear, you would enter STAR & CEPHEID. Where the database is all capitals, StarView will automatically convert your input to upper case. Text searches are case insensitive.

Searching on Target Description

Searches can be done on descriptions entered by the original observers during the Phase II (planning) process. These fields allow an archival researcher to search for HST observations of classes of objects. The target description and target categories appear on the <Target Search Specification> screen. The target description is the target category with additional descriptive words appended, so the target category is somewhat redundant.

If you wanted to search for all observations of nova stars within our galaxy, one could use the <Target Search Specification> screen, constrain "Target category" as `star`, and constrain "Target description" as `*nova*`. Note the use of the wild card delimiters (*), since the word "nova" will likely be embedded in a longer text. Alternatively, since the target description in StarView is the Phase II target category plus the Phase II target description—in that order—one could simply use the <Quick Search> and <General Search> screens and constrain the "Target description" field to `*star*nova*` or `star & nova`.

The observer assigns the target description as part of the Phase II proposal process, using the guidelines in the *Phase II Proposal Instructions*.[3] Each target must be assigned a single primary category followed by at least one descriptive keyword. Observers are encouraged to use as many as five descriptive keywords per category and are allowed to assign up to two categories.

The categories and corresponding keywords that the observer can use to describe fixed targets are presented in Table 5.3 through Table 5.11. For solar system targets, the descriptive keyword convention is presented in Table 5.12. Obviously, searches based on target description will be most successful if archival researchers use the same terminology used by observers to describe

3. Although Cycle 0 and 1 observations were not initially described using this set of guidelines, target descriptions for all Cycle 0 and Cycle 1 GO and GTO observations were redefined in the HST catalog to comply with the most recent *Phase II Proposal Instructions*, ensuring that a consistent set of terms are used to describe the archived observations.

the targets. Keep in mind that assigning target descriptions is an inherently subjective process. There are many ways to describe the same target, and different observers will inevitably describe the same target in different ways. You may, therefore, want to apply broad criteria when first constraining a target description. If you are looking for a complete list of all HST observations of a given type of source, you are encouraged to search also on the proposal title, abstract, and abstract keywords and to cross-correlate positional lists of sources with the archive. Furthermore, parallel observations usually are not well described by such keywords.

In Table 5.3 through Table 5.11, information in parentheses next to the keyword is explanatory only and is not part of the catalog. For example,Table 5.4 has a keyword identified as “LMXB (Low Mass X-Ray Binary).” “LMXB” is the keyword that appears in the target descriptor. The text is explanatory only.

Category Keyword	Contents
STAR	Galactic stellar object
EXT-STAR	Star in an external galaxy
STELLAR-CLUSTER	Galactic star cluster, group, or association
EXT-CLUSTER	Star cluster in an external galaxy
GALAXY	Galaxy or AGN
CLUSTER OF GALAXIES	Galaxy groupings, clusters, or large-scale structure
ISM	Interstellar medium of the galaxy
EXT-MEDIUM	Interstellar medium of an external galaxy
UNIDENTIFIED	Unidentified object
CALIBRATION	Calibration observations

Table 5.3: Keyword Categories

Descriptive Keywords for Stars (STAR or EXT-STAR)			
Wolf Rayet (WC)	Wolf Rayet (WN)	Main Sequence O	Giant O
Supergiant O	OE	OF	SDO
WDO	BO-B2 V-IV	B3-B5 V-IV	B6-B9.5 V-IV
B0-B2 III-I	B3-B5 III-I	B6-B9.5 III-I	BE
BP	SDB	DB	DA
DC	DZ	A0-A3 V-IV	A4-A9 V-IV
A0-A3 III-I	A4-A9 III-I	AE	AM
AP	Horizontal Branch Star	AGB Star	Composite Spectral Type
F0-F2	F3-F9	FP	Late-type Degenerate
G V-IV	G III-I	K V-IV	K III-I
M V-IV	M III-I	S Star	Carbon Star
Long Period Variable	Irregular Variable	Regular Variable	Luminous Blue Variable
Dwarf Nova	Classical Nova	Nova-Like	Recurrent Nova
Polar (AM Her Star)	Intermediate Polar (DQ Her Star)	Symbiotic Star	T Tauri Star
FU Orionis Star	Shell Star	Eta Carinae Star	Pulsar
Interacting Binary	X-Ray Novae	X-Ray Burster	X-Ray Transient
RS CVn Star	LMXB (Low Mass X-Ray Binary)	MXB (Massive X-Ray Binary)	W UMa Star
Beta Lyrae Star	Algol System	Barium Star	Blue Straggler
Binary Pulsar	FK Comae Star	Pulsating Variable	PG1159 Star
ZZ Ceti Star	Cepheid	Supernova	Supernova Type Ia
Supernova Type Ib	Supernova Type II	RR Lyrae Star	Planetary Nebula Central Star
Gamma Ray Burster	Brown Dwarf	Wolf Rayet	YSO
Herbig Ae/Be	Neutron Star	Emission Line Star	

Table 5.4: Fixed Target Keywords for Describing Stars (Galactic Stellar Objects) and Stars in External Galaxies

Descriptive Keyword for Stellar Clusters (STELLAR CLUSTER or EXT-CLUSTER)	
Globular Cluster	Open Cluster
OB Association	T Association

Table 5.5: Descriptive Keywords for Stellar Clusters (Galactic Star Clusters, Groups, or Associations) or Star Clusters in an External Galaxy

Descriptive Keywords for Galaxies (GALAXY)			
Spiral (Spiral Galaxy)	Lenticular (Lenticular Galaxy)	Elliptical (Elliptical Galaxy; not Dwarf Elliptical)	Dwarf Elliptical
Magellenic Irregular	Amorphous Irregular	Dwarf Compact (Dwarf Compact/HII Galaxy)	Dwarf Spheroidal
BCM (Brightest Cluster Member)	BGM (Brightest Group Member)	LSB (Low Surface Brightness/HI Rich Galaxy)	Seyfert
QSO (Radio Quiet)	Quasar (Radio Loud)	Radio Galaxy	BL Lac (BL Lac or BLAZAR)
Liner	Starburst	Ultraluminous IR Gal	Interacting Galaxy
Lyman Alpha Cloud	Protogalaxy	Gravitational Lens	Einstein Ring
High z Gal (Redshift Greater than 0.5)			

Table 5.6: Descriptive Keywords for Galaxies (or AGN)

Descriptive Keywords for Clusters of Galaxies			
Supercluster	Void	Group	Rich Cluster
Poor Cluster	High Redshift Cluster (z>0.5)	BCM (Brightest Cluster Member)	BGM (Brightest Group Member)
Gravitational Lens	Galaxy Pair	Interacting Galaxy	Einstein Ring
Blank Sky			

Table 5.7: Descriptive Keywords for Clusters of Galaxies (Galaxy Groups, Clusters, or Large-Scale Structures)

Descriptive Keywords for Interstellar Medium (ISM or EXT-MEDIUM)			
Herbig-Haro Object	Planetary Nebula	HII Region	Reflection Nebula
Dark Cloud	SNR (Supernova Remnant)	Ring Nebula (Shock Ionized)	HI Cloud
High Velocity Cloud	Intermediate Velocity Cloud	IRAS Cirrus	Cometary Nebula
Molecular Cloud	Bipolar Outflow	Absorption Line System	Absorption Line System - Galactic
Absorption Line System - Extragalactic)	Damped Lyman Alpha Cloud (Extragalactic)	IGM	ICM
Coronal Gas (10^5-10^6K)	Hot Gas (10^7-10^8K)		

Table 5.8: Descriptive Keywords for Insterstellar Media (of the Galaxy or of an External Galaxy)

Descriptive Keywords for Unidentified Objects		
Radio Emitter	Infrared Emitter	Optical Emitter
Ultraviolet Emitter	X-Ray Emitter	Gamma Ray Emitter
Blank Field	Parallel Field	High Latitude Field
Low Latitude Field		

Table 5.9: Descriptive Keywords for Unidentified Objects

Descriptive Keywords for Calibration Observations		
Astrometric	Photometric	Wavelength
Point Spread Function	Ion	Taled
Occulting Finger Location	Occultation Mode Test	Polarimetry
Aperture Location	Sky Background	FGS Stability
Scattered Light Test	Spatial Distortion Test	Detector Linearity Test
Instrument Sensitivity Test	Target Acquisition Test	Detector Sensitivity Test
Narrow Band Filter Calibration	Focus Test	Spacecraft Glow
Quantum Efficiency Test	Throughput Test	Virtual Pointing
Pointing and Jitter Test	Carrousel Stability Test	Shutter Control Test
Raster & Step/Dwell Scan Verification	FGS Trasnfer Function Test	

Table 5.10: Descriptive Keywords for Calibration Observations

Discrete Features of Objects			
Corona	Ring	Ansae	Protoplanetary Disk
Wind	Accretion Disk	Jet	Lobe
Hotspot	Nucleus	Halo	Disk
Bulge	Polar Ring	Dust Lane	Spiral Arm
Shell	Tidal Tail	Bar	Multiple Nuclei
Cooling Flow	Emission Line Nebula	BLR (Broad Line Region)	NLR (Narrow Line Region)
Filament	Ejecta	Knot	Star Forming Region
Shock Front	Ionization Front	Conduction Front	Undesignated

Table 5.11: Discrete Features and Keyword Descriptors for All Categories

Keyword	Comments
PLANET	If observation is centered on planet, may be followed by planet name, e.g., PLANET JUPITER
SATELLITE	If observation is centered on object, may be followed by name of object, e.g., SATELLITE GANYMEDE
COMET	If object is centered on comet's nucleus, may be followed by name or catalog designation, e.g., COMET 1979X
ASTEROID	If target is asteroid center, may be followed by common name or catalog number, e.g., ASTEROID CERES
FEATURE	Surface features are followed by the name of the parent body, e.g., FEATURE IO
OFFSET	May be followed by name of parent body, e.g., OFFSET COMET HALLEY
RING	Will be followed by name of parent body, e.g., RING SATURN
TORUS	Will be followed by name of parent body, e.g., TORUS SATURN
OTHER	May be followed by description of observation type, e.g., ASTROMETRIC REFERENCE or ZODIACAL LIGHT

Table 5.12: Solar System Keywords

Searching on Proposal Title and Abstract

Besides searching for individual HST observations of a given source class based on the target description, you may want to search for HST observing proposals that concentrate on, or include, observations of a certain class of source. Refer to our text search strategy at the beginning of this section (page 66). The <Duplication Abstract> or <Proposal Abstract> screens contains a summary of information about each accepted proposal, including the proposal title and the keywords from the proposal abstract, as well as the proposal abstract itself. To find, for example, proposals for observations of Seyfert galaxies, constrain proposal title as `*seyfert*`. To expand the search to proposals that pertain to Seyfert galaxies, repeat the search, clearing constraints for proposal title, and constraining the abstract text as `*seyfert*`. Having identified and recorded specific proposal numbers of interest, you can then return to the <Quick Search> or <General> screens, list the relevant proposal numbers separated by commas, and bring up all observations that were taken for such proposals.

Assessing Data Quality

The quality of data in the HST Archive varies greatly. While it is difficult to assess the quality of the data in a given HST exposure from the keyword information alone (i.e., without actually obtaining and analyzing the data), there are several keywords that are written to the HST catalog and displayed by StarView screens that can help you to get a feel for the quality of the data in a given dataset. Among these are the following (each of which are described in the following sections):

- The PDQ keywords and comments
- The exposure flag (expflag)
- The fine guidance system lock used to track the target (fgslock)
- Previewing images
- Observation log files for data taken after October 20, 1994

When interpreting the relevance of these parameters for a given observation, bear in mind that the importance of these parameters to data quality is relative. It depends both on the characteristics of the source being observed and the purpose to which you will put the data.

In addition to the complete science data set, the archive contains compressed versions of all public data sets. These compressed versions can be viewed with StarView (and the WWW interface) and thus allow the user to gain an idea of the quality of an image or spectrum by direct inspection. A detailed discussion of the preview capability can be found in Chapters 3 (WWW interface) and 4 (StarView).

In addition to the above methods of assessing data quality, for data taken after October 20, 1994, you can also obtain observation logs for a given dataset. The observation log files contain detailed pointing information (including jitter information) as well as the information on the spacecraft position and attitude. This information is provided at high time resolution, and should be particularly useful in many cases for investigating problems that are revealed by an inspection of the data or data quality comments. The Observation Logs can be retrieved using Starview by first marking the science dataset in StarView (say on the <Quick Search > or <General Search> screens) and then selecting the "Observation Log Files" option on the archive retrieval screen.You can inspect some of this information with the <Observatory Monitoring Search> Screen.

Procedural Data Quality Keyword and Comments

Each science dataset is displayed and evaluated for data quality after it has been calibrated by OPUS. OPUS assigns a parameterized PDQ keyword to the dataset and writes an optional PDQ comment. The PDQ quality keyword and comments are written to the HST catalog and can be displayed in StarView using the <Quick Search> or <General> screen (which displays the PDQ comments). When you are interpreting the relevance of the PDQ keyword and comments, bear in mind that:

- Data quality parameterization is inherently subjective
- The relevance of the keyword and comments depends on the nature of the target of the observations

Care must be taken to combine a knowledge of the characteristics of the target with the PDQ keyword and comments when evaluating data quality. For example, while an evaluation of `no-source` for an observation where the target was a bright star and the integration time sufficient that a clear detection was expected may well indicate poor data quality, the same evaluation for an observation where the target was a distant, faint cluster of galaxies (for which co-adding of many exposures is required) indicates little about the quality of these data.

As described above, the PDQ evaluation is composed of a parameterized keyword and a comment. The comment describing the data is fully at the discretion of the operations astronomer. Table 5.13 lists possible values that the operators can assign to the parameterized PDQ keyword and a brief explanation of their meaning. This list of permissible keyword values was officially adopted as of February 1, 1992. Data processed prior to that date were described with a similar set of values. However, some of the original values were found not to be useful and were dropped from the current list, while other values were added. Most of the values on the list have been used since shortly after launch. Note that while several of the allowed values may apply to a given observation, the operator can assign only one value to the keyword for each observation. Also note that when data is reprocessed, it is not re-evaluated for data quality. So, some of the older, obsolete keyword values remain for some observations.

Keyword	Meaning
BADCHAN	Quality significantly compromised by dead CCD column(s) or bad diode(s)
COSRAY	Compromised by cosmic-ray contamination
DATA-DROP	More than about 2% missing, or data missing from probable area of interest
EDGEPSF	Got only an edge of the point-spread function
INCOMPLETE	Got only some of the expected data groups
NO-COUNTS	Zero-level data
NO-EVAL	Inadequate time or resources for data evaluation
NO-SOURCE	No sources visible in image
NOISY	High background, low signal-to-noise ratio
OK	No apparent problems
POOR	Other problems affecting probable scientific utility (used when no other keyword applies)
SATURATED	Target saturated; counts rolled over, etc.
TRAILED	Observation taken on gyros, trailed sources, but otherwise OK
UNDEREXP	Observation seems underexposed
UNKNOWN	Uncertain of usefulness or quality of data

Table 5.13: PDQ Keywords

The PDQ Files

The complete OPUS data quality report can be retrieved from the archive. Every PDQ file is archived as ancillary data (class ASA) with the same root name as the observation and an extension of `_pdq.fits`. In addition to the data quality keyword and comments, the complete PDQ file contains predicted as well as actual observation parameters extracted from the standard header and science header files. To obtain the PDQ files associated with particular datasets, be sure that the **[Data Quality]** button is selected on the <Retrieval Request - File Options> screen.

OPUS Observer Comment Files

Observer comment files may help an archive user determine the quality of an HST observation. OPUS also monitors the health of the telescope and provides observers with a real-time interface.

Observer comment files contain updated mission information obtained at the time the observation was executed. OPUS personnel put comments into this ASCII text file. However, these files are not created for every observation executed. The data quality files, like the PDQ files, can be retrieved using the **[Data Quality]** button on the <Retrieval Request - File Options> screen.

Exposure Flag

The exposure flag keyword (`expflag`) serves as a comment to the exposure time keyword (`exptime`). It indicates whether the exposure completed successfully, without interruption, and whether the actual exposure time was different from the predicted exposure time. Note here the difference between predicted exposure time and proposed exposure time. The proposed exposure time includes setup time, while the predicted exposure time is only the predicted on-source integration time. The exposure flag can be useful in that it allows the archival researcher to determine whether the integration time obtained for a given observation is equal to the integration time the original observer expected for that exposure. The details of how the value of this keyword is set are complex and instrument-dependent. Table 5.14 gives a generic description of the possible values of this keyword and their meaning.

Fine Guidance System Lock

The tracking mode requested for each HST observation is given in the keyword `fgslock`, which is displayed on the <Exposure Search> screen and on the different instrument screens. There are currently three tracking modes available during HST observations: coarse and fine lock, which use the FGS's, and gyro stabilization. When the HST is stabilized with gyros, no guide star acquisition occurs, and the absolute error of positioning is ±30". The anticipated guiding accuracies for the three modes are 0.002"/sec drift rate for gyro hold, 0.015" RMS jitter for coarse track, and 0.005" RMS jitter for fine lock. Obviously, the guiding accuracy required by the archival researcher in a given observation depends on the purposes for which the data are to be used. For the three different tracking modes, the values of the `fgslock` keyword are GYROS, COARSE, and FINE.

Keyword	Meaning
NORMAL	EXPTIME was successfully calculated from telemetry information, is equal to the predicted exposure time, and there is no indication that the exposure was interrupted. EXPFLAG is also set to `NORMAL` when EXPTIME was successfully calculated and the predicted exposure time was not available.
INTERRUPTED	EXPTIME was successfully calculated from telemetry information, is equal to the predicted exposure time, but there is an indication that the exposure was interrupted.
INCOMPLETE	EXPTIME was successfully calculated from telemetry information and is less than the predicted exposure time.
EXTENDED	EXPTIME was successfully calculated from telemetry information and is greater than the predicted exposure time.
UNCERTAIN	The Shutter Log Overflow flag was set, which indicates that not all shutter open and close times are available. EXPTIME was calculated from the shutter open and close times that are available.
INDETERMINATE	EXPTIME could not be successfully calculated from the telemetry, and the predicted exposure time was not available.
PREDICTED	EXPTIME could not be successfully calculated from the telemetry, and EXPTIME was set to the predicted exposure time.

Table 5.14: Exposure Flag Keyword Values

Observation Log Files

Observation log files for each science dataset taken after October 20, 1994 have been produced in the pipeline and written to the HST archive. The observation log files contain a specialized set of pointing and engineering data associated with each science exposure (including the jitter information). You can retrieve these log files using StarView via the <Observatory Monitoring Search> screen. You can also retrieve these files by first marking the science dataset in StarView (say on the <Quick Search> or <General Search> screens) and then selecting the observation log files option on the archive retrieval screen. Remember, that the observation log files are only available for those data taken after October 20, 1994.

ASCII Catalogs

To assist in searching the HST Archive and in preparing proposals, ASCII catalogs are available which list completed and planned proposals and exposures.

Proposals

One catalog is available that summarize proposals which have been submitted.

- The Proposal Abstracts Catalog lists abstracts from completed and planned proposals. It is sorted by proposal ID. (See the file `proposal_abstracts.cat`.)

Exposures

Two catalogs have been created which provide a summary of completed and planned exposures. For each catalog, there are separate files for the entire catalog, sorted by RA and Dec, and for solar system targets only, sorted by target name.

- The Planned and Archived Exposures Catalog (PAEC) lists completed and planned exposures. For planned exposures, conflict types are indicated. The PAEC is appropriate for observers who are planning to submit proposals for HST. (See the files `paec.cat` and `paec_ss.cat`.)
- The Archived Exposures Catalog (AEC) lists exposures which have been completed and have been archived into the HST Archive. The AEC is useful for Archive researchers; more information about exposures in the HST Archive is available through StarView. (See the files `aec.cat` and `aec_ss.cat`.)

The easiest way to access these catalogs is through the World Wide Web at: `http://archive.stsci.edu/ascii_catalogs.html`

6

Advanced StarView Queries

In This Chapter...

StarView provides two powerful tools for specifying your own customized searches of the Hubble Space Telescope (HST) catalog: a custom query feature and a Structured Query Language (SQL) editor.

StarView's custom query feature lets you construct your own custom queries (i.e., searches) of the HST catalog. This query can have one catalog field or many fields (current limit is 112). Typically, you would use this feature when the predefined StarView screens do not have the information (i.e., the catalog fields) that you are interested in. With the custom query feature, you can choose to display a wide variety of catalog information on a single screen, picking and choosing from among all of the available fields and tables in the HST catalog. For example, you may want to display target names and proprietary data release dates (and nothing more) on a simple table format screen, or you may want to display some of the target flux information that is not provided on any of the predefined StarView screens. With the custom query feature, you control what information is displayed. A complete list of all StarView tables and attributes can be found in the *Data Description* supplement.

The SQL editor lets you make searches of the HST catalog that cannot be defined on any of the normal StarView search screens. With the <SQL Editor> screen, you can display and modify the SQL commands for the current query, display and modify a set of SQL commands copied from an external file, or enter your own SQL commands. Typically, you would do this when you want to make some specific queries of the HST catalog that involve SQL constructs that are not possible through the normal procedure of entering constraints on a predefined StarView search screen. For example, you would use the SQL editor if you wanted to list all unique values of a specific field in the catalog, or if you wanted to impose a logically complex combination of constraints on the catalog search.

Using the Custom Query Feature

StarView's predefined screens are designed to satisfy the needs of most archive users. However, only a small fraction of the fields in the database are contained on the predefined forms. StarView's custom query feature lets you select other fields in the database of interest and construct queries with these fields.

To build a custom query, you:

1. Select fields (attributes) from the database in which you are interested.
2. Constrain your search by placing limits on some of these fields.
3. Begin the search.
4. View the results.

You can also save the query to a file so that you do not have to repeat the setup process.

Selecting Fields From the Database

The first step in building a custom query is to select fields (attributes) from the database. A list of all possible attributes is presented on the <Custom Query> screen. You may optionally filter and sort this list to derive a subset of attributes from which to choose. Then you can select attributes from the list that will define your search. The procedures for selecting fields from the database are further explained below.

1. Display the <Custom Query> screen by selecting **|Build Custom Query|** from the |**Commands|** menu on the <Welcome> screen or from the **|Customize|** menu on other StarView screens.

   An example of what may be displayed is shown below:

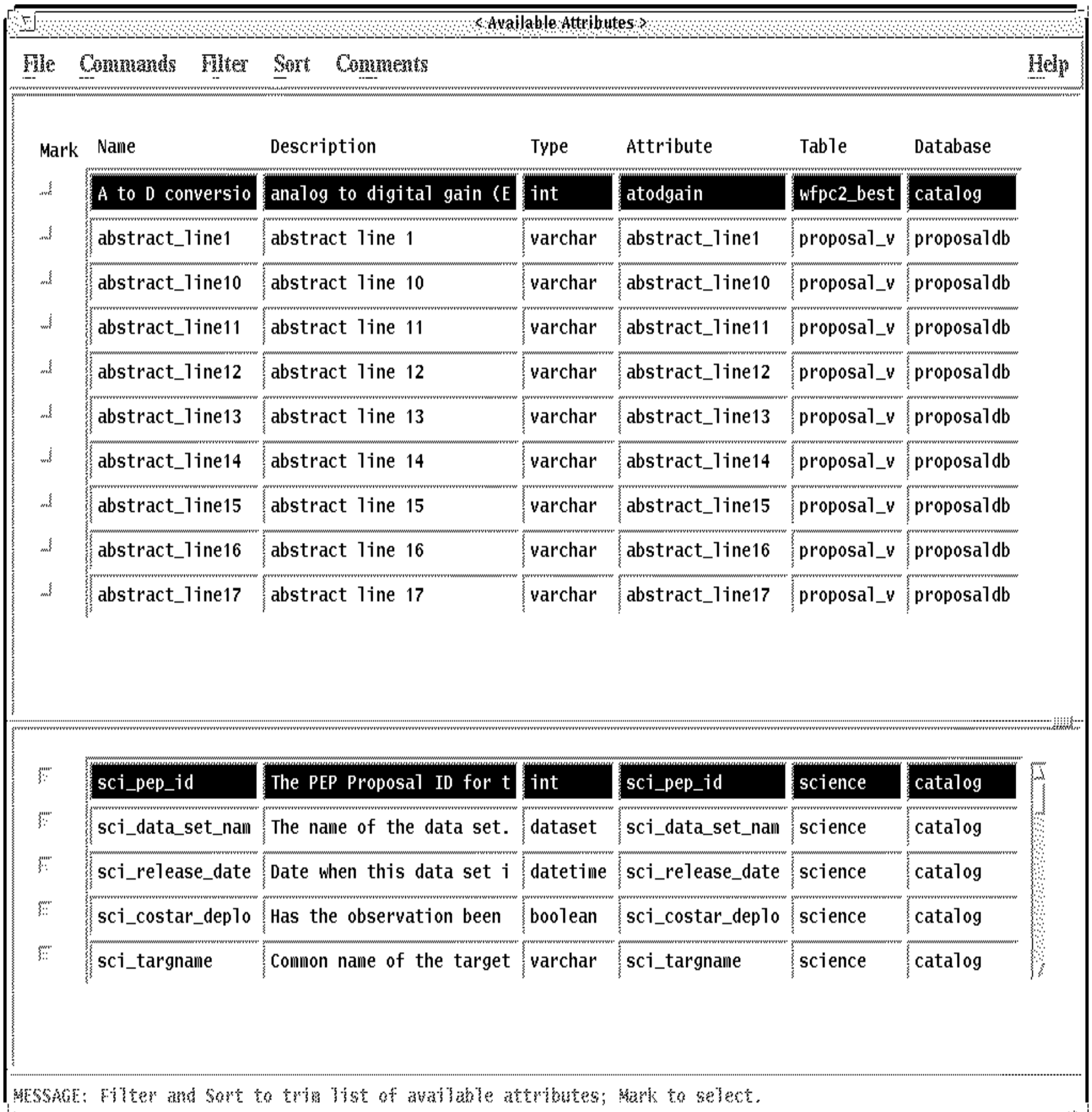

Figure 6.1: <Custom Query> Screen

If you display the <Custom Query> screen from the <Welcome> or <Table Format> screen immediately after you start up StarView, no attributes will be preselected (i.e., the bottom list will be empty). If you display the <Custom Query> screen from a search screen, attributes corresponding to the field labels on the search screen will be preselected and will appear in the lower list. Select **|New|** from the **|Commands|** menu of the <Custom Query> screen to remove all of the attributes in the select list and to begin a new search.

On the <Custom Query> screen, database attributes (fields) are displayed in two lists. The upper list displays the available database attributes. You can select attributes from this list that you wish to include in the current query.

Attributes that you select for inclusion will appear in the lower list. Attributes can be removed from the select list at any time.

Each attribute is defined by a row in the lists. Scroll up or down, with the arrow keys, to view additional or previous rows. Scroll right or left within a field (column) to view information that extends beyond the field boundaries.

Filtering Attributes

2. To filter your list of available attributes, select an item from the **|Filter|** menu.

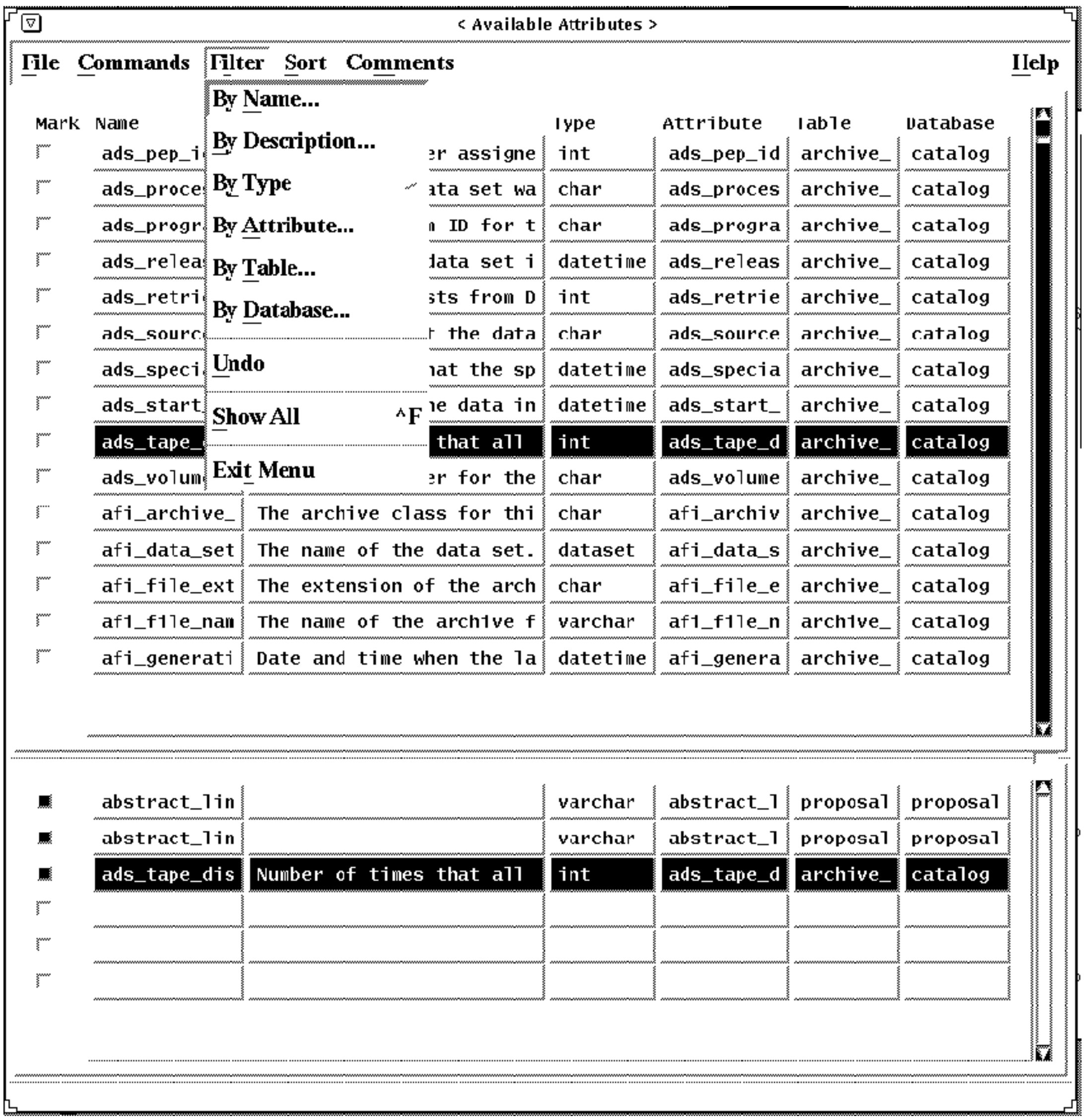

Figure 6.2: |Filter| Menu

Filtering limits the set of attributes that are displayed to a subset of the attributes in the database.

Each successive filtering further narrows the available attributes in the upper list. Select **|Undo|** to undo the last filter operation performed in the current session. Select **|Show All|** to restore the list of all available attributes.

If you select **|By Name|**, **|By Description|**, **|By Attribute|**, **|By Table**|, or **|By Database|**, a dialog box will appear, prompting you to type a name or description. Type a complete or a partial name or description. If you filter on a partial name or description, attributes with those characters in any position in their name or description will be displayed. If you select **|By Type|**, a submenu will appear.

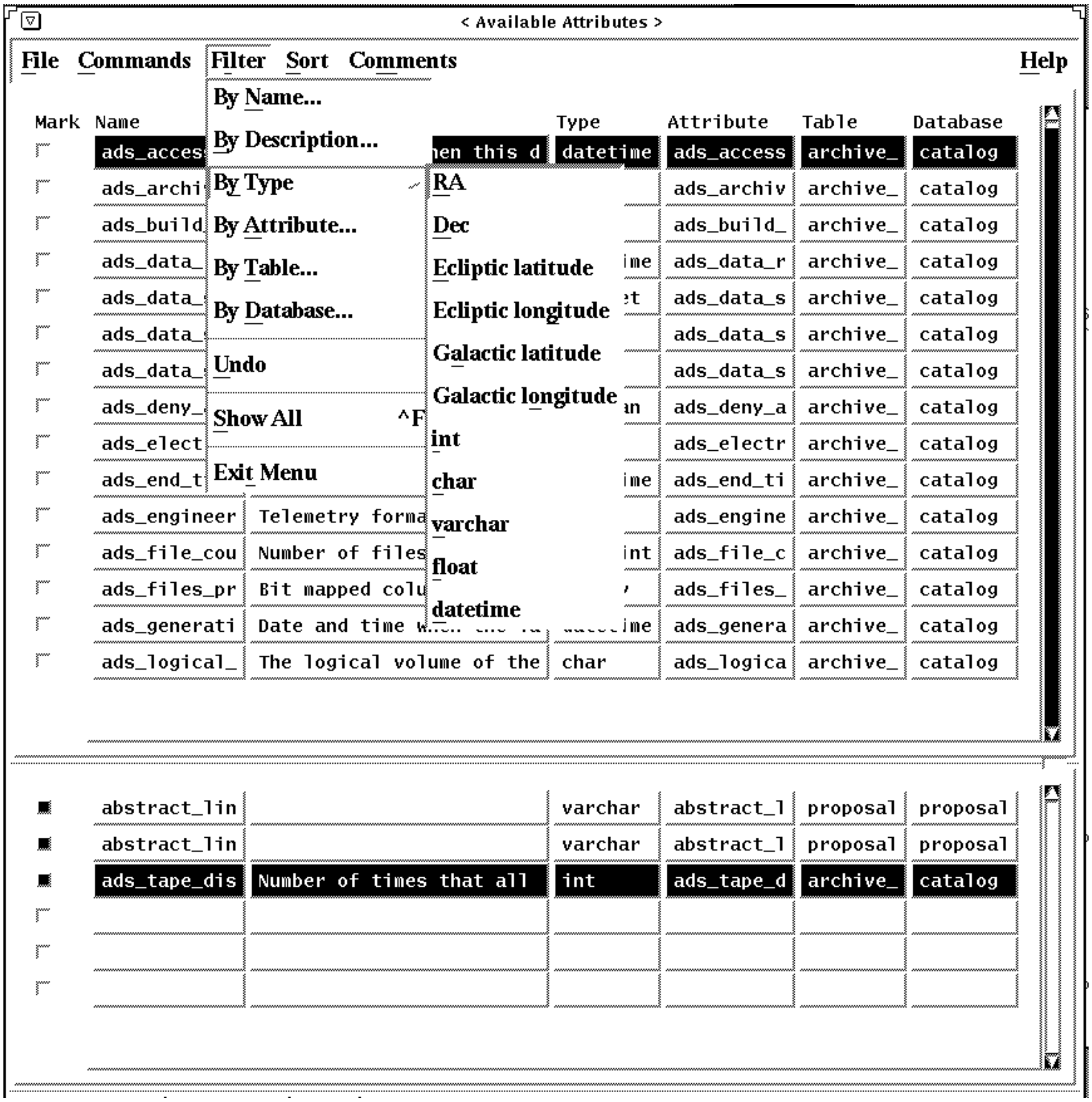

Figure 6.3: |By Type| Submenu

Choose a data type from the submenu.

Sorting Attributes

3. To sort your list of available attributes, select **|By Name|**, **|By Type|**, **|By Attribute|**, **|By Table|**, or **|By Database|** from the **|Sort|** menu.

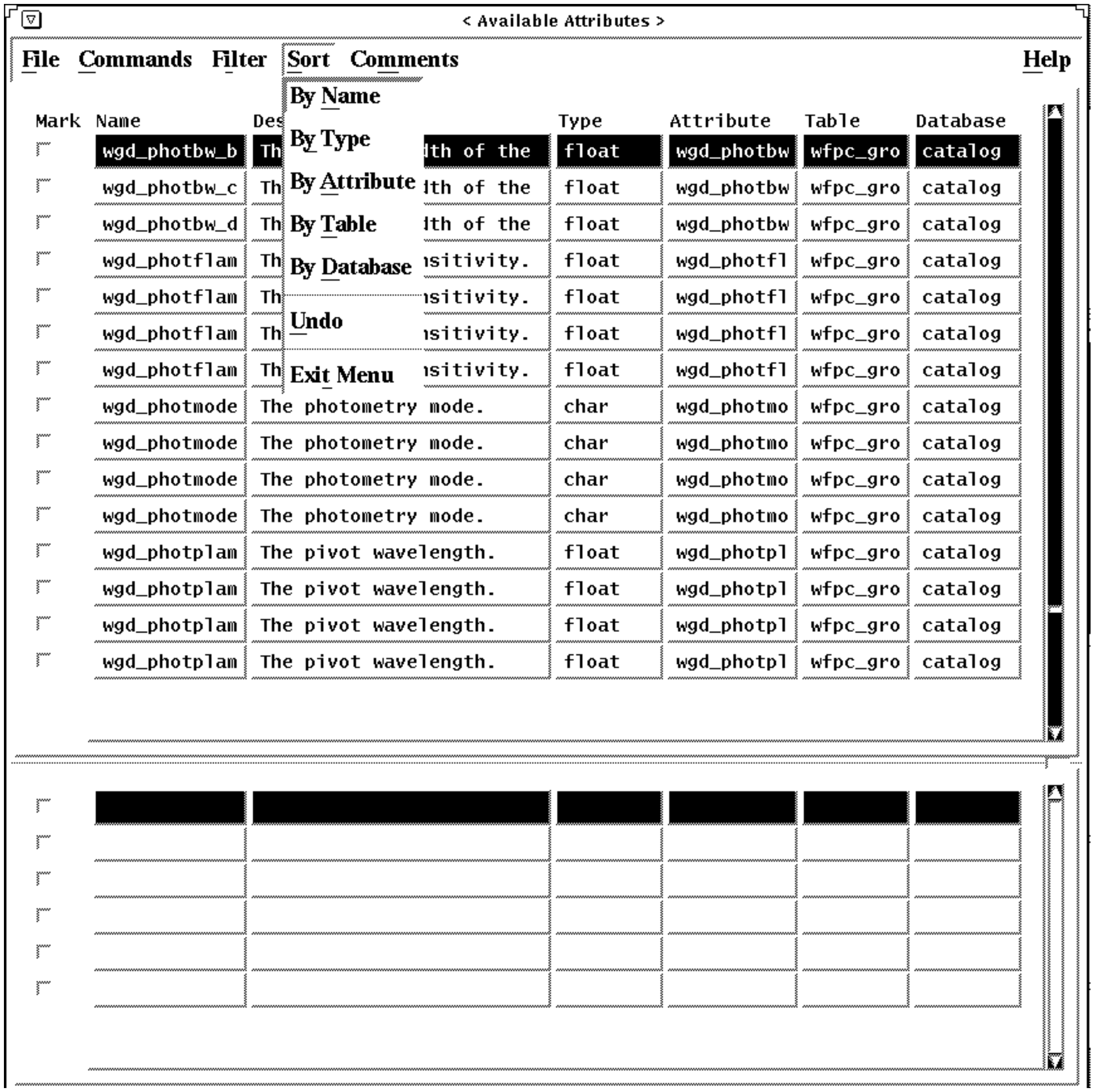

Figure 6.4: |Sort| Menu

Available attributes in the upper list will be sorted alphabetically by the menu item selected. Successive sorting operations are not cumulative. Select **|Undo|** from the **|Commands|** menu to undo the last sort operation for the current session.

Selecting Attributes

4. To select an attribute to include in the current query simply click the corresponding **[Mark]** button. (You could also highlight the attribute and choose "Select" from the **|Commands|** menu). The attribute will be displayed in the lower list of selected attributes with a tick mark next to the name (see Figure 6.5). You can select a maximum of 112 attributes to include in a query.

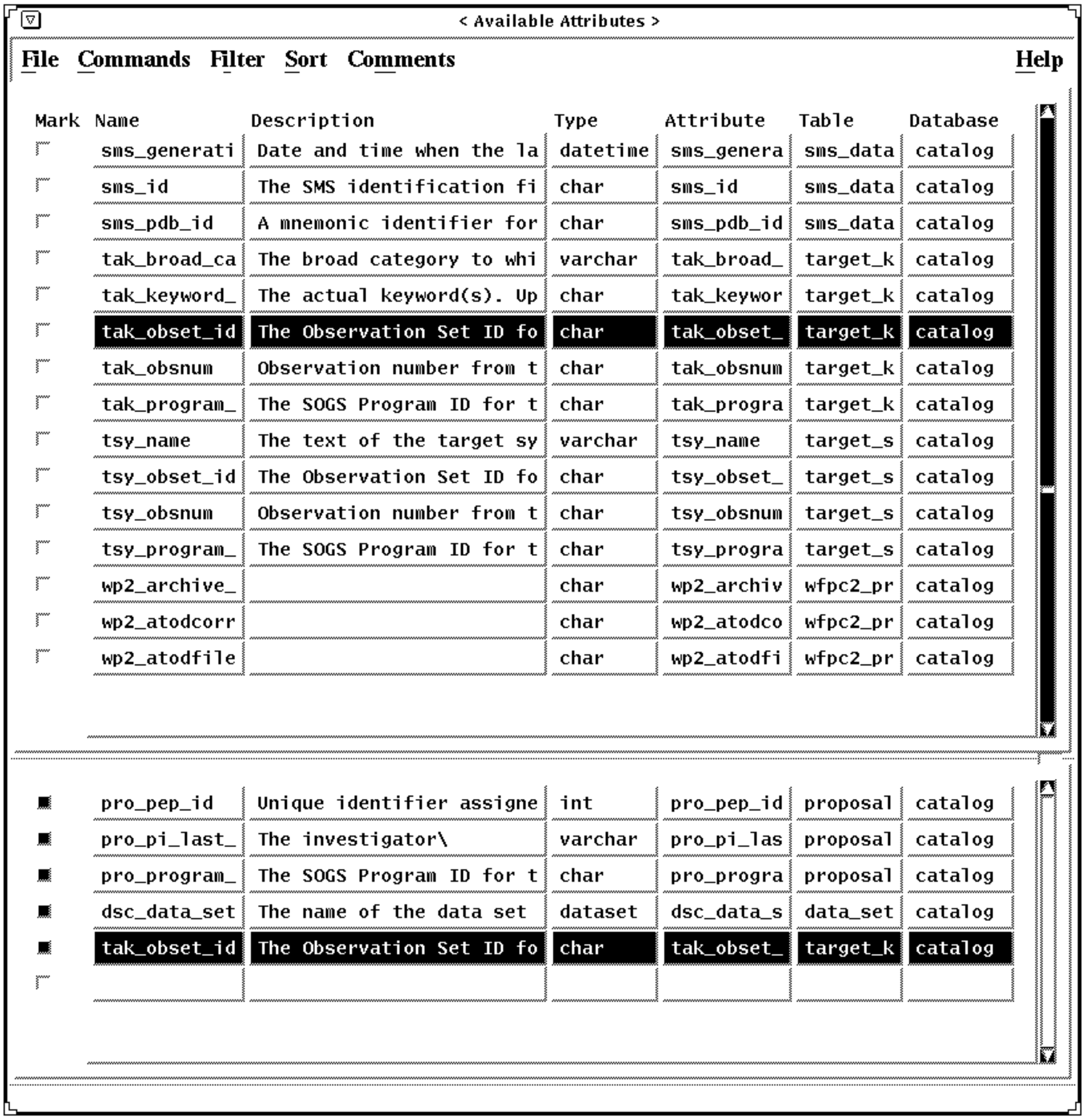

Figure 6.5: Selected Attributes on the <Custom Query> Screen

You can select all of the attributes displayed in the available list by choosing **|Select All|** from the **|Commands|** menu.

Removing Attributes

5. You can remove attributes from a query if you exceed the 112-attribute limit or otherwise don't want to include them in the query.

From the list of selected attributes (lower list), simply click on the **[Mark]** button. Alternatively, from the list of available attributes (upper list), you can either click on the **[Mark]** button or highlight a selected attribute and then choose “Deselect” from the **|Commands|** menu.

Either way, the tick mark will disappear, and the attribute will be removed from the lower list of selected attributes.

Completing the Selection

6. After compiling a list of selected attributes, choose **|Done|** from the **|Commands|** menu.

This will dismiss the <Custom Query> screen and let you constrain your query. Alternatively, selecting **|Exit Screen|** will abandon the custom query and return you to your previous StarView screen.

If you select **|Done|** to proceed with the custom query, you will invoke the <Table Format> screen.

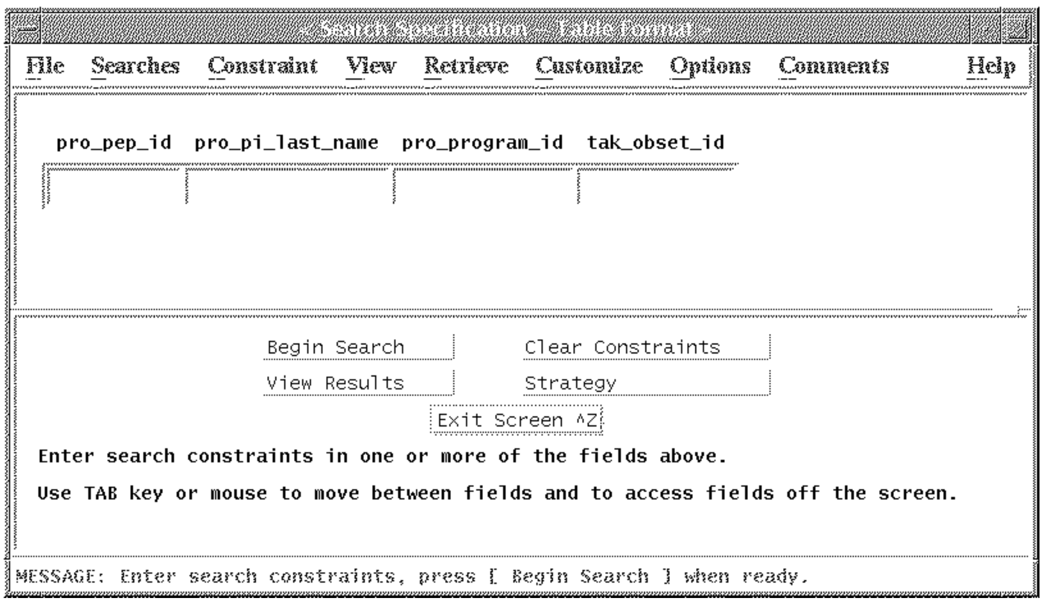

Figure 6.6: <Table Format> Screen

Your selected attributes will now appear as column headings on the <Table Format> screen in the order that they appear in the selected list on the <Custom Query> screen. You can constrain searches, view returned records, and save a query from the <Table Format> screen (see page 103).

Constraining Your Search

7. To constrain your search, move the cursor to one or more underlined fields in the first row of the <Table Format> screen and enter your search constraints.

StarView validates user input; therefore, search constraints must be correctly formatted. Constraints on the <Table Format> screen should be formatted the same as those on other search screens. For more information on validating user input and formatting search constraints, see page 37.

Initiating Your Custom Query Search

8. Initiate a custom query search from the <Table Format> screen by pressing **[Begin Search]**.

Viewing Returned Records

9. Your search results will be displayed on the <Table Format> screen (see below):

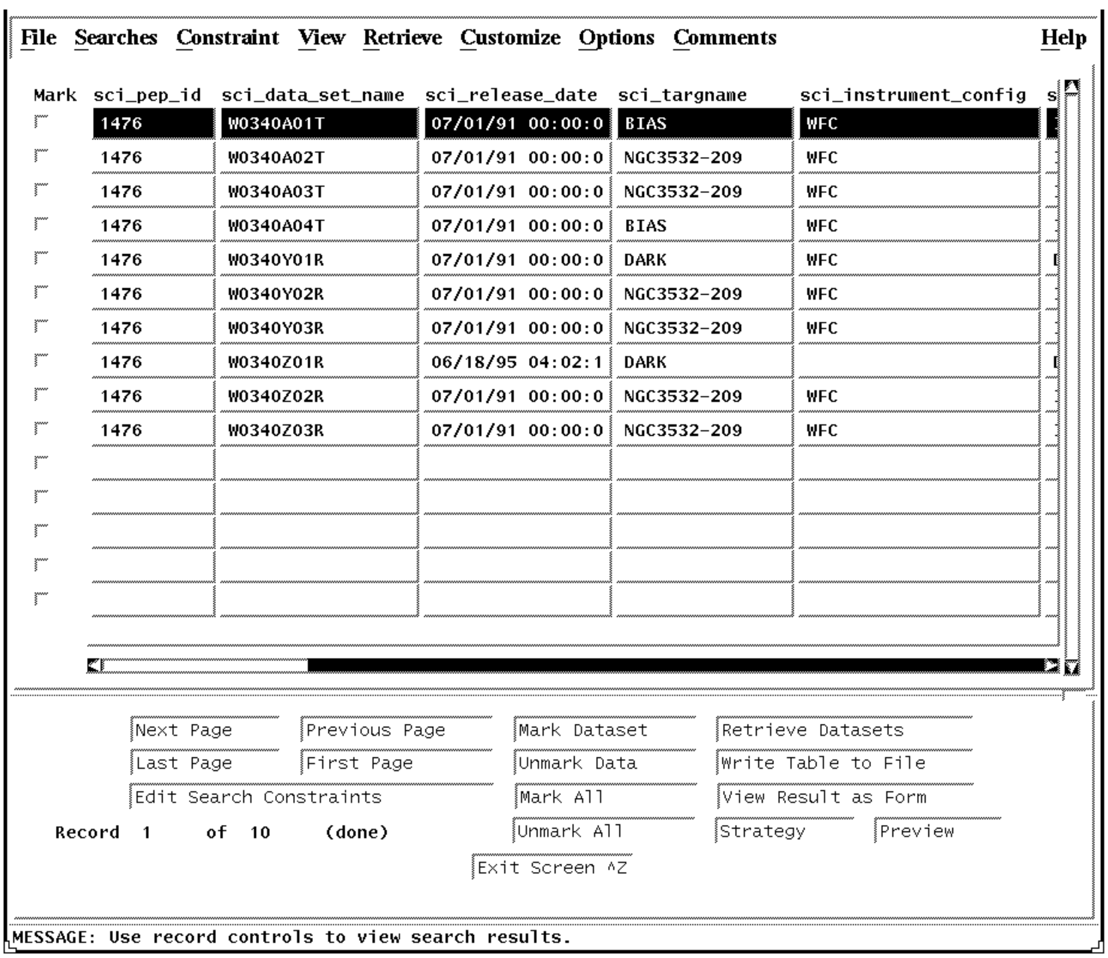

Figure 6.7: <Table Format> Screen With Search Results

For more information on using the <Table Format> screen, see page 105.

Cancelling A Custom Query

Press Control-C before the first record is returned to cancel a custom query. You may want to cancel a custom query if you built or qualified it incorrectly, or if the database search for matching records is taking too much time.

Modifying a Custom Query

You can modify the search constraints or the fields used in a custom query. If you modify fields (i.e., database attributes), a new query will be constructed, and you will lose the current search constraints, but not your choice of fields. To modify search constraints or database attributes, follow the instructions on page 104.

Saving a Custom Query

You can save a custom query in a file for later use. Follow the instructions for “Saving a Query” on page 103.

Restoring a Custom Query

You can restore a custom query that was previously saved to a file. Follow the instructions for “Restoring a Query” on page 103. Once you have restored a custom query, you can modify it or use it as is to browse the catalog.

Using the SQL Editor

StarView searches are automatically translated into SQL.[1] Through the <SQL Editor> screen, you can display SQL for the current query or from an external source, or enter your own SQL. You can also edit your SQL, submit it, and view results as you would with any other query. Procedures for using the <SQL Editor> are explained below.

---

1. SQL query generation is performed by a system called QUICK, which stands for “Quick is a Universal Interface With Conceptual Knowledge.” QUICK was developed by Dr. Ralph Semmel of the Johns Hopkins University Applied Physics Laboratory. It is written in CLOS and is integrated in StarView using the Lisp-to-C Translator™ from Chestnut Software, Inc.

What is SQL?

SQL is a language designed for relational database management systems. For example, StarView supports the Sybase database management system. In a relational database management system, data are presented as tables (also known as relations). Each row of the table is a record of a single entity. Each column describes a characteristic (attribute) of an entity.

Typically, StarView translates a user's catalog search request into SQL. The SQL is then used by the archive's database engine, Sybase, to provide the search results. This translation is automatic. It is based on the attributes selected from the <Custom Query> screen or on the fields displayed on the current search screen. This automatic translation into SQL is one of StarView's most powerful features. It allows you to access most of the fields in the HST catalog, without you having to be a database expert.

There are many special cases, however, that would require a knowledgeable user to query the database directly. It is primarily for these cases that the <SQL Editor> screen was provided. Through it, users are able to formulate directly arbitrary SQL statements for the database to process.

The general benefit of the <SQL Editor> screen for most StarView users is the ability to save queries (including your entered search constraints) for later reuse.

Displaying SQL for the Current Query

To display SQL for the current query, select **|Edit SQL|** from the **|Customize|** menu of a search screen. The <SQL Editor> screen will appear.

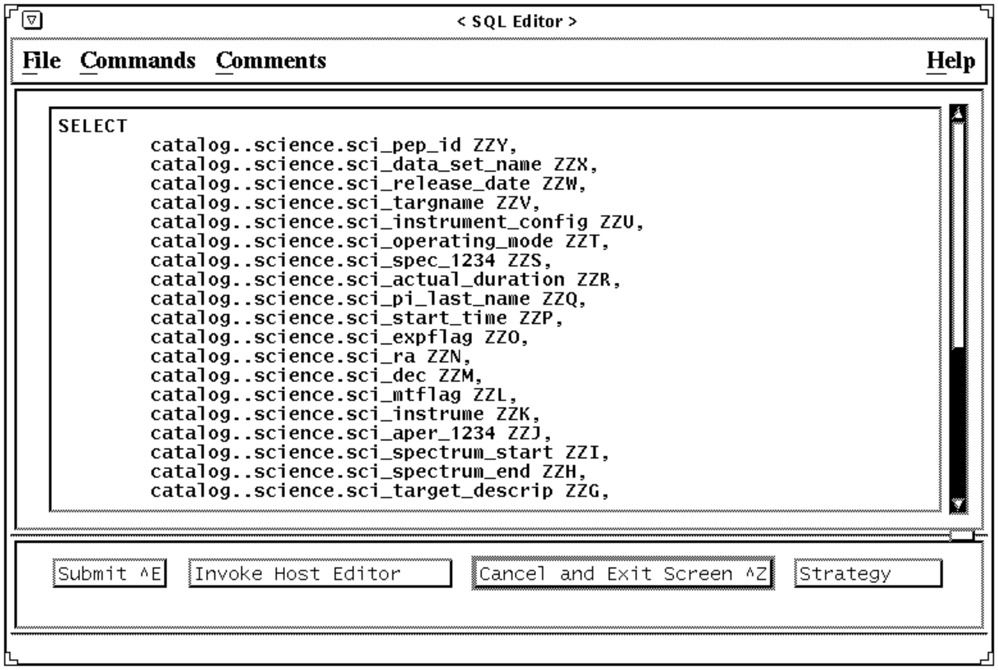

Figure 6.8: <SQL Editor> Screen

Scroll vertically with the arrow keys to view text on this screen that may extend beyond the screen's boundaries.

Displaying SQL From an External Source

Display SQL from an external source by selecting **|Restore Saved SQL From File|** from the **|File|** menu of the <SQL Editor> screen. The <File Selector> dialog box will appear.

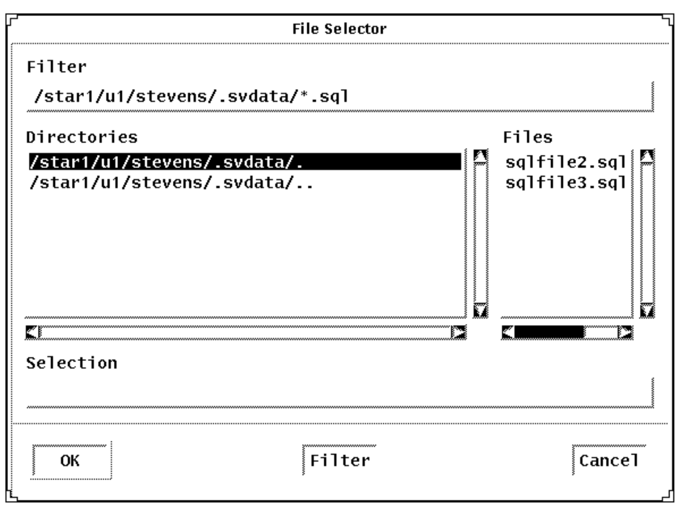

Figure 6.9: <File Selector> Dialog Box

For more information on the <File Selector> dialog box, see page 133. Select a file from this dialog box, then press **[OK]** to read the file and display the SQL. Press **[Cancel]** to dismiss the dialog box without opening a file.

Entering Your Own SQL

To enter your own SQL, display the <SQL Editor> screen from the <Welcome> screen or from a search screen. If displayed from the <Welcome> screen immediately after startup, the <SQL Editor> screen is initially blank, allowing you to formulate arbitrary SQL statements. If displayed from a search screen, this screen contains the SQL for the current query, even if this search has not been submitted for processing. Select **|Clear Screen/Enter New SQL|** from the **|File|** menu to delete the SQL and begin a new query. Consult the references listed on page 95 to find out how to construct SQL statements.

Editing SQL

You can edit SQL directly on the <SQL Editor> screen. See key help for key bindings that you can use on this screen.

Alternatively, you can use an external text editor (e.g., Emacs or EDT) to edit the SQL, as indicated below:

1. Save the SQL to a file by selecting **|Save Current SQL|** or **|Save Current SQL As|** from the **|File|** menu.
2. Temporarily exit StarView by selecting **|Escape to Operating System|** from the **|File|** menu.
3. Edit the SQL file.
4. Log out of the system shell to return to StarView.
5. Open the edited SQL file by selecting **|Restore Saved SQL From File|** from the **|File|** menu.

Submitting an SQL Query

To submit an SQL query, click on the **[Submit]** button or select **|Submit|** from the **|Commands|** menu.

Viewing Returned Records

Returned records are displayed on the <Table Format> screen. See page 105 for more information on using the <Table Format> screen.

Cancelling an SQL Query

Press Control-C before the first record is returned to cancel a query. You may want to cancel an SQL query if you entered or edited it incorrectly, or if the database search for matching records is taking too much time.

Saving an SQL Query

You can save an SQL query in a file for later use. Follow the instructions for “Saving a Query” on page 103.

Queries saved from the <SQL Editor> screen can be opened only on this same screen.

Restoring an SQL Query

You can restore an SQL query that was previously saved to a file. Follow the instructions for “Restoring a Query” on page 103. Once you have restored an SQL query, you can edit it or use it as is to browse the catalog.

SQL References

Refer to the documents listed below for more information on SQL.

ANSI X3.135.1989, *American National Standard Database Language—SQL With Integrity Enhancement*

Bowman, Judith S., et al., *The Practical SQL Handbook*, Addison-Wesley Publishing Company, Reading Massachussets, 1993.

Date, C. J., *An Introduction to Database Systems*. 5th edition. Reading, Massachusetts: Addison-Wesley Publishing Company, 1990

Date, C.J. with Hugh Darwen, *A Guide to the SQL Standard*. 3rd edition. Reading, Massachusetts: Addison-Wesley Publishing Company, 1993

McGoveran, D. with C.J. Date, *A Guide to Sybase and SQL Server*. Reading, Massachusetts: Addison-Wesley Publishing Company, 1992.

Sybase Publications Group, *Transact-SQL User’s Guide for SYBASE SQL Server*, Sybase Inc., Emeryville California, 1993.

Cross Correlation

If you are interested in finding out whether HST has observed a few individual sources, then you can simply search for matches between the HST catalog and those sources one at a time. However, if you have a list of sources whose RA and Dec you know, Starview provides a cross correlation capability that will search for matches between all members of your input list and the HST catalog.

The cross correlation capability is available on all StarView screens that have RA and Dec fields on the qualification form. It is easy to use. Simply click on the **[Cross Correlation]** button at the bottom of the screen. A dialog box will pop up requesting the name and location of the input list file. Your input list should contain multiple lines, each with a format of RA, Dec, and an optional comment, where the RA, Dec, and comment must be separated by commas or spaces. The RA and Dec must be in J2000 coordinates and can be written either as hh mm ss.s etc., or in decimal degrees. Declinations must include the +/- sign. Currently, the cross correlation facility supports input lists of 500 lines or less (depending on your system, larger input lists may be possible, but are not guaranteed).

To use the cross correlation feature in StarView:

1. Select pull-down menu item from the Constraint menu or select the **[Cross Correlation]** button.
2. A file selector dialog screen will pop up asking for the name of the cross correlation file. By default, it looks for the file `xcorrfile.lis` in your current directory.
3. The radius field will be given a default value of 10 if there is currently a value of 0 in the field. Otherwise, it maintains its original value.
4. Enter any additional constraints (e.g., qualify on instrument or exposure start time). You can also change the search radius at this time.
5. Click the **[Begin search]** button. This will search the database for values matching each line of the correlation file.
6. If a match is found the screen will switch to the view results screen. You can step through the returned records one at a time or switch to table row form. All of the normal functionality (e.g., preview) is available to you. On some screens (e.g., the <Duplication Check> screen) you will see information about the line from your input list displayed directly on the return screen (specifically the input line number, RA and Dec and comment). For screens where this information is not visible on the screen, the information is available in the table row format; it appears as the first 4 columns of the table row format, so you will have to scroll the screen to see most of the other values.

Your query will remain in cross correlation mode until you click on the **[Clear Constraints]** button on the qualifying screen, or until you exit the screen completely.

Users should be aware that a cross correlation facility is also available via the WWW interface at `http://archive.stsci.edu/search/` (see “Cross-Correlations” on page 22). The WWW interface also allows the cross-correlation of the HST and MAST catalogs with selected astronomical catalogs.

7 Additional StarView Topics

In This Chapter...

Once you are comfortable with the basic procedures for using StarView, you may want to try some of the additional features explained in this chapter.

Entering Data on a StarView Screen

StarView recognizes only certain data formats for search constraints. Table 7.1 provides examples of these data formats.

Data Type[a]	Examples of Allowable Formats
String	G190H, Y0ML0104T, PG0953+414, Stellar Cluster, FO*[b]
Boolean	Y, Yes, N, No, T, True, F, False, 1, 0
Integer	0, 13, 256
Float	1.5, 15.32, 153.26
Date/Time[c]	January 1 1990, January 1 90, Jan. 1 1990, Jan 1 1990, 1-Jan-1990, 1Jan1990, 1 Jan 90, 1/1/1990, 1-1-90, 1.1.90 12:24:32.4, 12 24 32 4, 12.24.32.4[d] January 1 1990 12:24:32.4[e]
Angle	See Table 7.2.

a. You can use relational operators (e.g., >, >=, =) with any data type except string. See Table 4.1 on page 37 for a list of relational operators that you can use in search constraints.
b. You can use wild cards only with the string data type.
c. Do not use commas in times and dates (example: May 1, 1990). The comma will be incorrectly interpreted as a list separator.
d. You may use 24-hour time with or without specifying AM or PM. You must specify AM or PM for 12-hour time.
e. When you specify both a date and a time for a constraint, type the date first, insert at least one blank space, then type the time.

Table 7.1: Allowable Data Formats

More on Formatting Search Constraints

The subsections below explain the rules for formatting search constraints. Specifically explained are:

- Using wild cards.
- Relating search constraints with “and” or “or”.
- Formatting positional values.
- Using spaces in search constraints.

You can also enter constraints with relational operators. For information on the relational operators that StarView supports, see page 37.

Using Wild Cards

You can (and often should) include wild cards in character fields. Note that date and time fields are numerical fields. Specify a wild card by typing the star symbol (*).

Wild cards let you specify multiple selections with related names, without having to specify each selection by its full, unique name. Use the wild card symbol to match zero or more characters. You can use more than one wild card in each item. For example:

```
Target: NGC*
```

The “*” is StarView’s wild card symbol. StarView converts this symbol to the equivalent symbol that the database management system, Sybase, needs for searching the catalog. See also the note on page 102.

See “Text Searches” on page 38.

Relating Search Constraints With “And” or “Or”

StarView lets you constrain multiple fields in a single search. Multiple search constraints are related by “and” by default. For example:

```
Proposal ID: >1000
Target: NGC4473-WFPOS-CNTR
```

This will return all records where the proposal ID is greater than 1000, and the target is NGC4473-WFPOS-CNTR. To relate search constraints by “or,” you must use the Structured Query Language (SQL) editor.

```
SELECT

proposaldb..proposal_info.pep_id ZZY,
proposaldb..proposal_info.continuation_id ZZX,
proposaldb..proposal_info.prop_type ZZW,
proposaldb..proposal_info.sci_category ZZV,
proposaldb..proposal_info.proposal_cycle ZZU,
proposaldb..proposal_info.pi_lastname ZZT,
proposaldb..proposal_info.proposal_title ZZI

FROM
proposaldb..proposal_info

WHERE
(proposaldb..proposal_info.sci_category LIKE "%GALAX%"
OR
proposaldb..proposal_info.proposal_title LIKE
"%GALAX%")
```

(The purpose of this search is to find all observing programs that are either in the Galaxies & Clusters category or which may be in another science category, yet contain the words “Galaxy” or “Galaxies” in their proposal title.)

The “%” is the wild card symbol for StarView’s database management system, Sybase. When you enter SQL directly on the SQL Editor screen, you must use this wild card symbol. See also the note on page 101.

Formatting Positional Values

Positional values are RA, longitude, Dec, and latitude. When constraining searches, format RA and longitude as 00h 00m 00.0s and Dec and latitude as 000d 00m 00.0s. You can also format search constraints for these items as shown in Table 7.2.

RA and Longitude		Dec and Latitude	
You enter:	**StarView assumes:**	**You enter:**	**StarView assumes:**
000:00:00.0	hms	000:00:00.0	dms
000 00 00.0	hms	000 00 00.0	dms
0000000.0	hms	0000000.0	dms
000.0	deg	000.0	deg
000d 00m 00.0s	dms	000d 00m 00.0s	dms
000d 00' 00.0"	dms	000d 00' 00.0"	dms
000.000d	deg	000.000d	deg
00h 00m 00.0s	hms		
00.000h	hr		

Table 7.2: Formatting Positional Values

Using Spaces

Leading and trailing spaces are ignored. Multiple spaces in a row are treated as one space. Spaces are significant in fields where you enter dates, times, or positions (RA and Dec). For example:

```
Observation date: 23 03 92
Observation time: 07 02 17
```

Using a Previous Query

If you routinely perform the same basic search, you may want to save it (including the search constraints) for future use. You can later restore and even modify it for reuse. The sections below explain these functions.

Saving a Query

If you want to search the catalog at a future time with a particularly defined query, save it to a file by selecting **|Save Current SQL|** or **|Save Current SQL As|** from the **|File|** menu of the <SQL Editor> screen, or **|Save Current Query|** or **|Save Current Query As|** from the **|File|** menu of the <Table Format> screen. The save function overwrites any existing file of the same name. If you have not yet saved the current query, the <File Selector> dialog box will appear, prompting you to name the file that will contain the current query. For more information on the <File Selector> dialog box, see page 133.

StarView also automatically saves the current query in a file once a search begins. Therefore, you can use this file (`previousquery.sql` for queries saved from the <SQL Editor> screen and `previousquery.qry` for queries saved from the <Table Format> screen) to restore the previous search (see below).

You can externally edit any of these query files to modify the search request. When you restore an edited file, the modified query is used.

Restoring a Query

To search the catalog with a previously defined query:

1. Select **|Restore Saved SQL From File|** from the **|File|** menu of the <SQL Editor> screen or **|Restore a Saved Query|** from the **|File|** menu of the <Table Format> screen.

The <File Selector> dialog box will appear and will display a list of saved files. For more information on the <File Selector> dialog box, see page 133.

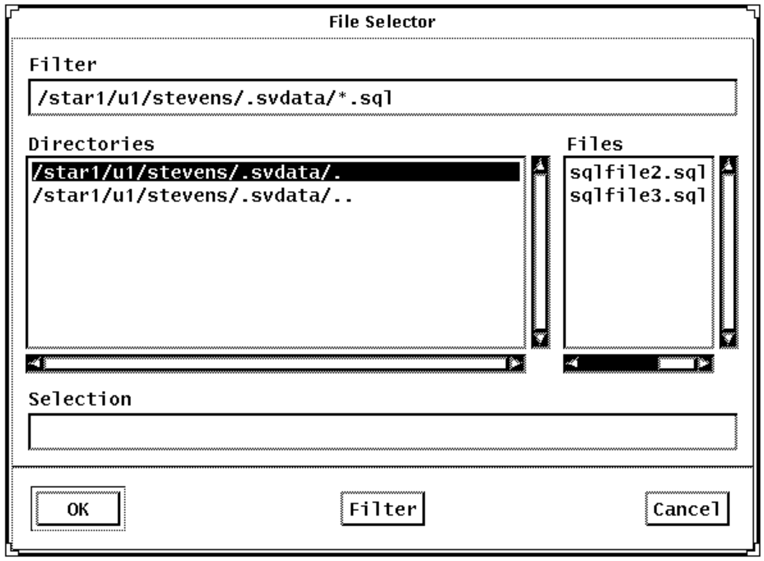

Figure 7.1: Saved Files Displayed on the <File Selector> Dialog Box

2. Select the file named `previousquery.sql` or `previousquery.qry` (whichever one is displayed) to restore the previous search, or select another saved query file.

   By default, query file names have a `.SQL` or `.QRY` extension.

Once you have restored a search, you can modify it or use it as is to browse the catalog.

Modifying a Query

You can modify the constraints or the fields used in a search. If you modify fields (i.e., database attributes), the constraints from the previous query are cleared. If desired, you can enter new constraints.

Modifying Search Constraints

To modify search constraints:

1. Display a query on a search screen or on the <Table Format> screen. Do this after you restore a query from a file, by pressing **[Submit]** on the <SQL Editor> screen.
2. Change, add, or delete search constraints.
3. Optionally, save the query.
4. Search the catalog by pressing **[Begin Search]**.

Modifying Database Attributes (Fields)

To modify the fields used in a search:

1. Open a query by selecting a predefined StarView search screen or by restoring a query file.
2. Display the <Custom Query> screen by selecting **|Build Custom Query|** from the **|Customize|** menu.

   For procedures on using this screen, see "Using the Custom Query Feature" on page 82.
3. Add or delete attributes in the selected attributes list (i.e., the lower list).
4. Select **|Done|** from the **|Commands|** menu to continue the modifications on the <Table Format> screen.
5. Optionally, constrain your search.
6. Optionally, save the query.
7. Search the catalog.

More on Viewing Records

This section explains how to view multiple records with the <Table Format> screen and how to write search results to a file. For basic procedures for viewing records, see Chapter 4.

Viewing Multiple Records With the <Table Format> Screen

The typical StarView results screen presents one record of catalog information at a time. As you know by now, you can display multiple records in a single table. Figure 7.2 shows a sample search results screen in table format.

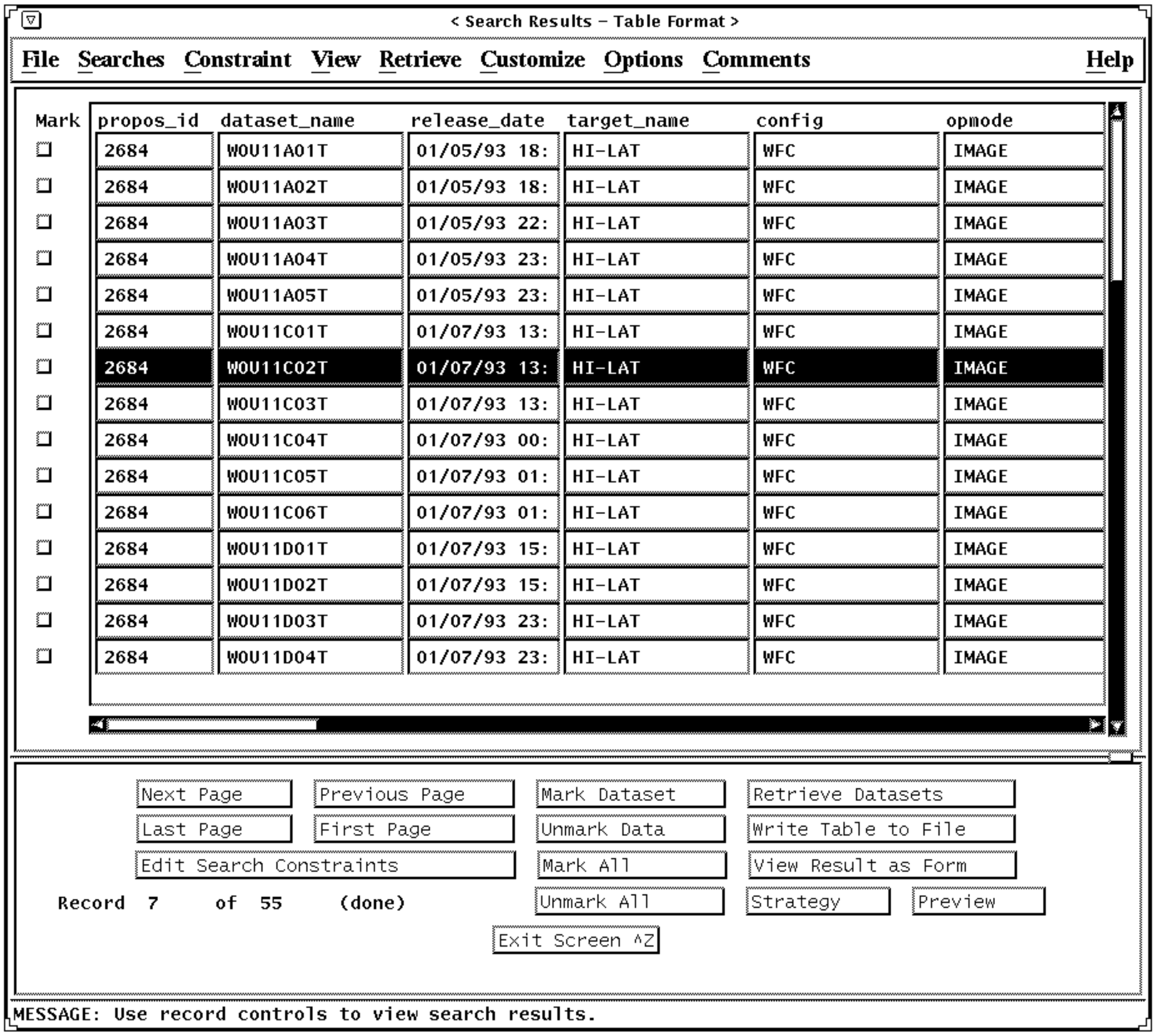

Figure 7.2: <Search Results - Table Format> Screen

The <Table Format> screen displays several records at one time for a limited number of fields (represented by the columns in the table). Scroll bars at the right and bottom of the screen allow you to modify the columns and rows displayed. Scroll the table left or right to view columns hidden off the sides. Moving left from the leftmost column will cause the next column hidden off the screen to be displayed. Likewise, moving right from the rightmost column will expose the next hidden column to the right.

StarView takes advantage of a larger screen. If you change the size of the table width by grabbing the corner with your mouse, StarView will adjust to the increased available space. You can change the column widths, delete, and rearrange columns with mouse commands and "click-and-drag" techniques. (See "Saving Search Results to a File" on page 42.) These changes will be reflected in the saved ASCII table if you do not then select the

[Select Output Columns], which enables you to quickly select a few columns, but wipes out any formatting you may have specified with mouse commands previously.

If you entered the <Table Format> screen from one of StarView's predefined search screens, then you can return to the corresponding single-record results screen by clicking the **[Exit Screen]** button.

You can begin another search on the corresponding search specification screen by pressing **[Edit Search Constraints]**. You can also enter search constraints directly in the table format (see below) immediately after pressing **[Edit Search Constraints]**.

The table format results screen has a search specification companion screen, also displayed in a tabular format. This is essentially the same search screen that appears whenever a custom query is generated (see page 82 and Figure 7.3). You can use this screen to conduct a search that constrains any of the available fields, in any combination. Enter search constraints in this way:

1. Enter the data area if necessary.
2. Click on a field that you want to be constrained.
3. Enter the constraint for that field.
4. Repeat steps 2 and 3 to constrain additional fields (see Table 7.2).

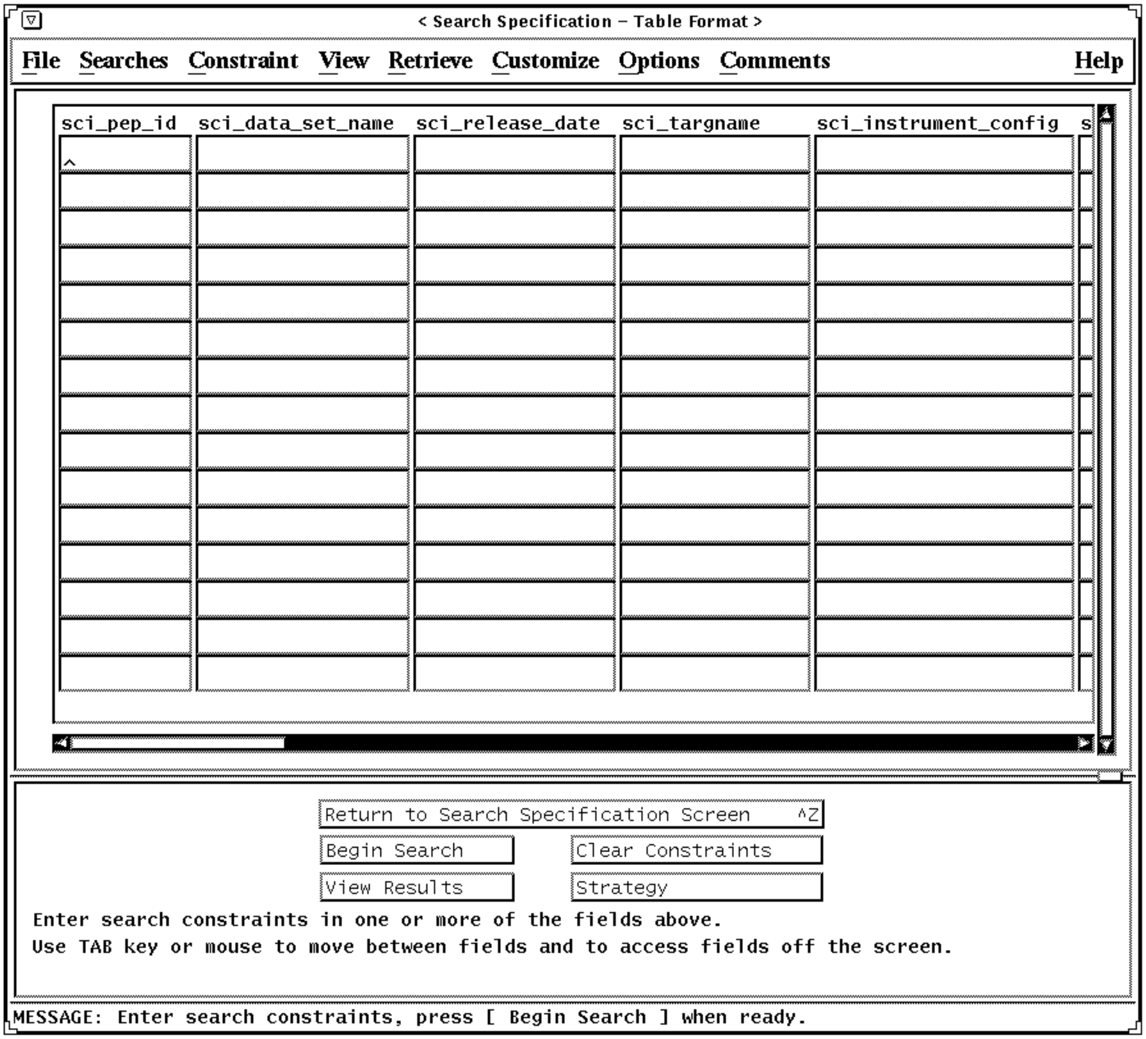

Figure 7.3: <Search Specification - Table Format> Screen

The catalog search is then initiated in the usual way by pressing **[Begin Search]**. The results of your search request will finally be returned on the corresponding <Search Results - Table Format> screen. As with any StarView results screen, you can write your search results to a file for later review by pressing **[Write Table to File]** (see page 109).

If you wish to retrieve the data associated with the datasets shown on the screen, press **[Mark All]** to retrieve all of the datasets corresponding to your search request. Press **[Mark Dataset]** to retrieve only the current dataset. On most user displays, the “current” dataset in the table format is the highlighted record (or the one appearing in bold type). As on other screens, the marking commands can be reversed, by pressing either **[Unmark Data]** or **[Unmark All]**.

[Unmark Data] operates only on the record that is currently highlighted in bold type.

The first column in a table format results screen has column heading “Mark.” This is the column in which marked datasets are identified. This column will have a “tick mark” value in the data area of the screen if the dataset has been marked for retrieval, and the column will be blank if the dataset has not been marked for retrieval.

You can write your search results to a file by pressing **[Write Table to File]** (see below). Before doing this, you may notice that there are some records that you are not interested in seeing. For example, a search for all observations of Jupiter may yield a number of satellite observations. You can therefore delete single or multiple records from your results table by selecting **|Delete One Record|** or **|Delete Range of Records|**, respectively, from the **|View|** menu.

Writing Search Results to a File

You can save your search results to a file for later use with other programs or analysis tools. To save your results:

1. Press **[Write Result to File]** on a search results screen or **[Write Table to File**] on the <Table Format> screen.

   The <Table Export> screen will appear.

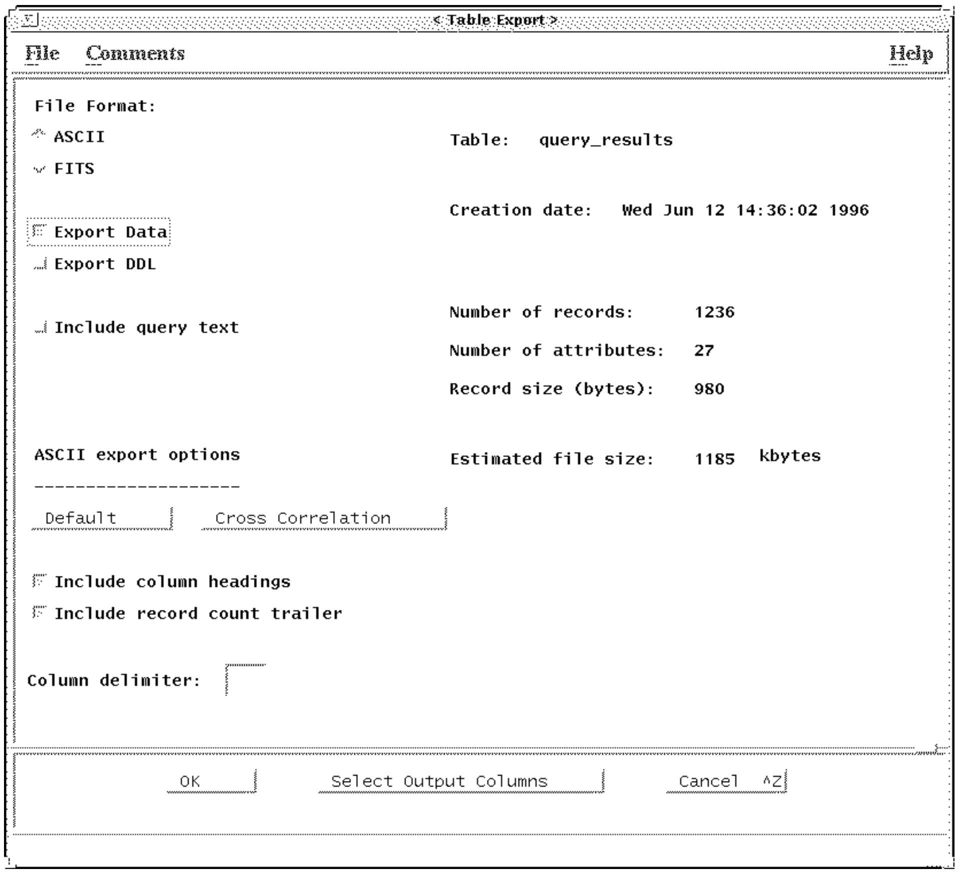

Figure 7.4: <Table Export> Screen

2. On the <Table Export> screen, choose output options from among the items listed on the left. Table 7.3 presents descriptions of these fields. (For more information about saving files, see "Retrieving Datasets From the Archive" on page 45.)

Choose this option:	Purpose
File Format[a]	
– ASCII	Format the exported table as an ASCII text file (default).
– FITS	Format the exported table as a standard FITS file, using the ASCII Tables Extension.
Export Data	Write the data table to the exported file (default).
Export Data Definition Language (DDL)	Generate an additional file describing the table structure (for example, field names, data types).
Include query text	Include, in the exported file, the Structured Query Language (SQL) statement that produced the data.
ASCII Export Options:	
– Include column headings	Include the database column headings in the file (default).
– Include record count trailer	Include, at the end of the file, the number of records in the table (default).
– Column delimiter	Override the character (a space) that StarView uses to separate the columns in the exported table. You can specify any ASCII character (or string) as the separator

a. Choose FITS if you plan to work much with the file. ASCII text wraps at the end of lines.

Table 7.3: Options on the <Table Export> Screen

3. Press **[OK]** to begin writing the search results to a file.

The <File Selector> dialog box will appear.

4. In the <File Selector> dialog box (see page 133 for information on how to use this dialog box):

- Specify the file to which the list will be written. Be careful to specify a new file name, unless you want to overwrite an existing file.
- Press **[OK]** to write the results to the file and to dismiss the <File Selector> dialog box. A large file may take several seconds to write.

Once the search results have been written, a dialog box will appear, requesting that you acknowledge the export.

5. Press **[OK]** to dismiss the dialog box and return to the search results screen.

More on Retrieving Data

This section explains how to specify datasets for retrieval both on the <Archive Retrieval> screen and directly using StarView's retrieval utility. For basic retrieval procedures, see Chapter 4.

Specifying Datasets on the <Archive Retrieval> Screen

You can use the <Archive Retrieval> screen directly to specify datasets for retrieval, in addition to any that you may have marked on the results screens. You can add datasets one at a time by name or add several dataset names at once from a file. If necessary, you can also unmark datasets on the <Archive Retrieval> screen or write the list of marked datasets to a file (for later use or for your records).

Adding Datasets by Name

To add a specific dataset to your archive retrieval list, do the following:

1. Press **[Add Datasets by Name]**.
2. Type a dataset name in the dialog box that appears.

   You can use uppercase, lowercase, or mixed case letters.
3. Press Return after typing the dataset name or **[OK]** to add the dataset name to the retrieval list.

   The added dataset will be displayed on the <Archive Retrieval> screen and will automatically be marked for retrieval. After the dataset is added, the "add dataset" dialog box will reappear.
4. Add another dataset, or press **[Cancel]** to dismiss the dialog box.

Adding Datasets From a File

To add several datasets to your archive retrieval list, using a file that contains a list of the dataset names, do the following:

1. Outside of StarView, create a file that contains a list of the desired dataset names.

   Place each dataset name on a separate line in the file. You can use uppercase, lowercase, or mixed case letters.
2. Within StarView, press **[Add Datasets from File]** on the <Archive Retrieval> screen.

The <File Selector> dialog box will appear. See page 133 for information on how to use this dialog box.

3. In the <File Selector> dialog box:

   - Select the file that contains the list of dataset names, or type the file name in the "Selection" field.
   - Press **[OK]** to read the file, to add the dataset names to the retrieval list, and to dismiss the <File Selector> dialog box.

   The added datasets will be displayed on the <Archive Retrieval> screen and will automatically be marked for retrieval.

Unmarking Datasets

Only marked datasets will be retrieved. Each of the datasets that initially appears when you enter the <Archive Retrieval> screen is already marked. You can unmark any of these if you decide not to retrieve it. Press **[Unmark One Dataset]** to unmark the current dataset (printed in bold type on the retrieval screen), or press **[Unmark All Datasets]** to unmark every item in the retrieval list. You can undo these actions and restore the original markings by pressing **[Mark One Dataset]** or **[Mark All Datasets]**, respectively.

Writing a Dataset List to a File

The list of datasets appearing on the <Archive Retrieval> screen can be written to a file. As described above, you can use this file (or an edited version) to add these datasets to a future archive retrieval list. To write the dataset list to a file, do the following:

1. Select **|Write Dataset List to a File|** from the **|View|** menu.

   The <File Selector> dialog box will appear. See page 133 for information on how to use this dialog box.

2. In the <File Selector> dialog box:

   - The filter is set in your home directory. If you wish to change directories, move the file.
   - Specify the name of the file that will contain the list. If you do not wish to overwrite an existing file, be sure to specify a new file name.
   - Press **[OK]** to write the dataset list to the file and to dismiss the <File Selector> dialog box.

Retrieving Data Directly

If you already have a list of datasets to retrieve and want to bypass searching and marking, you can use StarView's retrieve utility directly. But you will first need to initialize your system. On unix systems, type:

```
% source $starview_path/svinit.csh
```

On VMS system, type:

```
$ @STARVIEW:[STARVIEW.DIR]SVINIT
```

where the paths to `svinit` will vary from system to system and will depend on the location within your system of the StarView installation. If you have problems with this, see your system administrator.

Once you have your paths defined, you can retrieve using the following command syntax:

```
$ sv_dads_retrieve <dataset_list_file> [username password]
```

For example:

```
$ sv_dads_retrieve myfile.dat [Doe mypassword]
```

The *<dataset_list_file>* contains various options and datasets listed, one per line. For example,

```
BEGIN HEADER
     media NET
     host_computer kayak.stsci.edu
     host_directory /kayak/u1/jay/svdata
     data_calibrated TRUE
     data_uncalibrated FALSE
     data_oms FALSE
     data_usedref FALSE
     data_bestref FALSE
     classes
     extensions
     version 0# get the latest version (default)
END HEADER

V0ZF0102T
W12W0104T
X0XA0101T
Y0X30301T
Z0XZ0107T

END LIST
```

The “[ ]” symbol indicates that user name and password are optional. If you do not include them in the command, you will be prompted for them.

After typing the retrieve command, press Return. At this point, retrieval processing will be the same as if you had retrieved through StarView. Data will be written to a subdirectory of the `data` disk.

Modifying Your StarView Environment

StarView provides several screens that let you modify your StarView environment. Specifically, you can modify user defaults, archive retrieval defaults, output coordinates, and date and time formats.

To modify your environment:

1. Select a screen from the **|Options|** menu.

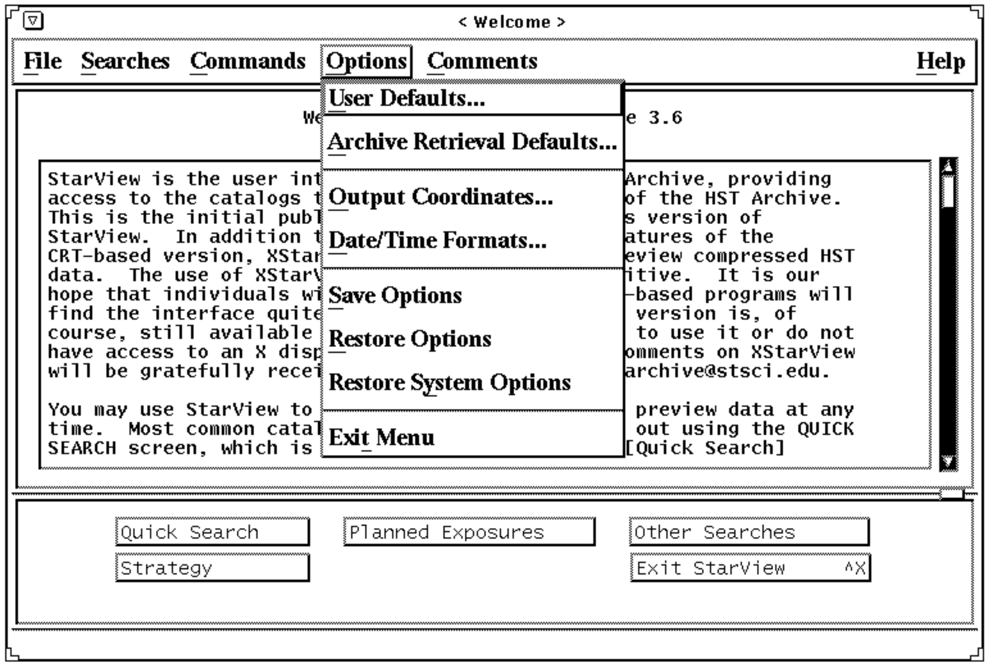

Figure 7.5: |Options| Menu

2. Choose new values for one or more fields on the screen.
3. Dismiss the screen and use the modifications for the current session by pressing **[OK]** or by selecting **|Exit Screen|** from the **|File|** menu.

You can use these new options for the current session only or save them for later reuse. On the **|Options|** menu:

Option	Purpose
|**Save Options**|	Save modifications for future sessions
|**Restore Options**|	Restore the startup values
|**Restore System Options**|	Restore StarView's default (original) values

Table 7.4: Commands in the |Options| Menu

You can modify particular components of your StarView environment by using the screens explained below.

User Defaults Screen

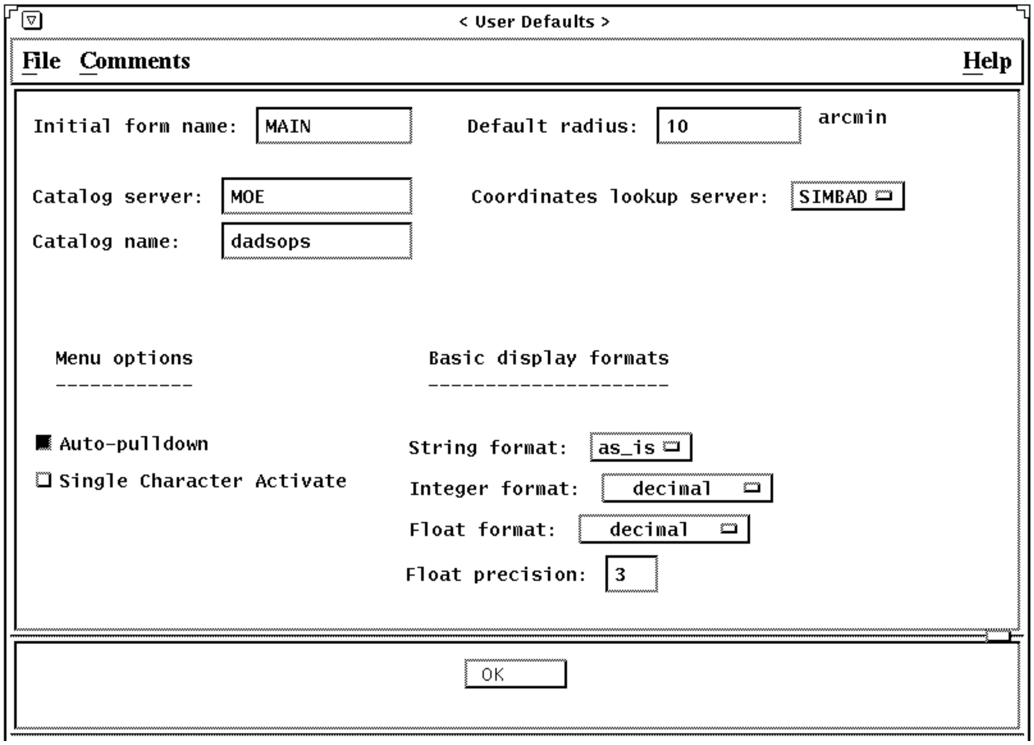

Figure 7.6: <User Defaults> Screen

This screen lets you modify the initial screen name, default catalog, menu options, default radius for circular-area searches around specific target positions, and basic display formats.

Field	Options
Initial form name	Type in the name of the StarView form that you want initially displayed after StarView starts up.[a] Examples: other_searches, proposal_abstract_qualify, quick_search_qualify, foc_qualify, hsp_ref_qualify, archive_retrieval, custom_query
Default radius	Examples: 1, 2, 3, ...
Menu options	Toggle selection. Auto-pulldown automatically displays the complete menu when you select the menu title. Single Character Activate allows you to execute a menu function by selecting it. Usually, you have to select a menu item and then press Return to execute the menu function.
Basic display formats	For String format, Integer format, and Float format, select an option from the popup choice list that is displayed when you select one of these items. For Float precision, type in an integer (e.g., 1, 2, 3, ...).
Coordinates look up	Select either SIMBAD or NED coordinate resolver

a. Exception: Instead of “welcome” type “main.”

Table 7.5: User Default Fields

Archive Retrieval Defaults Screen

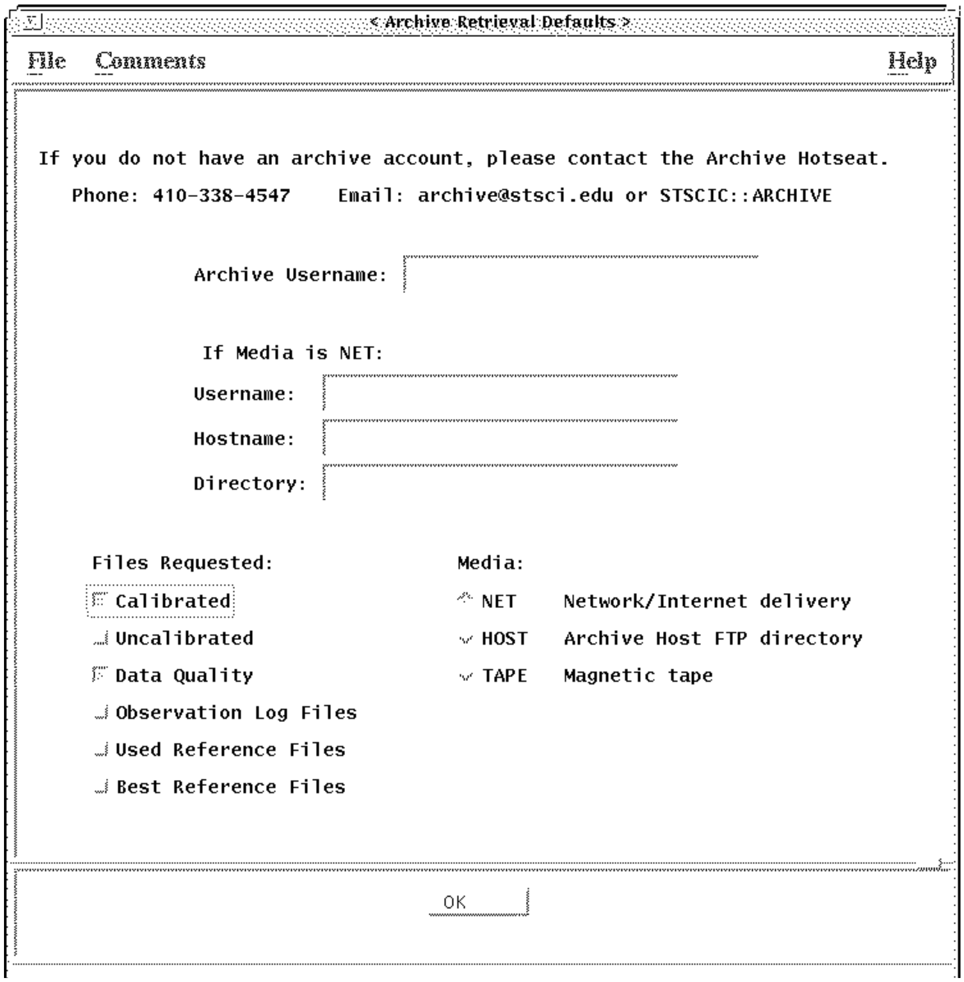

Figure 7.7: <Archive Retrieval Defaults> Screen

This screen lets you modify the defaults used in requesting datasets from the Hubble Space Telescope (HST) Archive.

Field	Options
Archive user name and password	Provide the user name and password that you were assigned when you registered as an archive user. See page 10 for registration procedures.
Files Requested	Toggle selection.
Media Format	Toggle selection. See “Specifying Formats and Media” on page 47.

Table 7.6: Archive Retrieval Options

Output Coordinates Screen

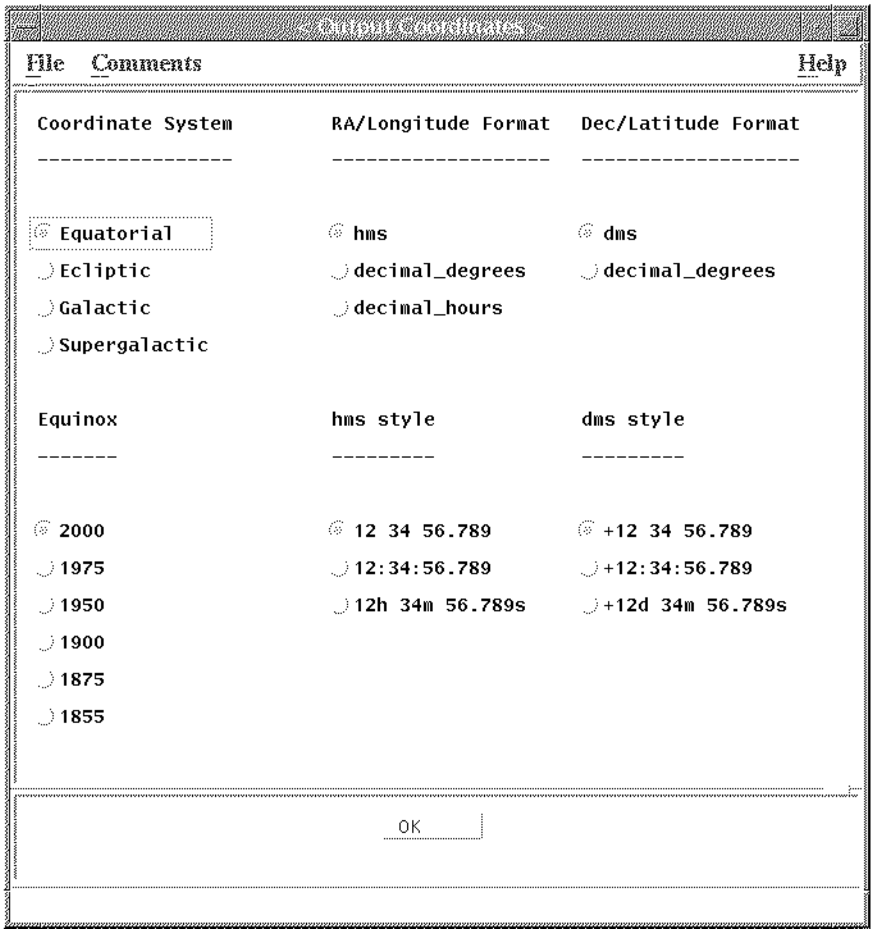

Figure 7.8: <Output Coordinates> Screen

This screen lets you modify the coordinate system, equinox, and format in which positional coordinates (RA, longitude, Dec, latitude) are displayed.

Field	Options
Coordinate System	Select Equatorial, Ecliptic, Galactic, or Supergalactic as the output coordinate system displayed on StarView's search results screens. This does not affect the input coordinates used on the search specification screens, which remain RA(2000) and Dec(2000).
Equinox	The coordinates will be precessed to the selected equinox before display. If you have selected Galactic as your coordinate system, the equinox is ignored.
RA/Longitude Format	You can select hours-minutes-seconds (hms), decimal degrees, or decimal hours as the format for RA and longitude fields.
Dec/Latitude Format	You can select degrees-minutes-seconds (dms) or decimal degrees as the format for Dec and latitude fields.

Table 7.7: Output Coordinates Options

The *input coordinates* on StarView's search specification screens (i.e., RA(2000) and Dec(2000)) are not affected by any of the above changes.

Date/Time Formats Screen

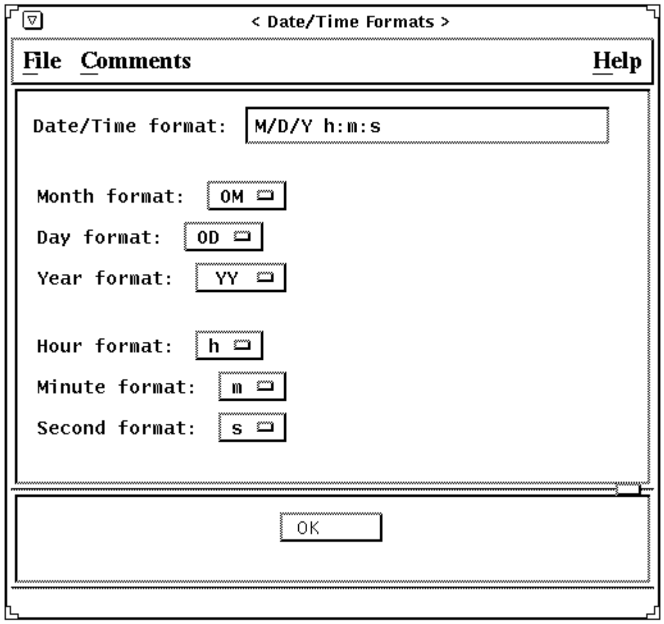

Figure 7.9: <Date/Time Formats> Screen

This screen lets you modify the format in which dates and times are displayed.

Field	Options
Date/Time format	Specify the order in which you would like the date and time components (e.g., month, year, hours) to be displayed.
Month format Day format Year format Hour format Minute format Second format	Select an option from the popup choice list that is displayed when you select one of these fields.

Table 7.8: Date and Time Format Options

Escaping to the Operating System

You can temporarily escape from StarView to the operating system to send e-mail, edit files, or do other non-StarView work. Follow the steps below.

1. Select **|Escape to OS|** from the **|File|** menu.

   A dialog box will appear, informing you that you are escaping to the operating system shell and that you must log out of the system shell to return to StarView.

2. Press **[OK]** on the dialog box.

   Your display will become blank, except for the system prompt.

3. Use the operating system to do your work.

4. Log out of the system shell to return to the current screen in StarView.

   Type `exit` on Unix systems, `logout` on VMS systems.

Working With the User Interface

This section explains various aspects of the StarView user interface: screens, menus, and fields. It also describes how to respond to StarView messages and how to save, open, and delete files.

StarView Screens

StarView screens let you search the HST catalog and request datasets from the HST archive. The following subsections describe the layout of StarView screens and explain how to move between items on a screen.

Understanding Screen Layout

StarView screens consist of several components. They are (explained below in order of appearance, from top to bottom):

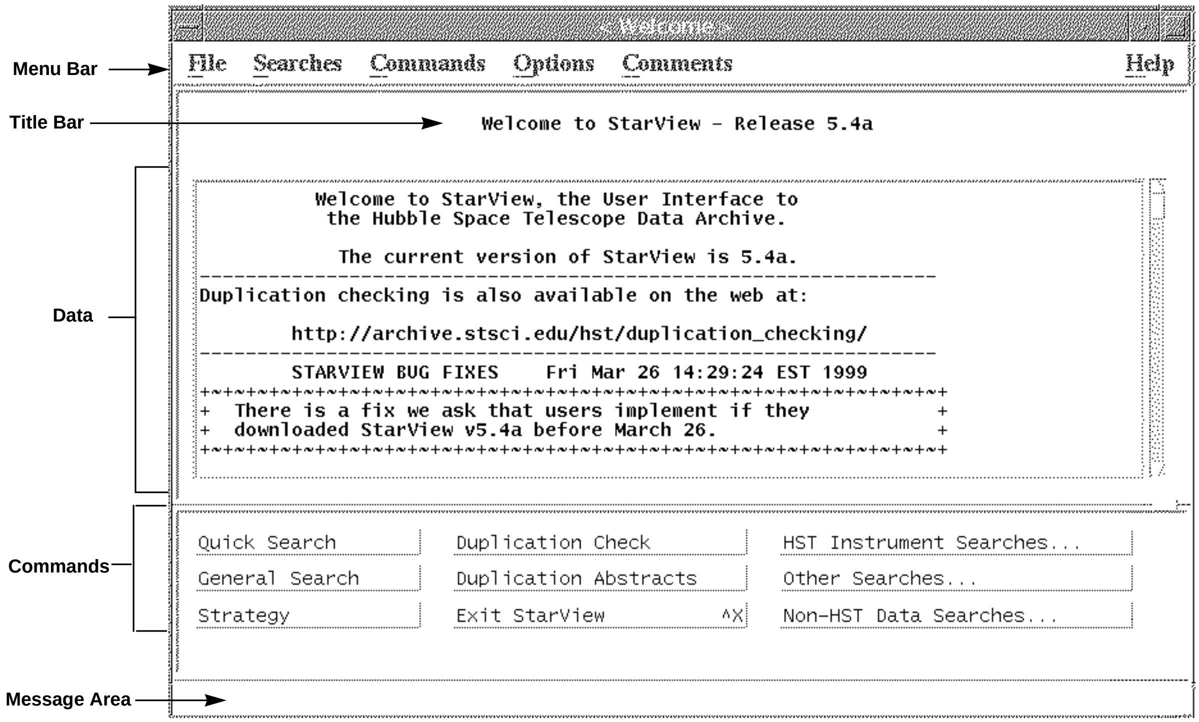

Figure 7.10: Screen Components

- Menu bar - contains the titles of the pulldown menus.
- Title bar - displays the title of a screen.
- Data area - normally, is the main display and user input area on a screen.
- Command area - is an optional area at the bottom of a screen that may contain pushbuttons for viewing search result records and for selecting major StarView functions. On search results screens, this area also displays the status of the current search.
- Message area - displays instructions and informative text.

More on Menus

For a basic explanation of StarView menus, see “Command Usage and Screen Interaction” on page 31. Menus display lists of functions for user selection. The menus and functions are screen-dependent. For example, the **|Constraint|** menu on a search screen lists functions for searching the HST catalog. The <Help> screen does not have a **|Constraint|** menu because you cannot search the catalog from this screen.

StarView has pulldown menus and submenus, which are explained below.

Pulldown Menus

The titles of pulldown menus appear across the top of a screen. Click on these names with the left mouse button to display the components of the menu, as shown in Figure 7.11.

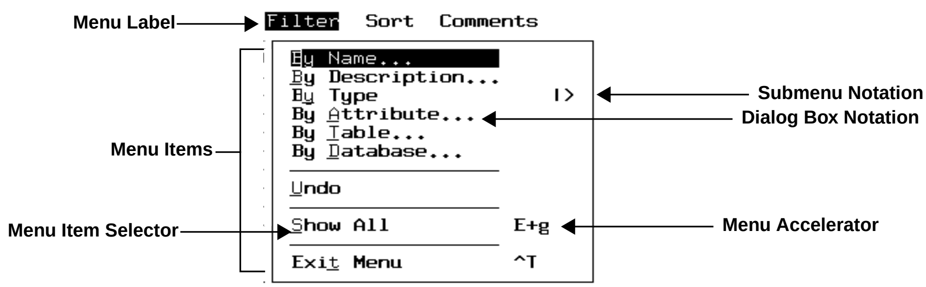

Figure 7.11: Menu Components

- Menu label - title of a menu.
- Menu items - functions that are displayed when a menu is selected.
- Menu item selector - single underlined letter in a menu item, used as a keyboard shortcut to move the cursor to that item.
- Menu accelerator - keyboard shortcut for executing a menu function, displayed to the right of some menu items.
- Dialog box notation - ellipsis (...) at the end of a menu item, indicating that a dialog box or another screen appears when the menu item is selected.
- Submenu notation - a bar and right angle bracket (| >) at the end of a menu item, indicating that a submenu appears when the menu item is selected.

To select an item with the mouse, click on the one you want. Selecting a menu item dismisses the pulldown menu, executes the desired function, and returns you to the current screen.

Submenus

Display a submenu by selecting a menu item with a " | >" symbol to the right of it. For example, selecting the **|Searches|** menu on the <Welcome> screen displays the following menu:

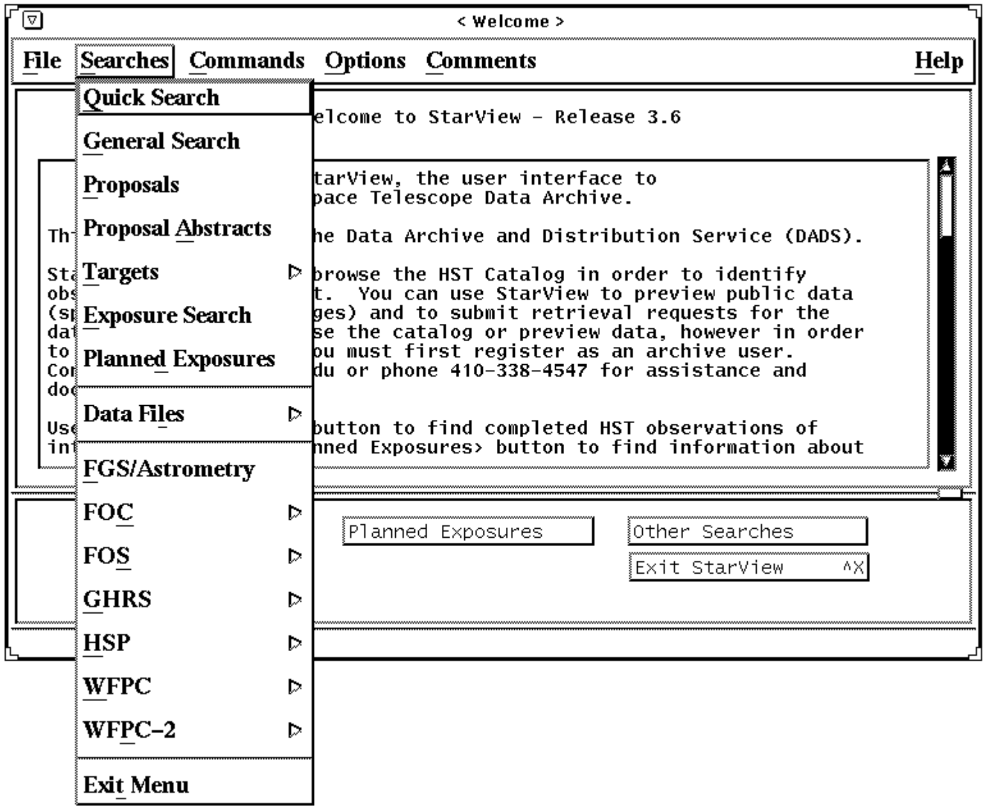

Figure 7.12: |Searches| Menu

Selecting **|Data Files|** on the **|Searches|** menu displays the following submenu:

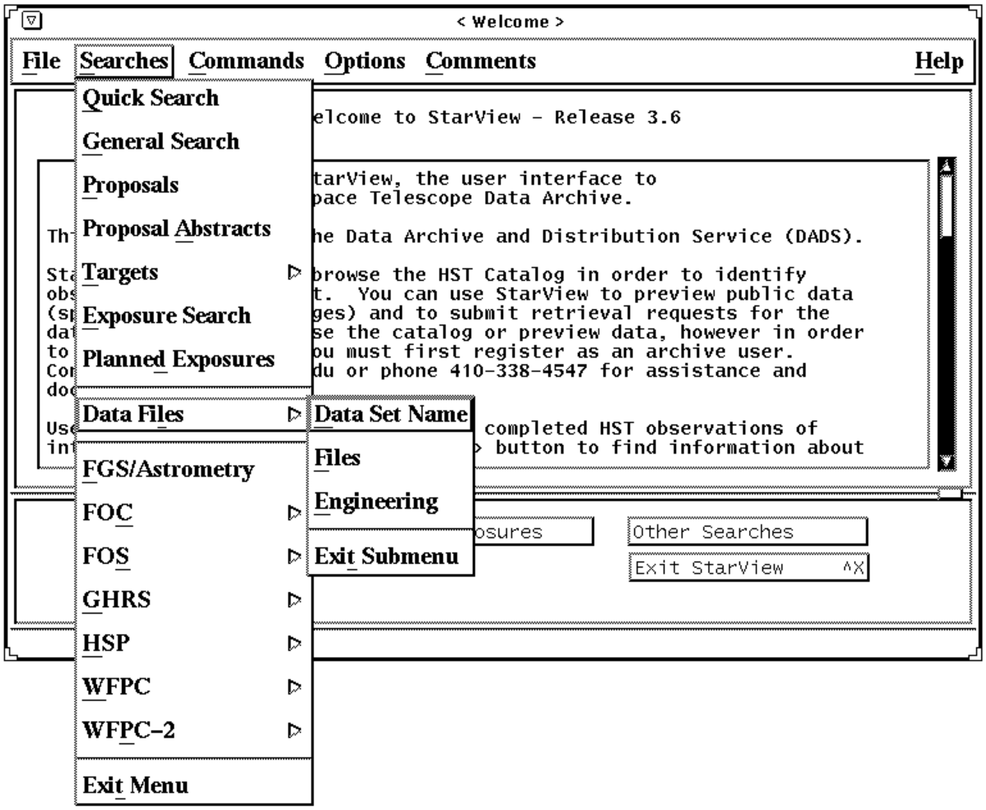

Figure 7.13: |Data Files| Submenu

Fields

Screens may contain fields in the data area and in the command area. Fields display text or let you enter values. Most fields have a field label, which characterizes the contents of the field. Field labels are mixed case, except labels that are ICD-19 keywords, such as “PXLCORR.”[1]

1. ICD-19 is the interface control document that the Space Telescope Science Institute (STScI) uses to correlate the contents of the HST catalog with the keywords in the data header files.

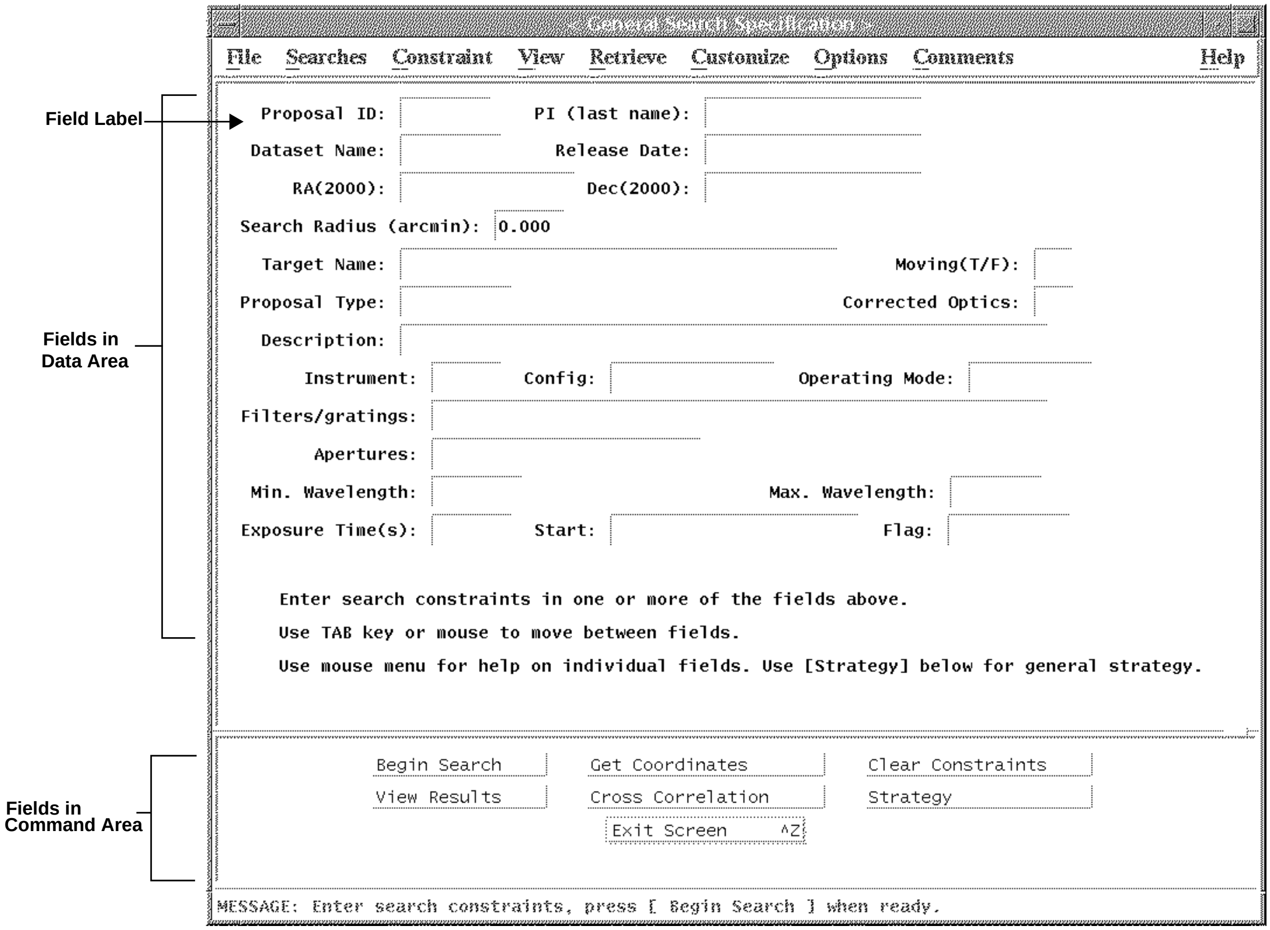

Figure 7.14: Types of Fields on a Screen

Fields can contain single or multiple lines of text. They can also display lists of values. Table fields appear on screens structured in a spreadsheet format, such as the <Table Format> screen.

StarView has three types of fields, as indicated in Table 7.9.

Type of Field	Characteristics	Restrictions	Example
Editable	Can be highlighted Can be modified Can be scrolled Can display help	None	Fields on a search specification screen in which you can enter values.)
Readonly	Can be highlighted Can be scrolled Can display help	Cannot be modified	Text area of the <Help> screen.
Unselectable	Can display status information	Cannot be highlighted Cannot be modified Cannot be scrolled Cannot display help	"Record m of n" field at the bottom of most search results screens

Table 7.9: Types of Fields

Using Special Fields

Screens may have special fields:

- Toggle fields
- Popup choice lists
- Radio fields

These fields are special because you enter values with minimal typing. They are used for data entry fields with a restricted selection of values.

Toggle Fields

Toggle fields simplify obtaining answers to questions with only two possible (Boolean) answers (for example, yes/no, true/false, or */blank).

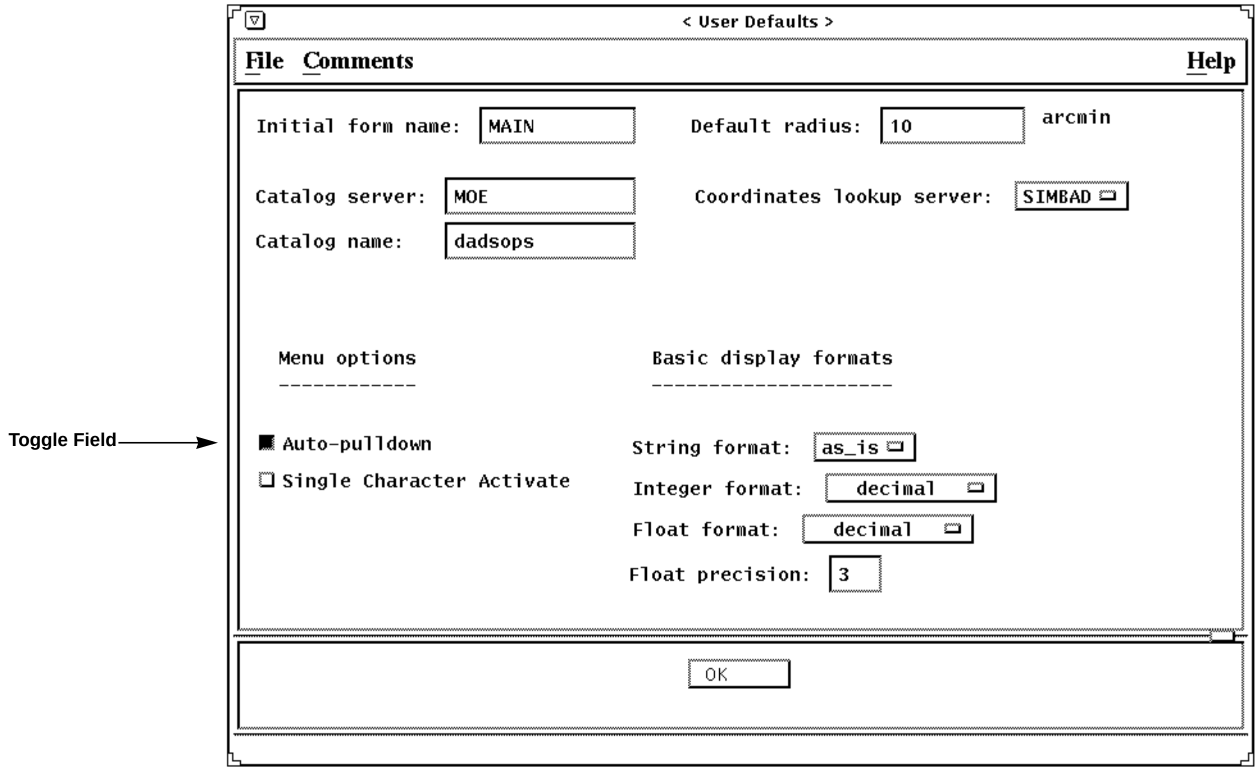

Figure 7.15: Toggle Field

Popup Choice Lists

Popup choice lists let you pick an item from a popup menu (choice list) that is then copied into the field. Therefore, you do not have to explicitly type a value in the field.

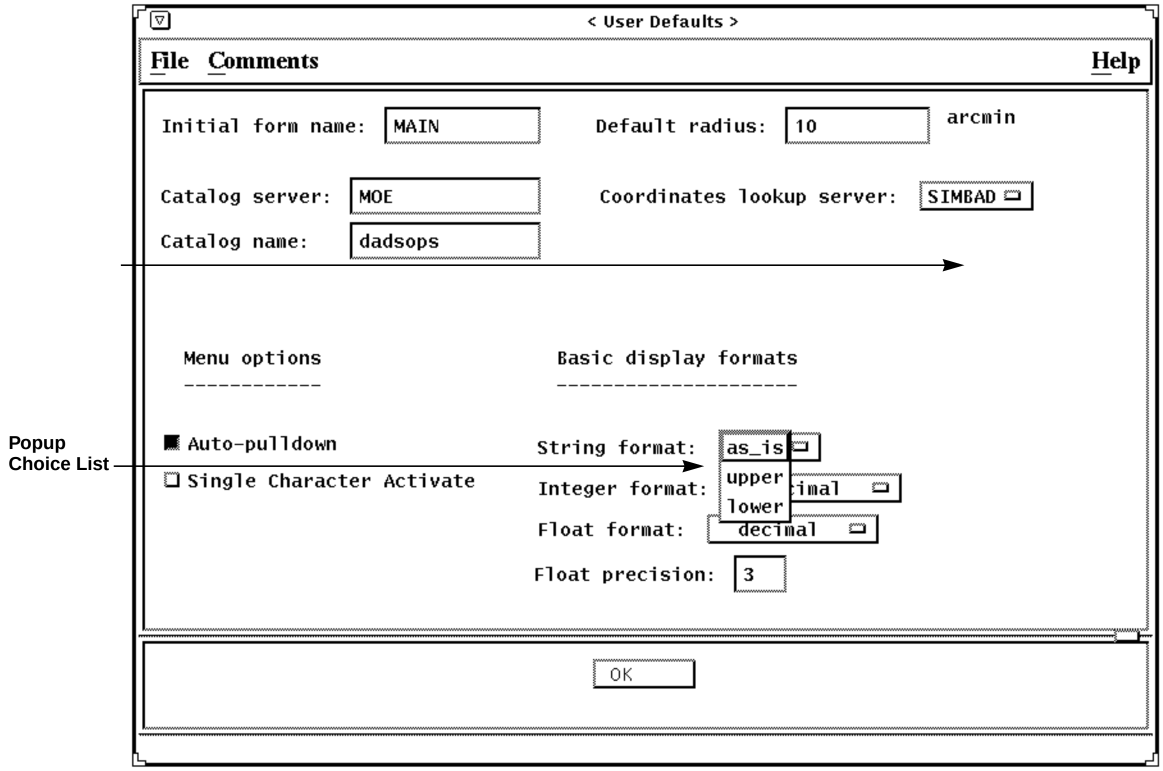

Figure 7.16: Popup Choice List

Radio Fields

Radio fields let you pick one of several mutually exclusive selections.

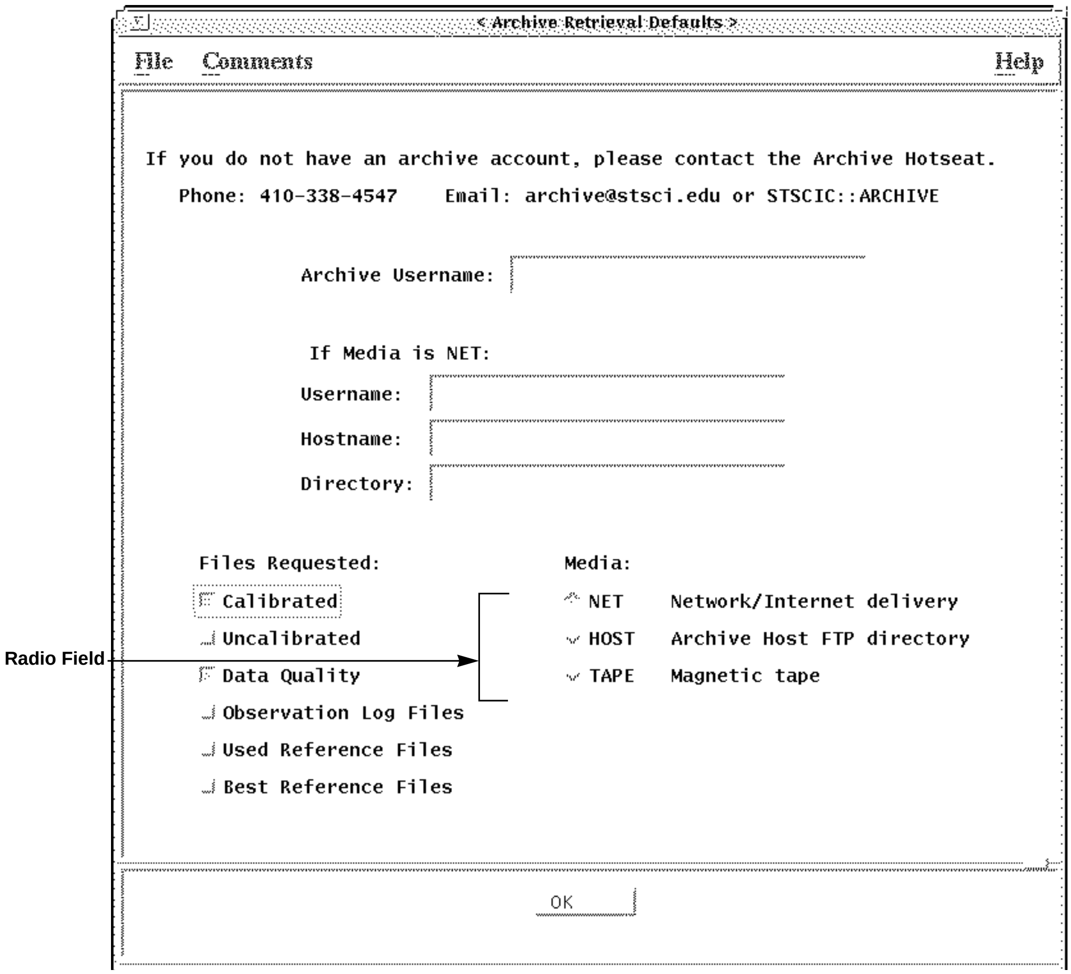

Figure 7.17: Radio Field

StarView Messages

While performing a task, you may accidentally enter an invalid value or attempt an inappropriate or invalid operation. Consequently, a message will appear either in the message area at the bottom of the screen or in a dialog box. The following subsections explain how to respond to messages in a dialog box.

Responding to Dialog Boxes

StarView has dialog boxes that display messages or request your input. Unlike screens, they do not contain menus. Instead, functions are executed using push buttons. You cannot proceed with an operation until you respond to a dialog box by choosing one of the displayed options by clicking on the appropriate button.

Some dialog boxes display a message that you need to read before continuing. After reading the message, press **[OK]**.

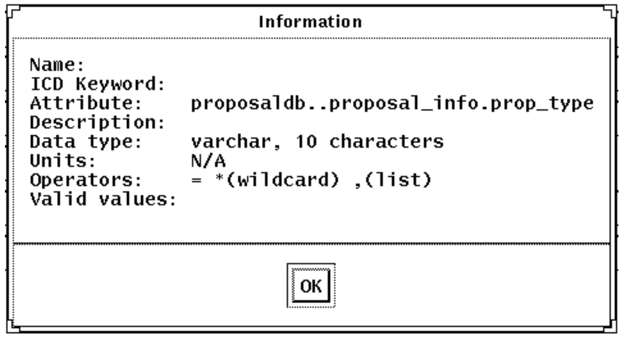

Figure 7.18: Informational Dialog Box

Some dialog boxes display questions. Respond to these dialog boxes by pressing **[Yes]** or **[No]**.

Some dialog boxes display messages that notify you of potential problems. Respond to these warnings by pressing **[OK]** or **[Cancel]**. Pressing **[OK]** continues a potentially destructive operation. Pressing **[Cancel]** instructs StarView to avoid (i.e., not perform) a potentially destructive operation.

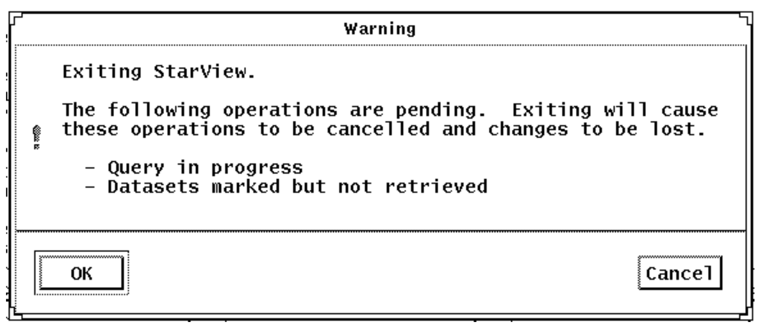

Figure 7.19: Warning Dialog Box

Some dialog boxes request your input. Respond to these messages by providing the input.

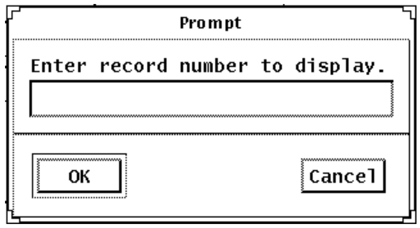

Figure 7.20: Prompt Dialog Box

Responding to the Error Dialog Box

The <Error> dialog box displays high-level error messages and additional, more detailed error messages in two vertically scrollable areas.

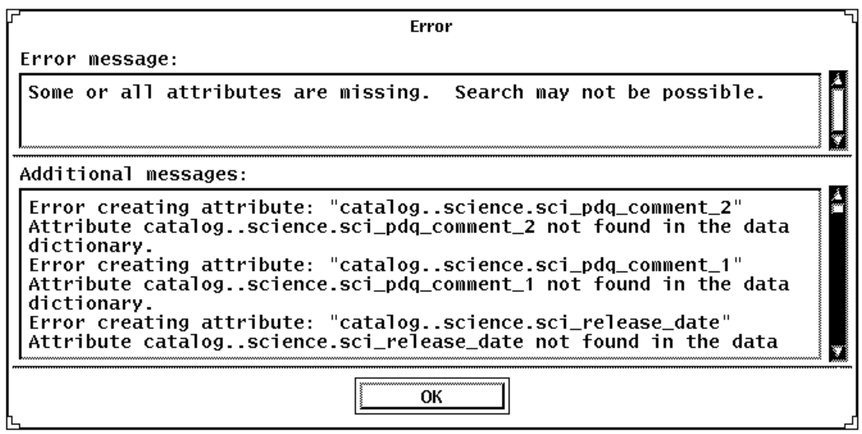

Figure 7.21: <Error> Dialog Box

Press **[OK]** to continue the current operation. If help is available for an error message, a **[Help]** pushbutton will appear on this dialog box.

Saving, Opening, and Deleting Files

While using StarView, you may want to save, open or delete query, retrieval request, or SQL files. The <File Selector> dialog box may be displayed while these functions are being performed.

Using the File Selector Dialog Box

The <File Selector> dialog box appears the first time that you save a file or when you open or delete a file. Use it to select a file. Press **[OK]** to execute the desired function.

If you have not previously saved a file, the <File Selector> dialog box will appear, prompting you for a file name. If you do not specify a file name extension, StarView will provide one. The default file name extensions are listed in Table 7.10.

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Default Extension	File Type
`.db`	Table containing query result records
`.txt`	Exported ASCII table
`.fits`	Exported FITS (ASCII Tables Extension) table
`.qry`	Query
`.sql`	SQL

Table 7.10: Default File Name Extensions

The <File Selector> dialog box will not appear for subsequent saves of a file unless you decide to save a file under a new name. Instead, the existing file will be overwritten.

Filtering Files

You may want to filter files before selecting one. Filtering lets you display particular files in a particular directory. Directories and files are displayed in vertically scrollable fields. Scrolling lets you view items that are not visible.

To specify a directory:

- Move to a higher directory level by selecting the "../" symbol on Unix and "[-]" on VMS.
- Move to a lower level directory by selecting a directory.
- Rescan the current directory by selecting the "./" symbol on Unix and "[ ]" on VMS. Rescanning updates the directory list.

To filter the list of files:

1. Type a partial or complete file name in the "Filter" field. For partial file names, you may use the "*" wild card to match zero or more characters.

Wild cards let you filter multiple files with related names, without having to specify each file by its full, unique name. For example, if you type `.qry`, you will display all files with that extension.

2. Press Return.

Selecting a File

You can select a file either from the list of files or by typing a file name in the "Selection" field, or by clicking on the file name from the list of files displayed.

Dismissing the File Selector Dialog Box

Press **[OK]** to dismiss the <File Selector> dialog box, execute the desired function, and return to the current screen. Press **[Cancel]** to return to the current screen without executing a function.

On-The-Fly Calibration

The On-The-Fly Calibration (OTFC) service will provide archival researchers with the ‘‘best’’ calibrated data without requiring them to go through the complex recalibration process themselves. As described in “Tutorial: Retrieving Calibration Reference Files” on page 51, in fact, improved calibrations are possible with calibration files which are more recent than those used to calibrate the archived data in the first place. The OTFC Pipeline was constructed using the OPUS pipeline architecture and consists of a process that will accept raw datasets from DADS and return updated raw and calibrated datasets. Also, the OTFC system will update the headers of the raw data to reflect any changes in header keywords as well as updating calibration switches and reference file names. This new header information is used by the pipeline system to identify the appropriate calibration steps and reference files.

Currently only WFPC-2 and STIS data will be processed in the OTFC pipeline. Eventually OTFC will be applied to NICMOS and future instruments data.

OTFC requests can be made through a modified version of the standard <Retrieval Request - File Options> screen in StarView (page 186) or via the archive WWW interface, once OTFC is released externally (Fall 1999).

Dedicated StarView screens for each instrument, described in “On-The-Fly Calibration Screens” on page 185, can be used to extract more information about the recalibration, including the date the software was last changed and the latest date of any header keyword update for any dataset.

8 HST Catalog Screens

In This Chapter..

In this chapter you will find descriptions of all StarView screens: screens that are used to view the Hubble Space Telescope (HST) catalog, retrieve data, get help, navigate around StarView, and manipulate StarView operations. The screens are presented in groups, organized according to the general class of actions that you would take and to the information displayed on the screens in each group. The screens within each group are presented alphabetically by screen name.

Refer to Figure 8.1 for assistance in locating a particular screen description. Figure 8.1 presents a schematic view of the groups of StarView screens, in the order that they are presented in this chapter. Screen names are listed in each box.

The External Data Sets screens are not described here as they are self-explanatory. Note also that retrieval of IUE data can *only* be done via the MAST WWW interface (see page 25; FIRST and DSS retrievals can be done either way), so users are advised to use that interface to search the IUE archive.

GROUPS OF STARVIEW SCREENS

Proposal

- Proposal
- Proposal Abstract
- Planned Exposure
- Solar System Target
- Duplication Checks
- Duplication Abstract

Observation

- Exposure Search
- General Search
- Quick Search
- Fixed Target
- OMS Screen

Instrument

- FGS/Astrometry
- FOC
- FOS
- GHRS
- HSP
- NICMOS
- STIS
- WFPC
- WFPC-2

Association

- NICMOS Association Search
- STIS Association Search

Calibration

- FOC Reference Files
- FOS Reference Files
- GHRS Reference Files
- HSP Reference Files
- NICMOS Reference Files
- STIS Reference Files
- WFPC Reference Files
- WFPC-2 Reference Files

OTFC

- Retrieval Request - File Options
- STIS OTFC
- WFPC-2 OTFC

Archived Files

- Dataset Name
- Engineering
- Files

Archive Retrieval

- Archive Retrieval
- Retrieval Request - File Options
- Retrieval Request - Media Options
- Retrieval Request - Override File Options

Environment

- Archive Retrieval Defaults
- Date/Time Formats
- Output Coordinates
- User Defaults

Utility

- Custom Query
- Help
- Other Searches
- SQL Editor
- Table Export
- Table Format
- Welcome

External Data Sets

- VLA FIRST Survey
- Digitized Sky Survey
- IUE Data

Figure 8.1: StarView Screens

Proposal Screens

StarView provides several proposal screens that let you look at the pre-observation proposal-level data stored in the HST catalog. For example, the screens provide information about proposers, proposal titles, proposal abstracts, proposed targets (including a special screen just for solar system targets), and proposed observations (including instrument parameters and exposure times). The StarView proposal screens are presented and described in this section.

These screens primarily display proposal-level information; that is, information that was provided by the observer during Phases I and II of the proposal submission process, although some fields are updated when exposures are taken. The <Planned Exposure> and <Solar System Target> screens are particularly useful for obtaining information about HST observations that have been approved for execution, but that have not yet been taken. Obviously, you cannot retrieve data for an observation that has not yet been taken. Hence, the corresponding StarView results screens in this group do not include dataset names or dataset marking/retrieval capabilities.

The <Duplication Check> and <Duplication Abstract> screens were designed to help observers determine whether their proposed observations conflict with previously accepted GO or GTO programs.

<Proposal> Screen

You can use this screen to initiate searches of proposal-specific information in the HST catalog. This screen contains only very general proposal information, with only one catalog entry per proposal. Since this screen does not provide exposure-level information about HST observations, the corresponding results screen does not include dataset name or dataset marking/retrieval capabilities.

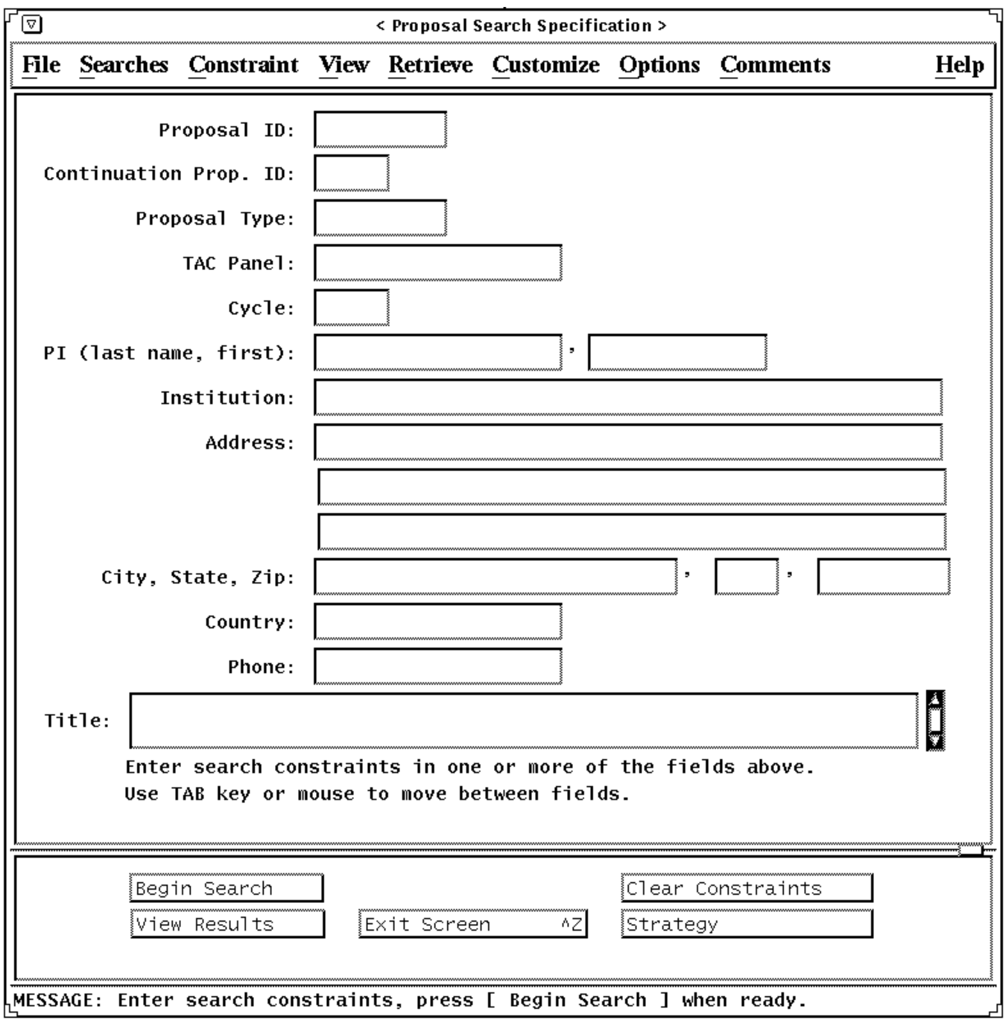

Figure 8.2: <Proposal> Screen

<Proposal Abstract> Screen

You can use this screen to initiate searches of proposal abstracts in the HST catalog. This screen contains only very general proposal information, with only one catalog entry per proposal. Since this screen does not provide exposure-level information about HST observations, the corresponding results screen does not include dataset name or dataset marking/retrieval capabilities.

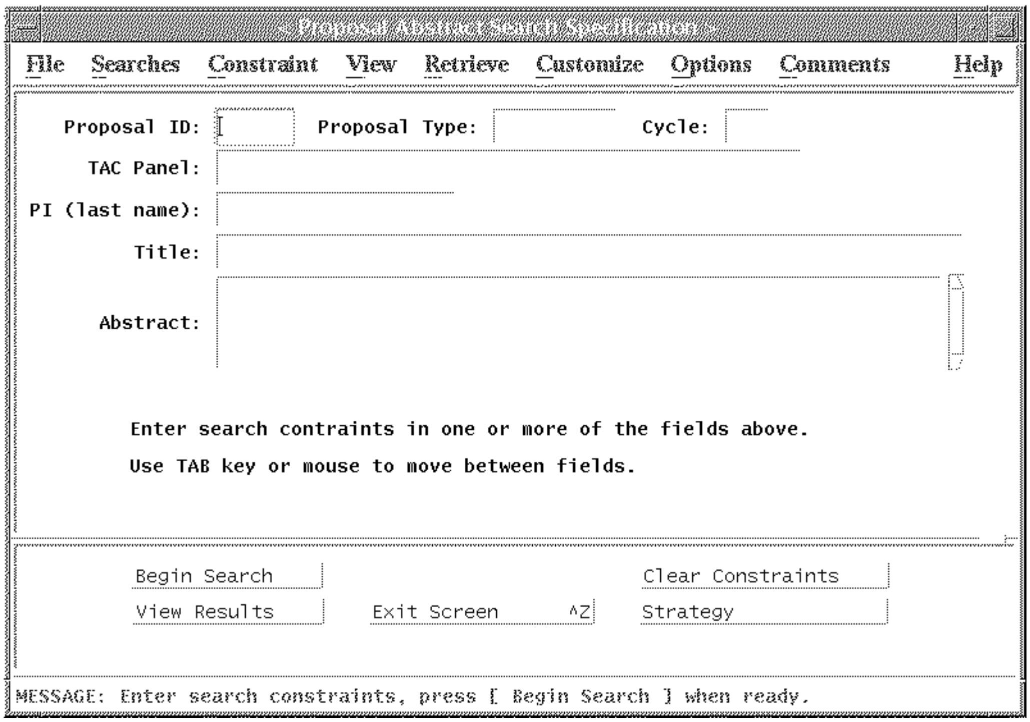

Figure 8.3: <Proposal Abstract> Screen

<Planned Exposure> Screen

The <Planned Exposure> screen can be used to check on the schedule dates and completion status of an HST proposal or to search for planned HST observations of a given target. This screen looks at tables made from the proposal entry and scheduling database at STScI. Thus, this screen provides information on all planned observations which have been through Phase II processing (including carryover proposals).

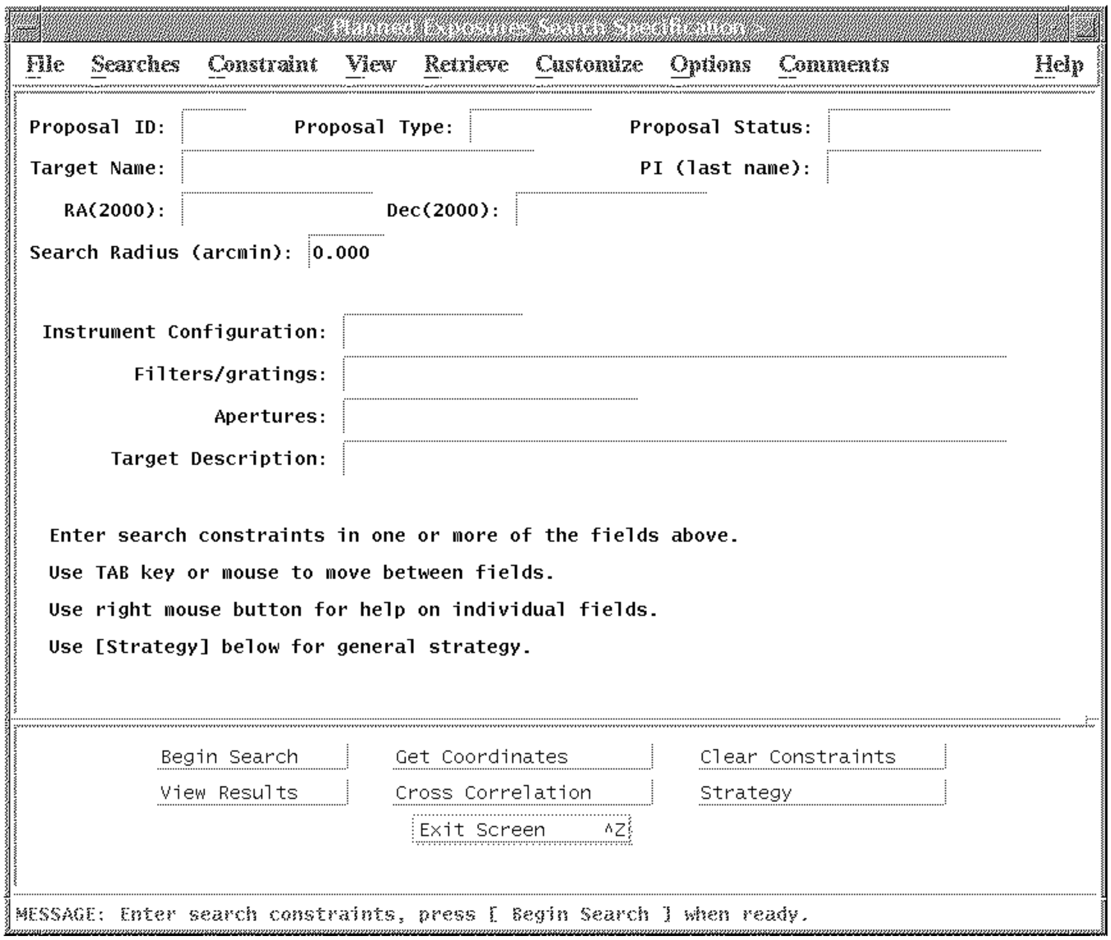

Figure 8.4: <Planned Exposure> Screen

<Solar System Target> Screen

You can use this screen to initiate searches for proposed and exposed solar system target observations in the HST catalog. This includes planned observations which have been through Phase II processing, as well as previous exposures.

Note that there are three levels of position keywords for solar system targets: with respect to the sun, with respect to the parent body, and with respect to the target itself.

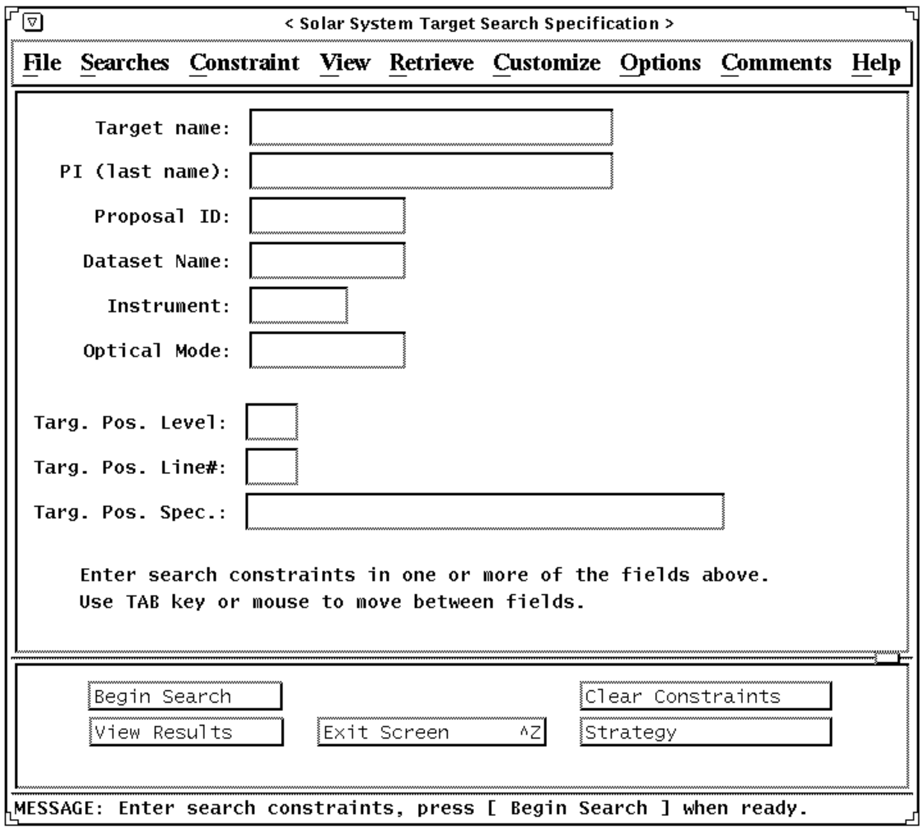

Figure 8.5: <Solar System Target> Screen

<Duplication Check> Screen

This screen was designed to facilitate duplication checking by proposers who are writing their Phase I, or initial, proposals to obtain HST observations. An observation is defined as duplicating a previous one if it is on the same astronomical target, with the same or similar instruments, a similar instrument mode, and a similar spectral range. Proposers must check their proposed observations and identify them and justify them in the Phase I proposal.

A duplication check for fixed targets MUST be done with coordinates. *A target name search is insufficient to reveal duplications.* The target names are entered by the observer, and therefore can vary subtly between proposers. If a proposer only has target names, the **[Get Coordinates]** button on this screen enables them to obtain target coordinates from NED or SIMBAD. Cross-correlation searches from ASCII coordinate lists can also be done with the Duplication screen. (See “Cross Correlation” on page 95.)

If a proposer identifies a conflict and accurately describes it to the Telescope Allocation Committee (TAC), then if the TAC decides that the observations are needed nevertheless, the TAC’s judgement will hold. However, if the conflict is not discussed and it is revealed later to be a conflict that the proposer should have included, then under normal circumstances that observation will be disallowed and the orbits taken away. A complete discussion of duplications or conflicts is beyond the scope of this manual. Proposers should consult the current Call for Proposals and Instructions for Phase I Proposal Preparation for the most up to date guidelines.

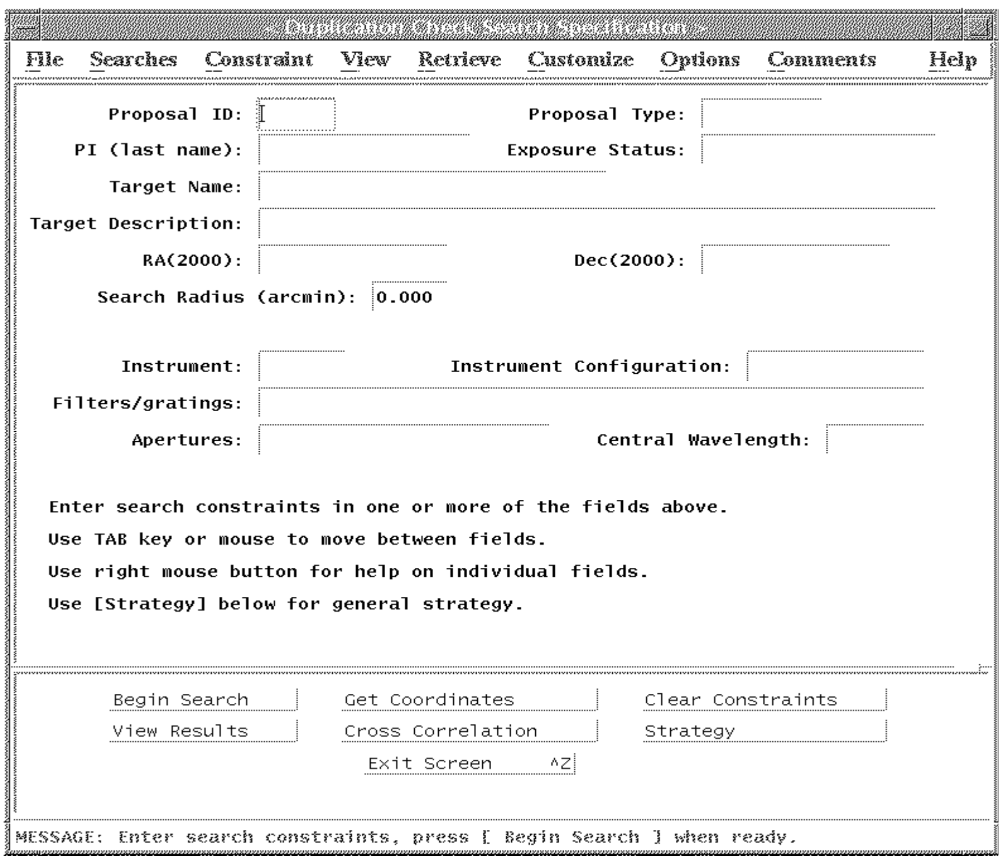

Figure 8.6: Duplication Check Screen

<Duplication Abstract> Screen

This screen, accessed via the Searches menu, was designed to help HST proposers do the required duplication checking. This screen provides supplementary information to that available from the Duplication Check screen. In particular, this screen enables proposers to search the abstract and proposal title for words relevant to scientific content, or to determine what sorts of proposals were evaluated by a certain panel in the previous cycle when trying to decide which TAC panel to suggest for proposal evaluation

Recall that the abstract is stored as a single text string, and that abstract searches are case sensitive. Searching the abstract thoroughly requires some special strategies, such as embedding all strings in wild-card characters, and listing all possible versions of a relevant string. For example, the string "*Quasar*,*quasar*,*QSO*,*AGN*,*Active gal*,*active gal*,*Active Gal*" will turn up more records than any of these strings entered singly.

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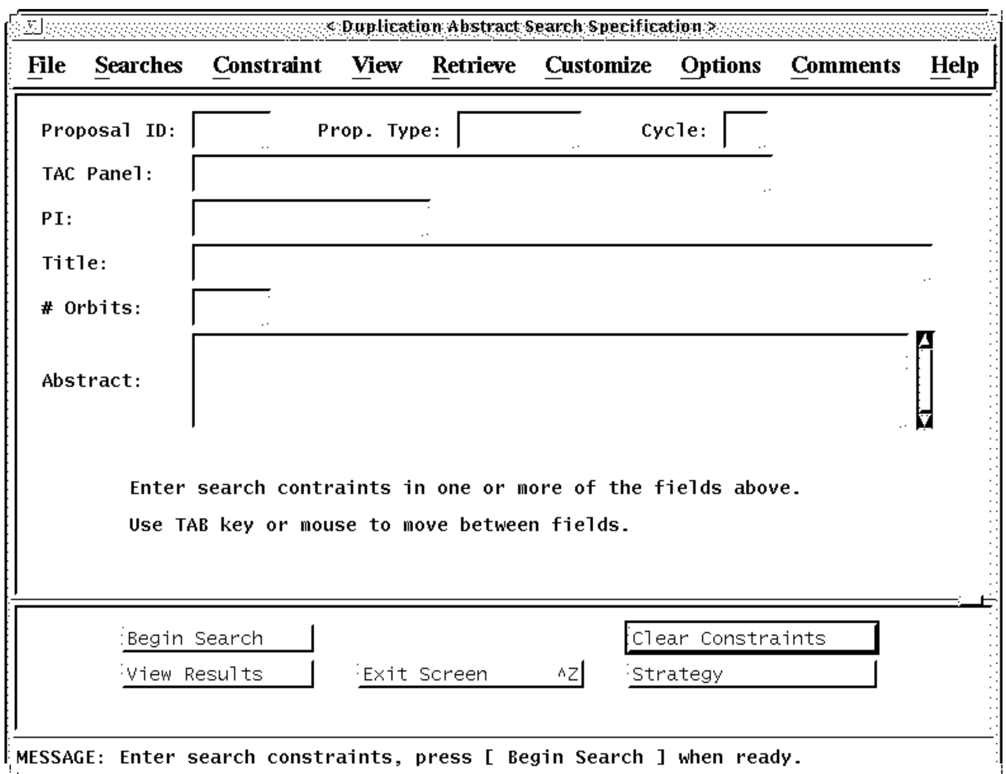


Figure 8.7: Duplication Abstract Screen

Observation Screens

StarView provides several observation screens that let you view the full catalog of completed HST observations. These screens are the heart of StarView. They let you see what observations have been done and then provide you with the option of retrieving the corresponding data from the HST archive. For example, you can conduct straightforward catalog searches on the <Quick Search> screen, use the <General> screen to conduct searches with lots of constraints, or use the <Exposure Search> and <Target Search> screens to conduct specialized searches based on proposal-level exposure and target information, respectively. Refer to Chapter 5 for search strategies that may be helpful in finding observations of specific targets in the HST catalog.

You cannot use these screens to find Fine Guidance Sensor (FGS)/astrometry observations. Those data files do not belong to the CAL archive class, and StarView results screens that include the “Release date” field are constrained to look at CAL class files in order to display on the screen the most scientifically meaningful release date (i.e., that for the actual science data files in the dataset). To view FGS/astrometry observation records and to retrieve the corresponding data files (archive class = AST; see Chapter 9), you will have to use the <FGS/Astrometry> instrument screen (see page 153).

The <Observatory Monitoring> Screen allows you to view the keywords in the Observatory Monitoring System (OMS) files. These files, generated since January, 1994, contain information about the orientation of the telescope and the jitter information recorded during observations.

<Exposure Search> Screen

You can use this screen to initiate searches of the HST catalog that correlate exposure-level information from the proposals with that from the actual observations. It is especially helpful to use this screen to search directly for specifically planned exposures according to either their Proposal Entry Processor System (PEPSI) line numbers (or exposure numbers) in the original proposal, or their PEPSI proposal sequence names (if any), or the IDs of their planned observation sets (obsets). In this way, you can correlate a collection of proposed observations with a collection of completed exposures. You can also use these obsets and sequences to find exposures that were taken essentially at the same time or under the same spacecraft conditions, or as part of a complete scientifically-defined set of observations.

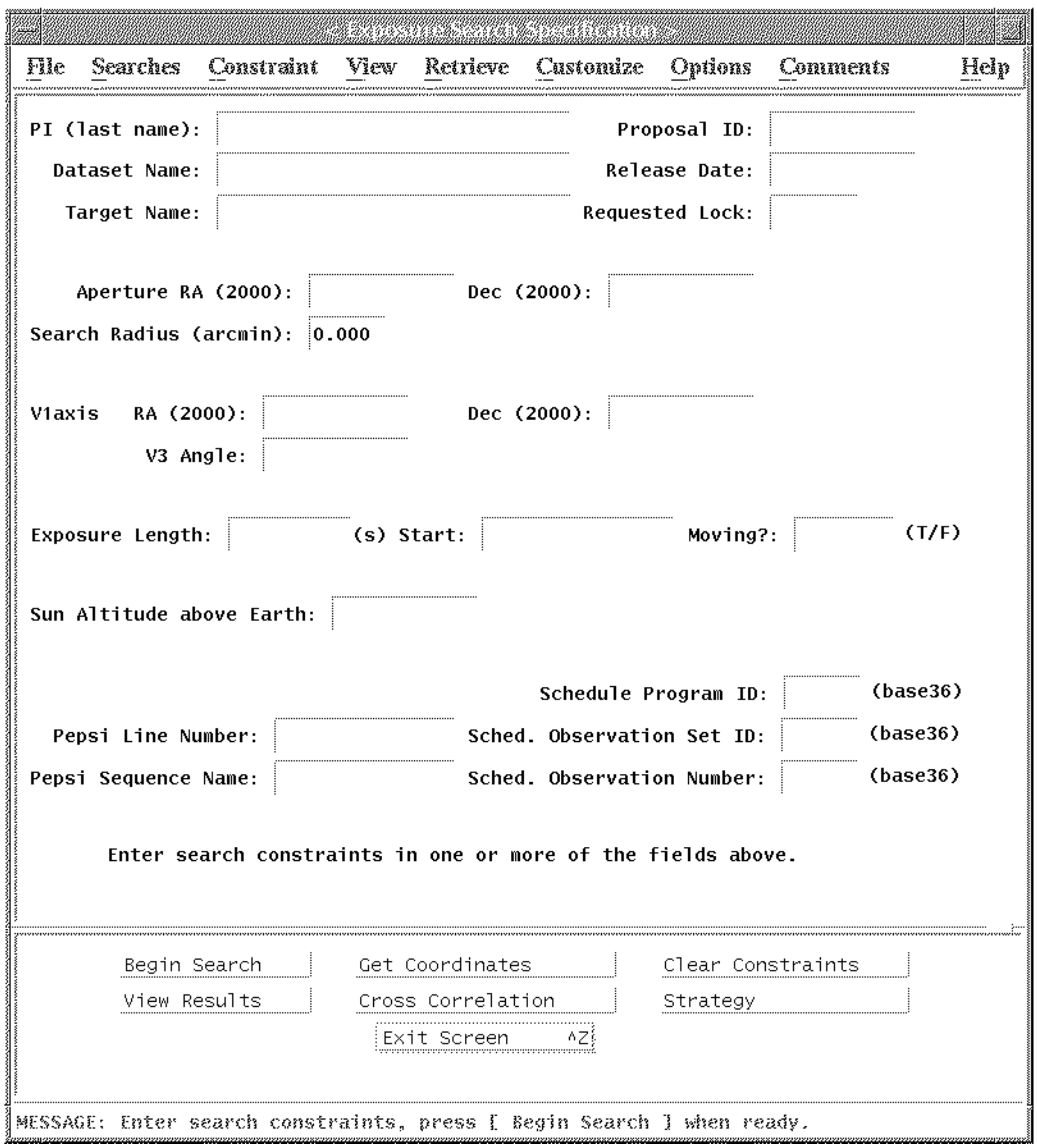


Figure 8.8: <Exposure Search> Screen

<General> Screen

You can use this screen to initiate a broad variety of informational searches of the HST catalog. This is the most general archive exposure search screen. The <General Search Results> screen includes the same fields as the <Quick Search Results> screen, but you can constrain any combination of those fields here. You can constrain only the most basic archival search fields on the <Quick Search Specification> screen (see page 149).

The results screen also includes the data quality comments from the Observation Support / Post Observation Data Processing System (OPUS, formerly known as PODPS). These comments (along with the exposure flag) may help you to assess the quality of the data in a given HST exposure before you ask to retrieve it. See the discussion that begins on page 74.

Chapter 5 describes helpful search strategies to find executed observations of specific targets in the HST catalog.

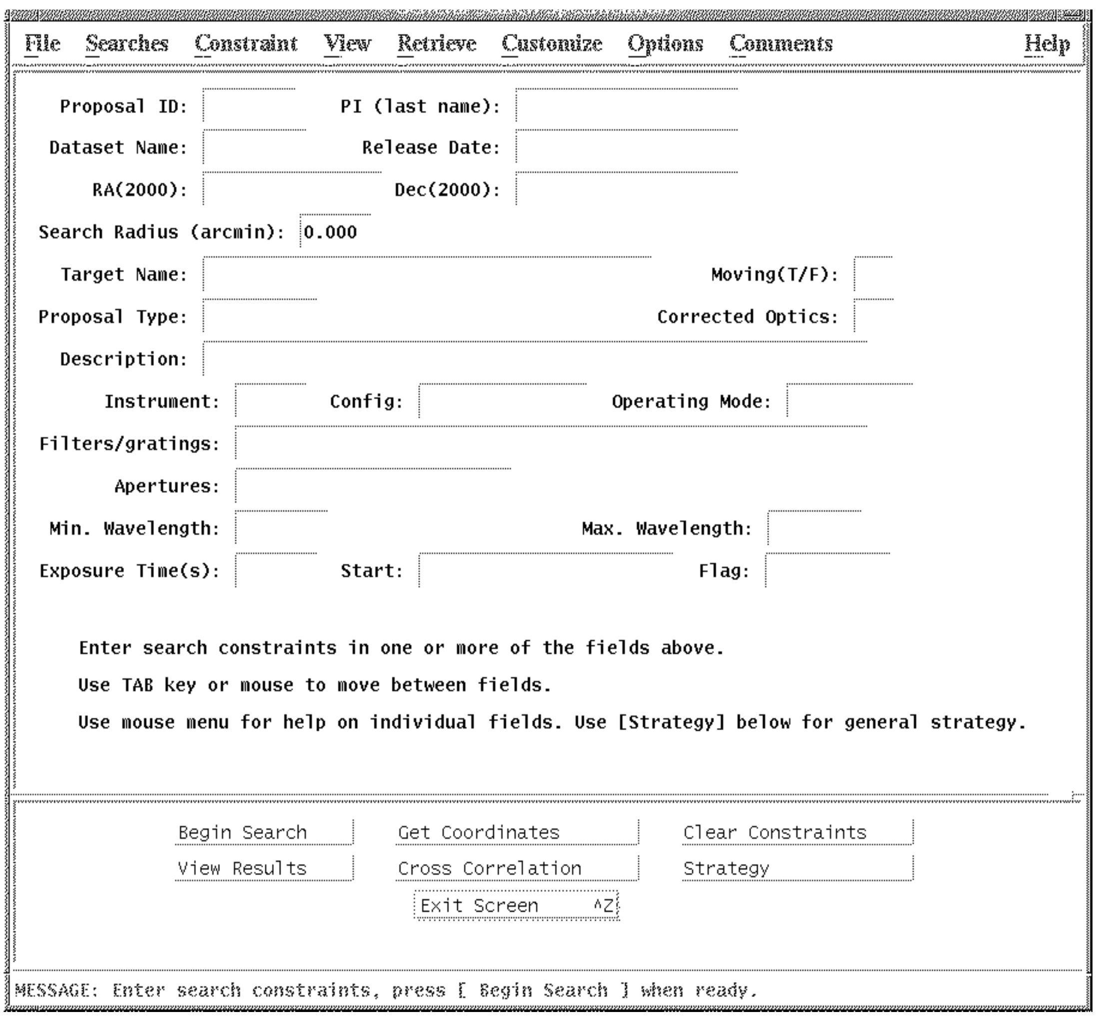


Figure 8.9: <General> Screen

<Quick Search> Screen

You can use this screen to initiate the most common types of informational searches of the HST catalog. The screen includes only a few simple fields by which you can constrain your catalog search. The <Quick Search Results> screen, however, includes the same comprehensive set of fields as the <General Search Results> screen (see page 148). Refer to Chapter 5 for search strategies that may be helpful in finding executed observations of specific targets in the HST catalog.

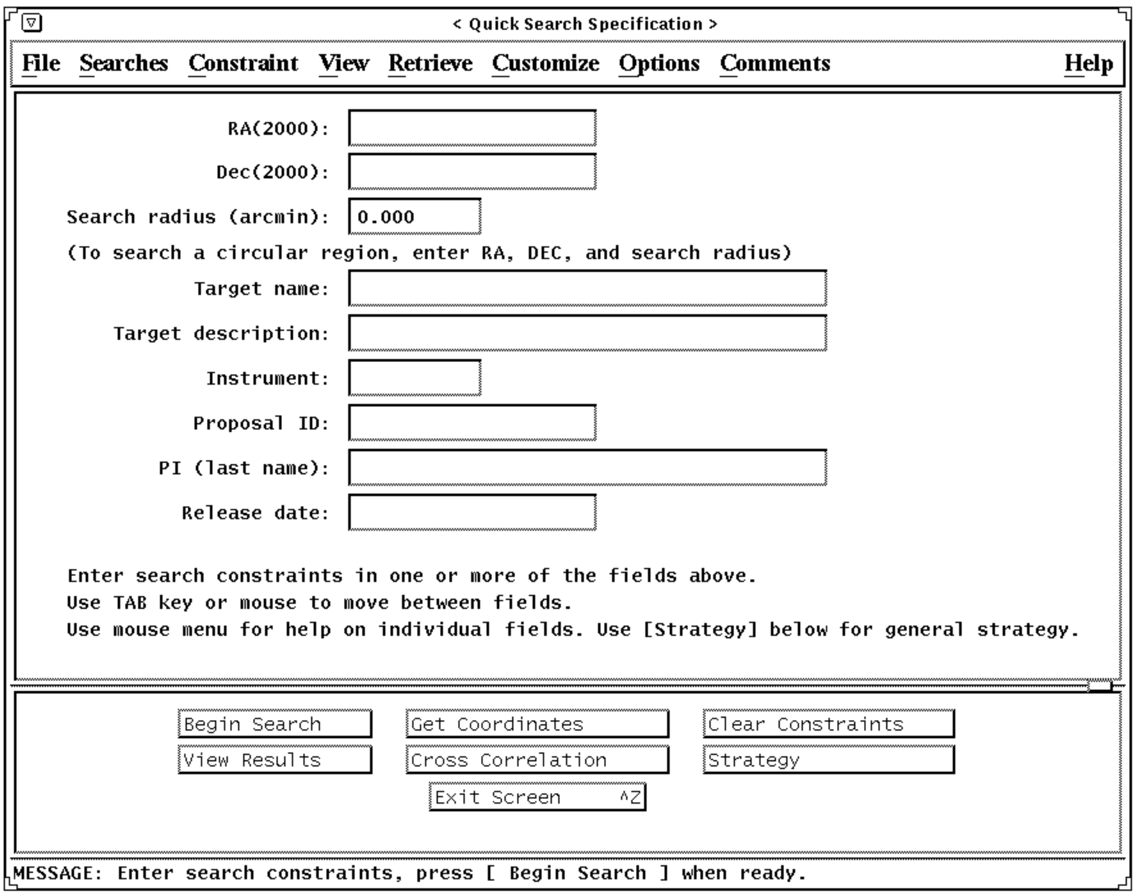


Figure 8.10: <Quick Search> Screen

<Fixed Target Search> Screen

You can use this screen to initiate searches of target-related information in the HST catalog. You can find observations of specific targets using either proposal-level or exposure-level search criteria (or some combination of the two).

Refer to Chapter 5 for helpful search strategies to find executed observations of specific targets in the HST catalog. Refer especially to Table 5.3 through Table 5.12 for comprehensive lists of the allowed target categories and descriptive keywords.

If you are specifically interested in solar system targets, then you can search the list of proposed solar system observations for specific targets using the <Solar System Target> screen. Then use the target names or proposal ID's that you find there to constrain your exposure search on this screen or on one of the other observation screens described in the preceding pages.

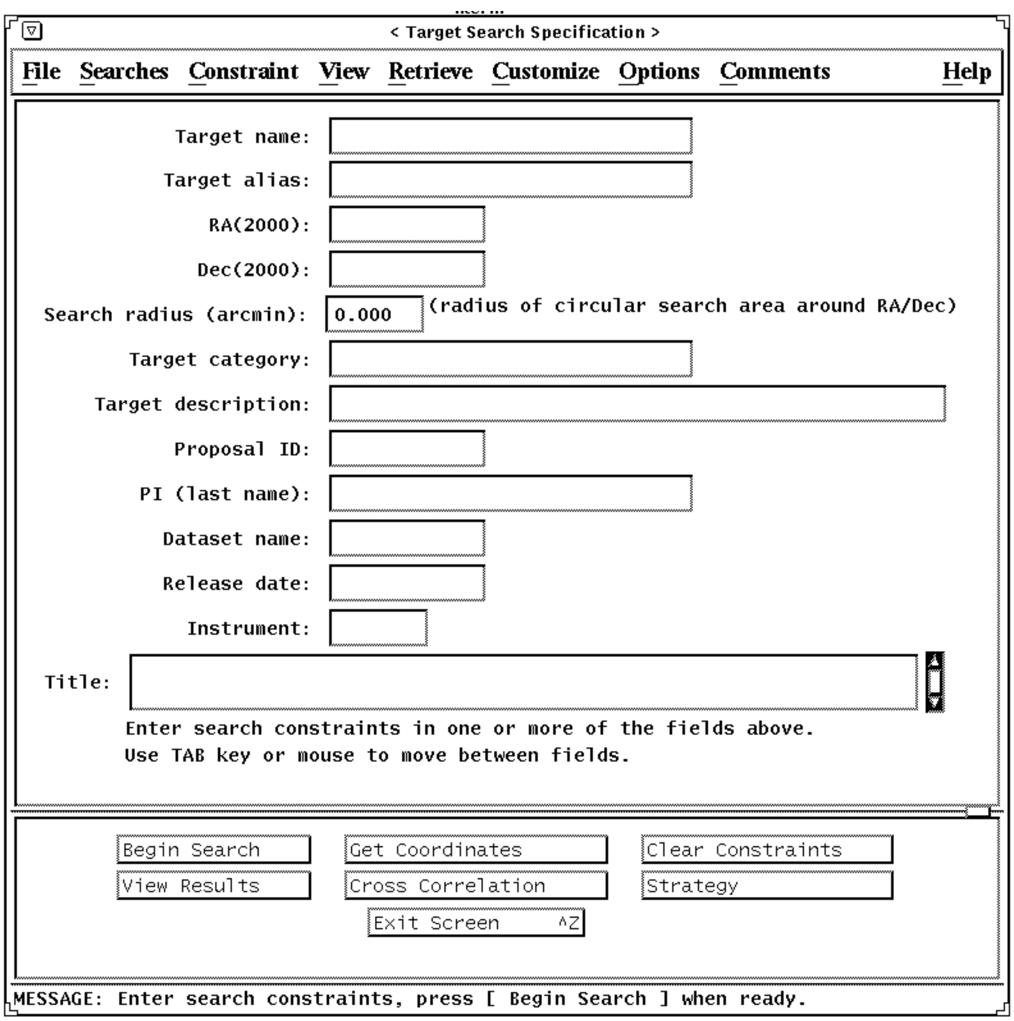


Figure 8.11: <Target Search> Screen

Observatory Monitoring Search Screen

The <Observatory Monitoring Search> screen allows users to search for observations based on telescope orientation criteria and it allows users to view and retrieve jitter information.

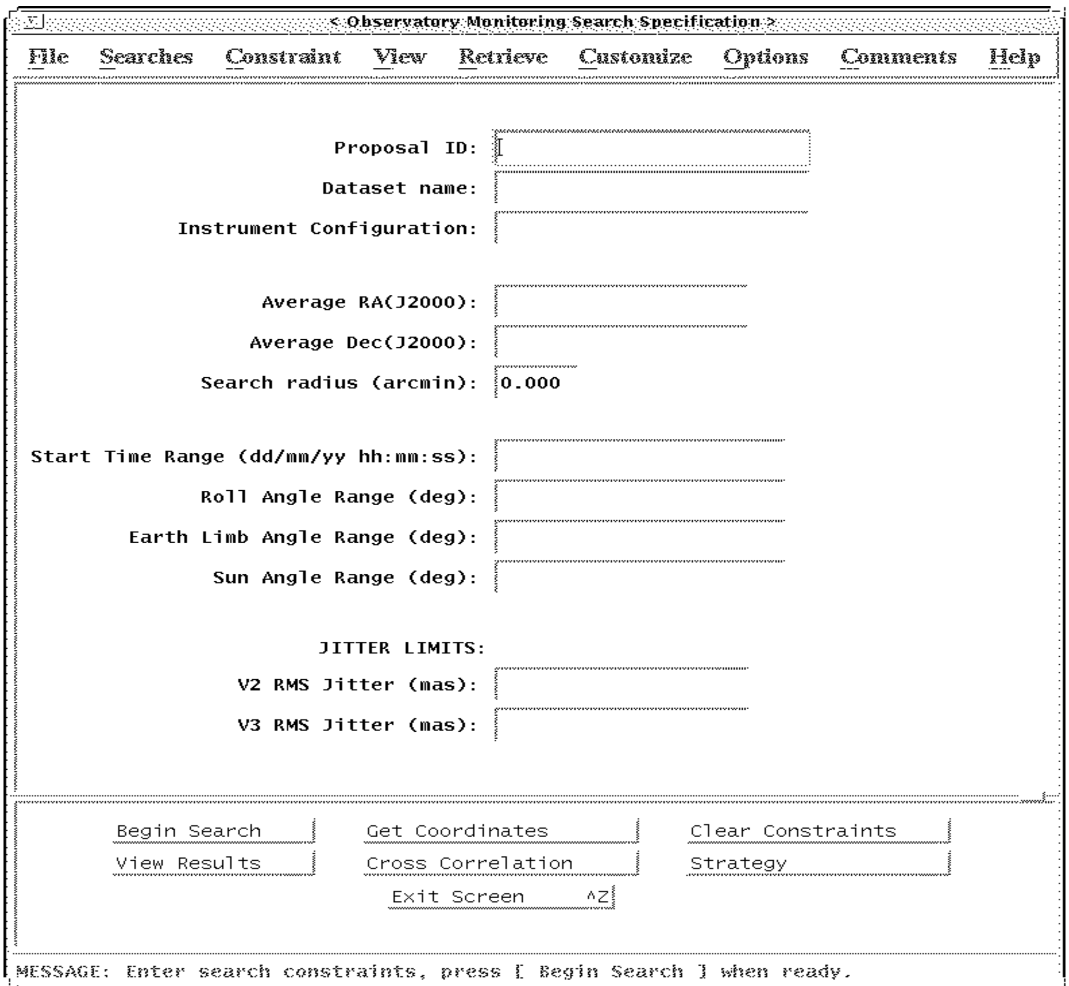


Figure 8.12: Observatory Monitoring Search Screen

Instrument Screens

StarView provides several instrument screens that let you view some of the instrument-specific exposure information stored in the HST catalog, all of them accessible from the <HST Instrument Searches> screen. There is one screen for each scientific instrument, and each contains parameters that are particular to that instrument (e.g., special configurations, set-up parameters, operating modes, and readout parameters). For example, you can use these screens to find all observations that were made using parameters equal to those of a particular observation that you may wish to retrieve. This could be very beneficial in analyzing and interpreting data obtained with special instrument configurations.

In addition to their instrument-specific fields, the StarView instrument screens all have a basic set of fields in common. Any combination of these fields can be used to constrain searches of the HST catalog. The common fields include:

- PI name
- Proposal ID
- Dataset name
- Release date
- Target name
- FGS lock (see page 77)
- Target position
- HST orientation (V1, V3 angles)
- Exposure parameters (duration, start time, and exposure flag (see Table 5.13))

However, it is the set of additional instrument-specific fields that distinguishes the nine instrument screens from one another (and from other StarView search screens) and that therefore makes each of these screens independently useful for instrument-unique catalog searches. These extra fields are described below as each separate screen is presented. Please refer to the individual Instrument Handbooks for a detailed description of the various fields.

<FGS/Astrometry> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to FGS/astrometry observations. In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- The specific target ID (which is derived from proposal ID plus target number)
- Which FGS was used for the astrometry observation
- Which FGS filter was used for the observation
- The magnitude of the observed target
- The telemetry format of the astrometry data
- The astrometry processing mode

You have to use this screen to view FGS/astrometry observation records in StarView and to retrieve the corresponding data files (archive class = AST; see Chapter 9). Since those data files do not belong to the CAL archive class, they cannot be viewed or marked on the usual StarView results screens. The typical StarView result screens that include the “Release date” field are constrained to look at CAL class files in order to display on the screen the most scientifically meaningful release date (i.e., that for the actual science data files in the dataset).

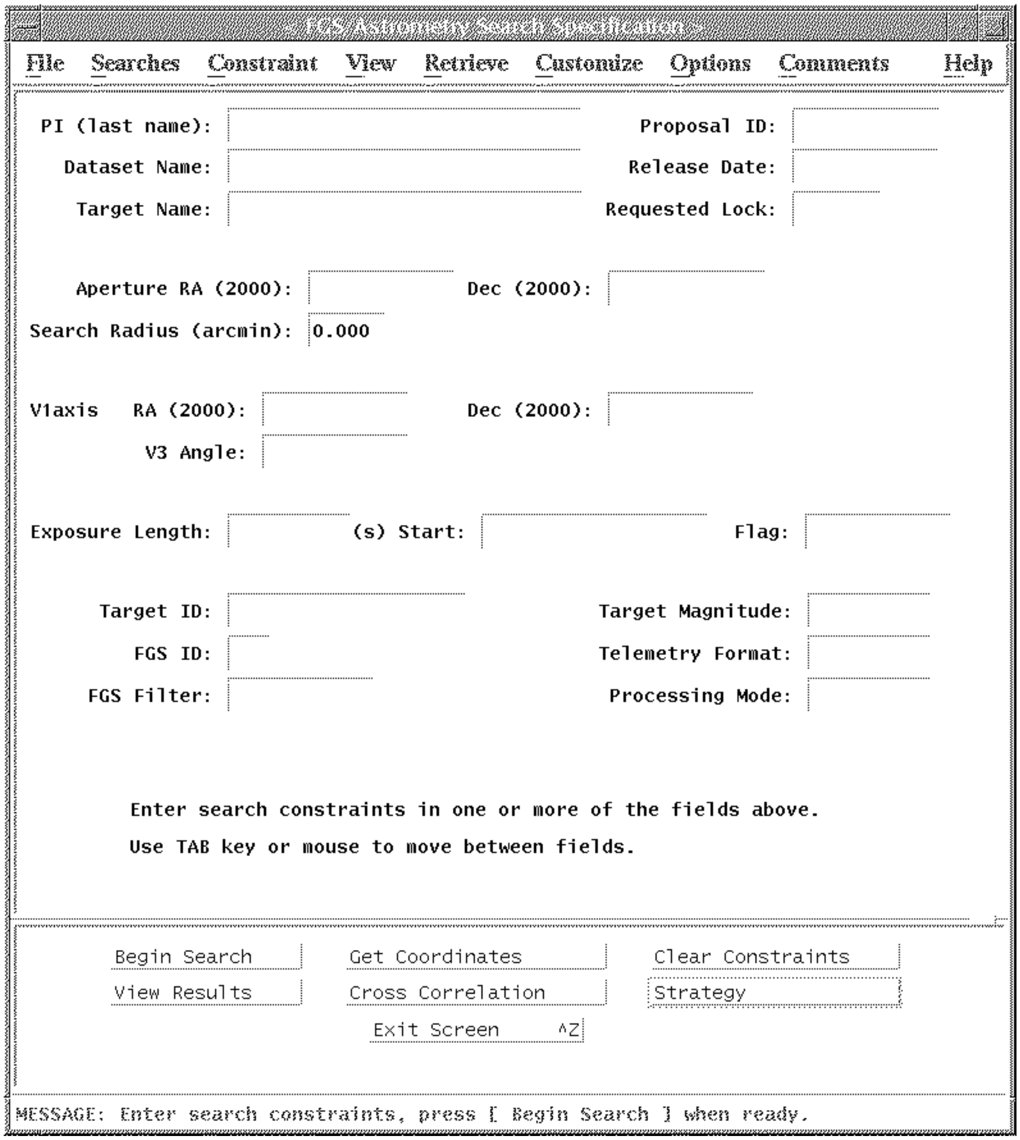


Figure 8.13: <FGS/Astrometry> Screen

<FOC> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to Faint Object Camera (FOC) observations. In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- Which optical relay was used (F48 or F96)
- The image format (NORMAL or ZOOM)
- The field of view (pixels per line vs. lines per frame)
- The orientation of north on the frame
- The offset (i.e., starting position) of the sub-image (pixel number and line number)
- Which filter in each of the four filter wheels was in the beam
- The shutter mode (INBEAM or NOTUSED)
- The LED calibration lamp status (ACTIVE or NOTUSED)
- The status of the spectrographic mirror mechanism (INBEAM or NOTUSED)
- The status of the coronographic apodizer mask (INBEAM or NOTUSED)
- The RMS bandwidth of the filter/detector combination (in angstroms)

As described on page 152, you can use this screen to find all FOC observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

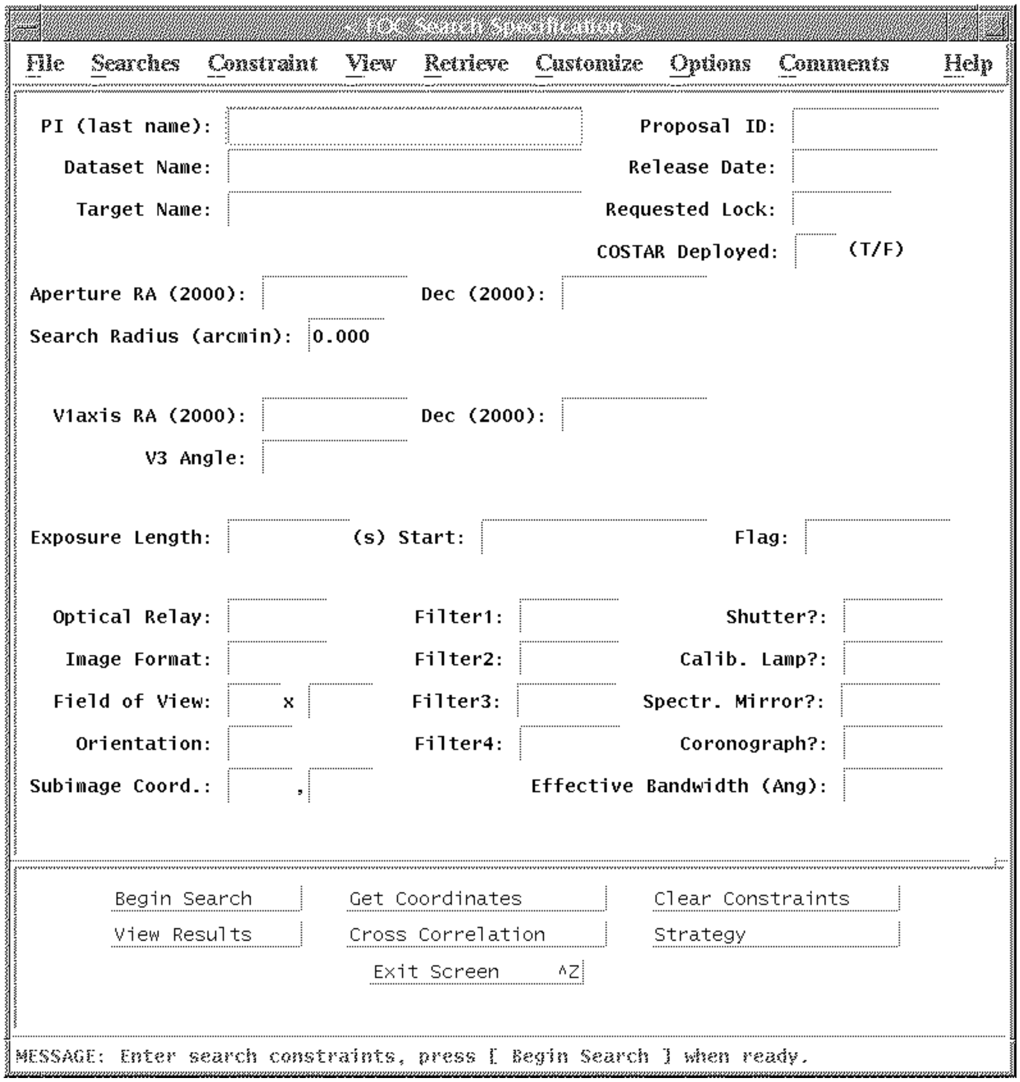


Figure 8.14: <FOC> Screen

<FOS> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to Faint Object Spectrograph (FOS) observations. In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- Which FOS detector was used (AMBER or BLUE)
- The ground software mode of the instrument (LED-FLAT-FIELD-MAP, TIME-RESOLVED, TIME-TAGGED, RAPID-READOUT, TARGET ACQUISITION, SPECTROSCOPY, or SPECTROPOLARIMETRY)
- The entrance aperture (using the codes designated [in parenthesis] in the first column of Table 29.3 of the *HST Data Handbook. Vol. II*)
- The position angle of the aperture (measured from north, along the +Y axis of the FOS field-of-view)
- The polarizer ID (A, B, C (= clear), or E (= error))
- The grating/disperser ID (using the codes designated [in parenthesis] in the first column of Table 29.4 of the *HST Data Handbook, Vol. II*)
- The minimum and maximum wavelengths of the observation (if specified by the proposer)
- The initial position angle of the polarizer
- The number of channels (i.e., diodes) read out
- The number of diodes that were over-scanned
- The number of steps (i.e., samples) taken per diode-width in a step pattern
- The acquisition mode

As described on page 152, you can use this screen to find all FOS observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

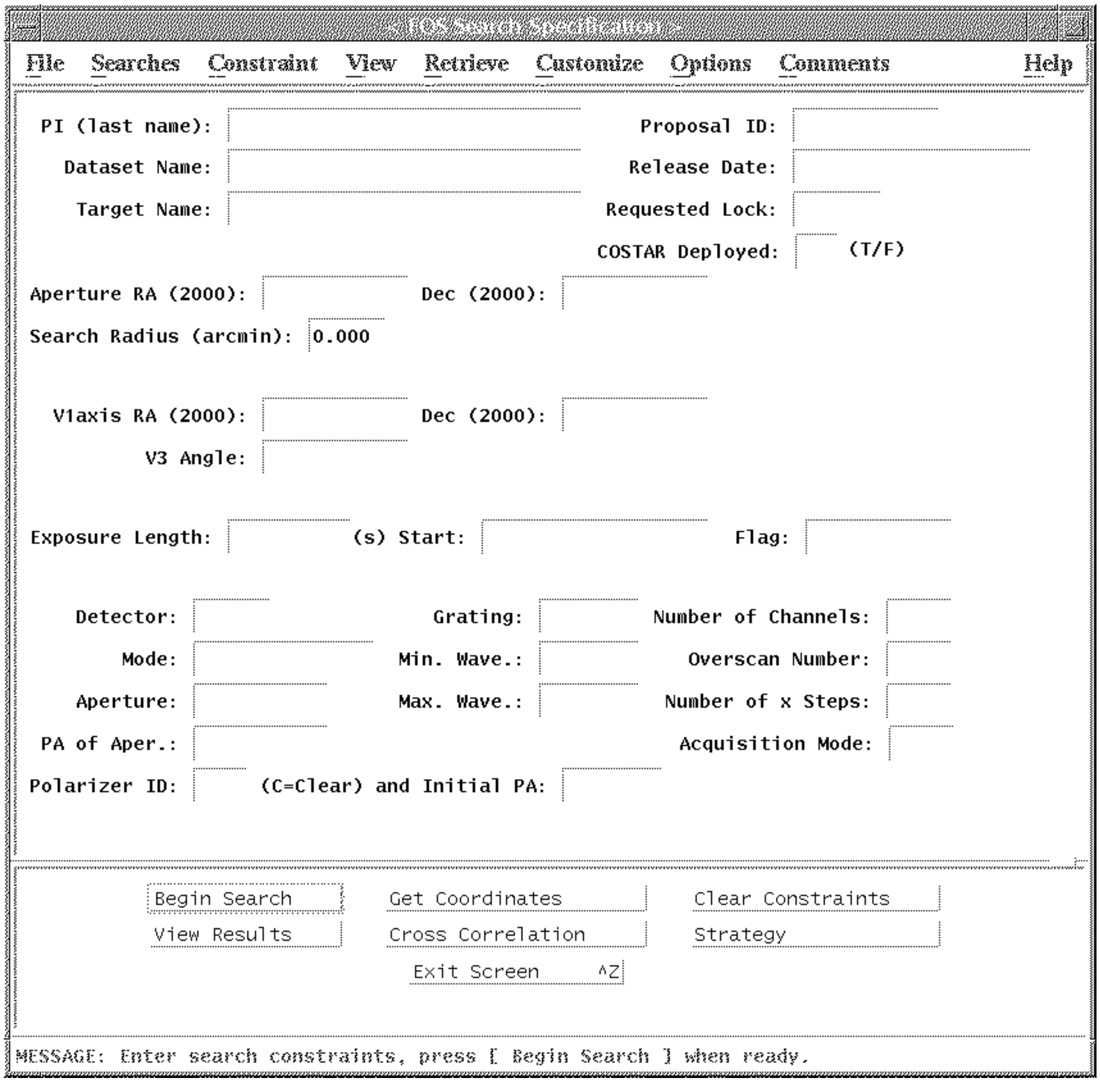


Figure 8.15: <FOS> Screen

<GHRS> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to observations using the Goddard High Resolution Spectrograph (GHRS). In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- Which GHRS detector was used (1 or 2)
- The observation mode
- The aperture used for the observation (SSA (= 0.25 arcsec), LSA (= 2.0 arcsec), or SC2 (for WAVE calibrations))
- The position angle of the target
- The spectral order of the echelle
- The grating used
- The minimum and maximum wavelengths of the observation
- The total flux from the target in the eight acquisition diodes obtained during the last frame of the target acquisition observation
- The step pattern of photocathode image deflections (1, 2, ..., 15; as described in the *HST Data Handbook*, *Vol. II*)
- The integration time at each position in the step pattern
- The fixed-pattern, spectrum-splitting keyword (FPSPLIT = NO, STD, TWO, FOUR, DSTWO, or DSFOUR)
- The expected number of observation repeats
- The recombined spectrum keyword (COMB-ADDITION = NO, TWO, FOUR, DSTWO, or DSFOUR)

As described on page 152, you can use this screen to find all GHRS observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

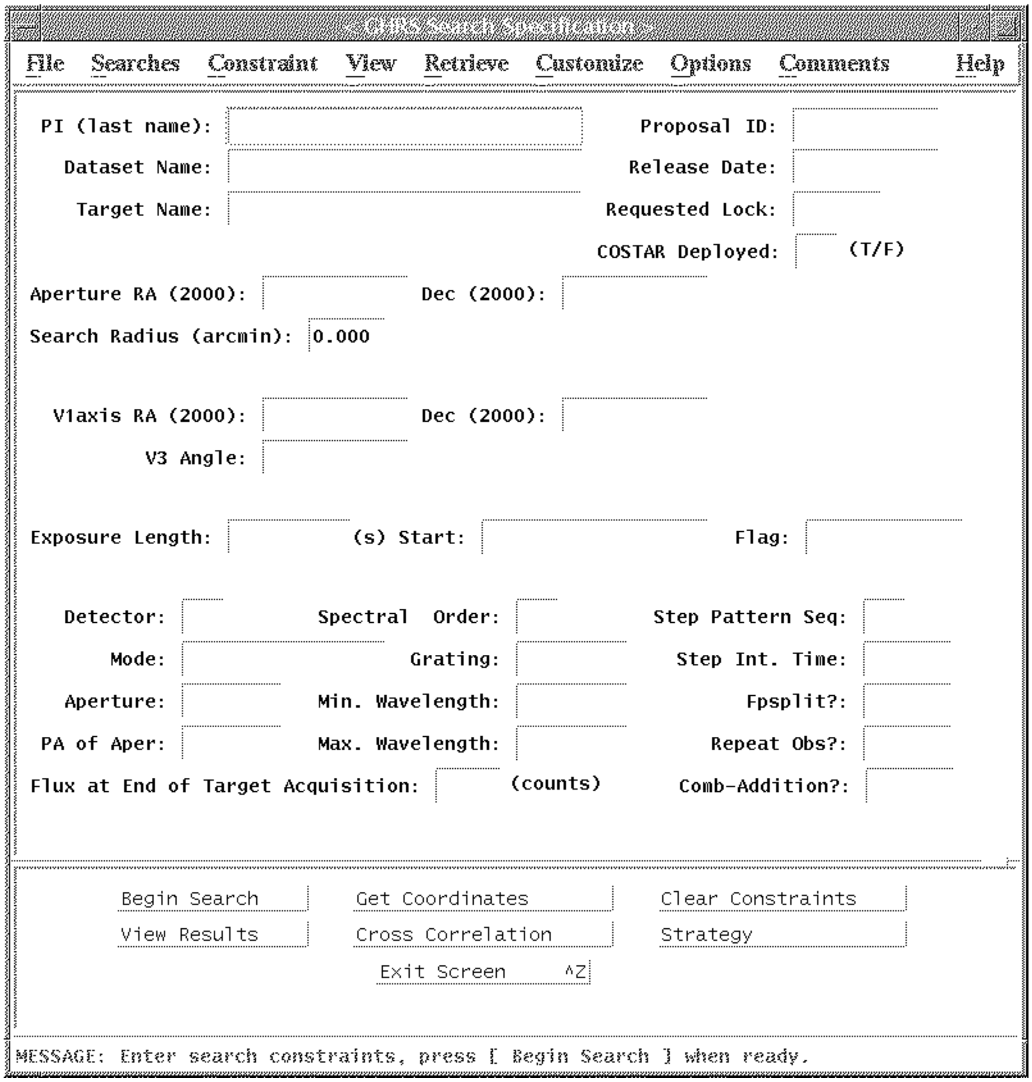


Figure 8.16: <GHRS> Screen

<HSP> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to High Speed Photometer (HSP) observations. In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find the:

- Instrument mode (SCP (single-color photometry), SSP (star/sky photometry), ARS (area scan), or DUM (dump))
- Detector used (0 (= none), 1 (= POL), 2 (= UV1), 3 (= VIS), 4 (= UV2), or 5 (= PMT))
- Aperture used for the object
- Sample time (i.e., time of integration)
- X and Y components of the object position's offset in the aperture
- Data source (STAR, SKY, or AREA SCAN)
- Data type (DIGITAL or ANALOG)
- Data format (BYTE, WORD, LWRD, ALOG, or ALL)
- Longitude of the prime meridian (for planetary target)
- Epoch of the longitude of the prime meridian (for planetary target)

As described on page 152, you can use this screen to find all HSP observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

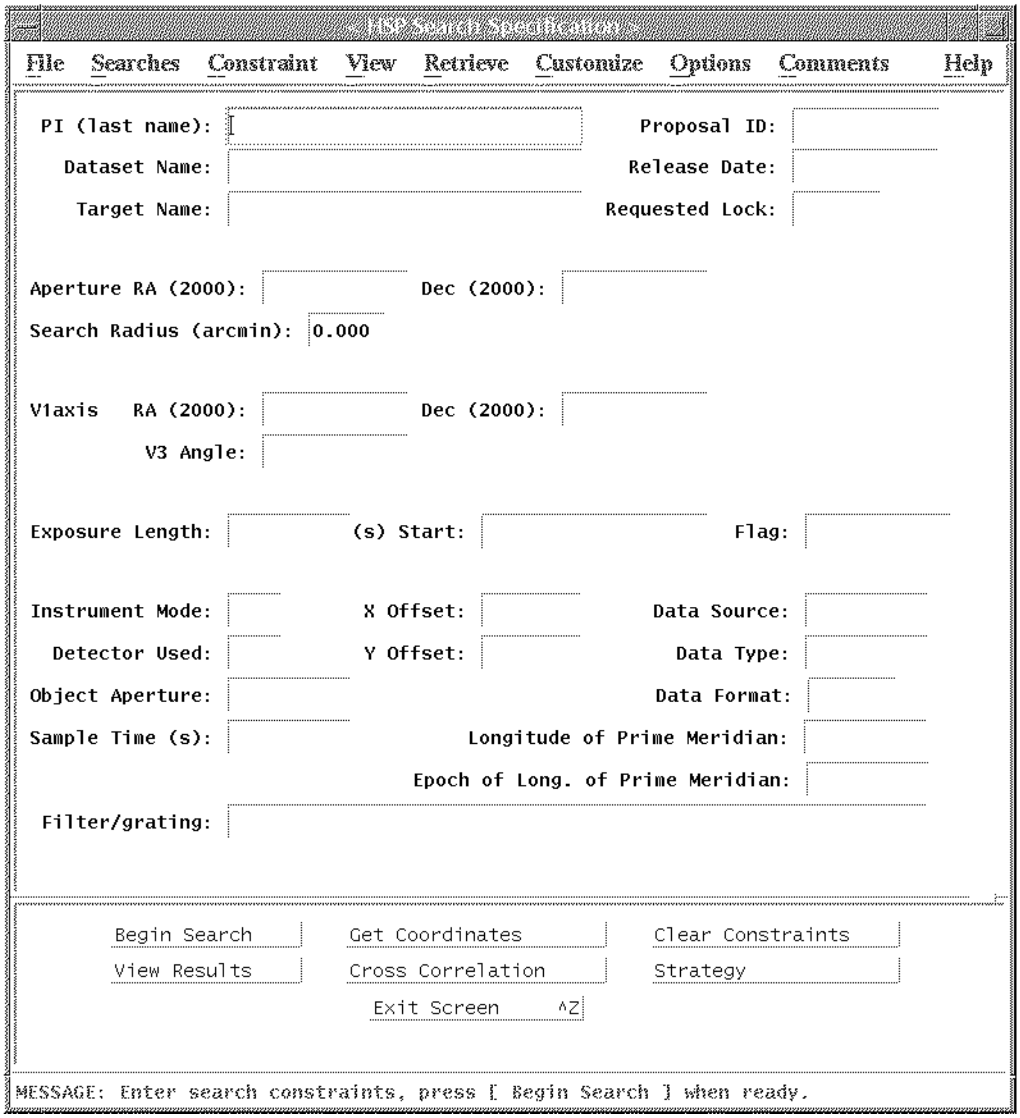


Figure 8.17: <HSP> Screen

<NICMOS> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to observations using the Near Infrared Camera and Multi-Object Spectrometer (NICMOS). In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- Which camera was used (camera 1, 2, or 3)
- Which aperture was used (NIC1, NIC1-FIX, NIC2, NIC2-FIX, NIC-CORON, NIC2-ACQ, NIC3, NIC3-FIX)
- The observation mode used (ACCUM, MULTI-ACCUM, BRIGHT OBJECT, ACQ RAMP)
- The image type (DARK, BIAS, INTFLAT, FLAT, EXTERNAL, EARTH-CALIB, or SPECIAL)
- The filters used (see the *NICMOS Instrument Handbook* for a complete summary)
- The sample sequence or a pre-defined set of sample times for MULTI-ACCUM mode
- The orientation of the NICMOS cameras (spacecraft orientations are rotated by 225 degrees from NICMOS coordinate system)
- NREAD or the number of multiple reads of the initial pixel values which are averaged to define the initial signal level (1-25)
- NSAMP or the number of ACCUM samplings
- READOUT or the NICMOS detector readout modes (ACCUM, MULTIACCUM, BRIGHTOBS, and ACQ).

As described on page 152, you can use this screen to find all NICMOS observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

The use of the <NICMOS Association Search> screen is described on page 172.

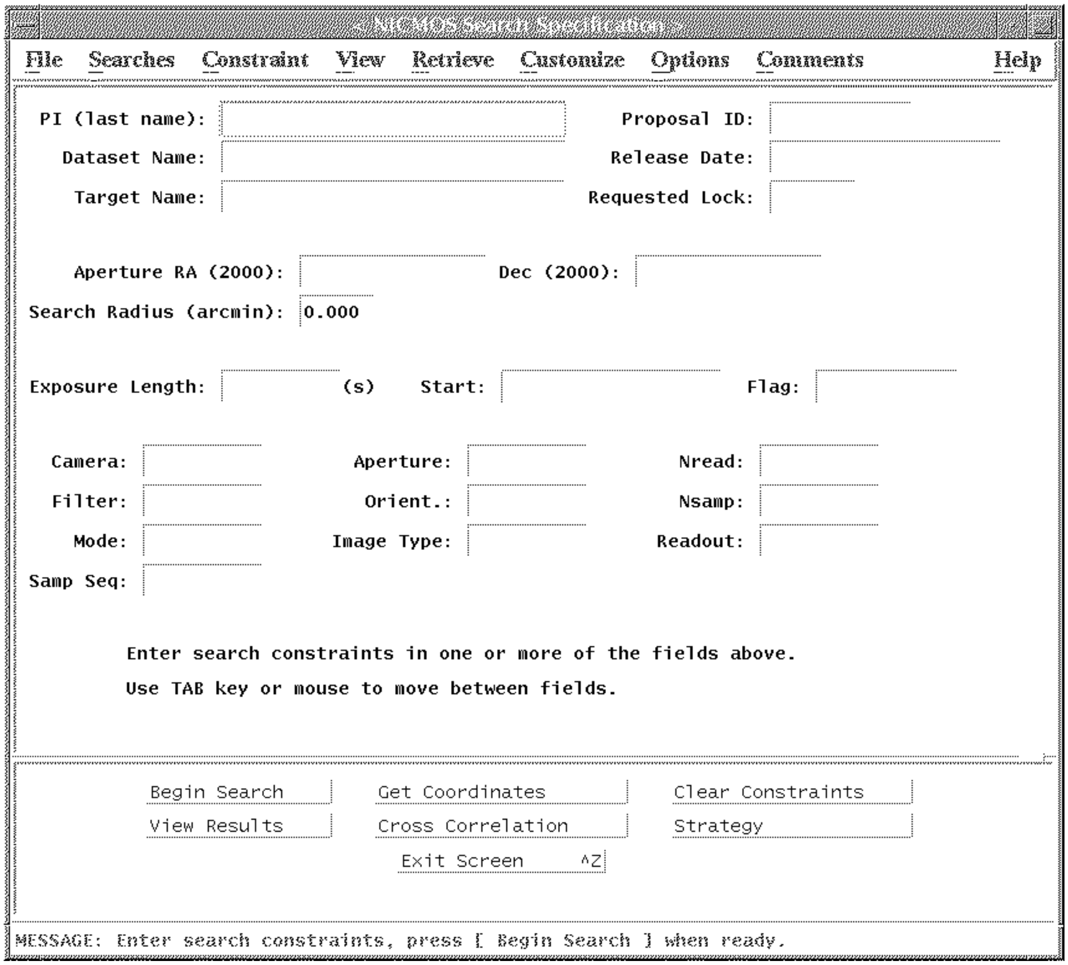


Figure 8.18: <NICMOS> Screen

<STIS> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to observations using the Space Telescope Imaging Spectrograph (STIS). In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- Which detector was used (STIS/CCD, MAMA, STIS/FUV-MAMA)
- The observation mode used (ACCUM and TIME-TAG)
- The optical elements in use (grating and filter)
- The central wavelength
- The aperture used (a complete summary of available apertures is presented in the *STIS Instrument Handbook)*
- Which calibration lamp subsystem was used (HITM, IM, NONE)
- Which was the primary instrument in case an observation was taken in parallel
- If a subarray (T) or if the full array (F) was used by the detector
- In the case of a CCD subarray the dispersion (which runs along AXIS1) and the long axis of the slit (which runs along AXIS2)
- The configuration status
- Whether the global linearity level was exceeded
- Number of cosmic ray split exposures (CRSPLITS)
- Number of repeat exposures in set (default = 1)
- Whether the Local Rate Check image (LRC) exists (T/F)
- If the Local Rate Check (LRC) failed (T/F).

As described on page 152, you can use this screen to find all STIS observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

The use of the <STIS Association Search> screen is described on page 174.

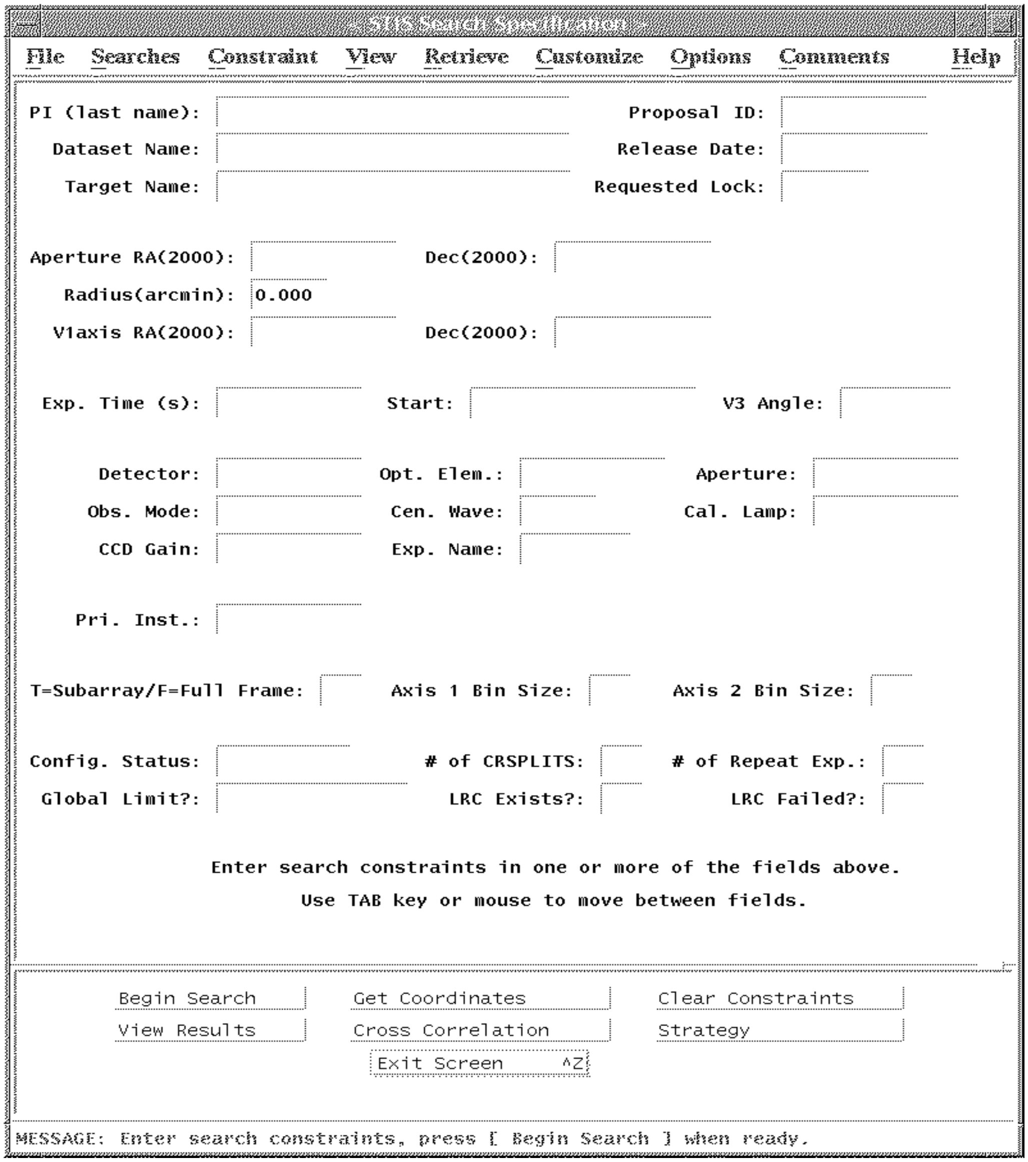


Figure 8.19: <STIS> Screen

<WFPC> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to observations using the Wide Field Planetary Camera (WFPC). In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- Which camera was used (WF (wide field) or PC (planetary camera))
- The observation mode used (FULL (full resolution, 800 x 800) or AREA (area integration, 400 x 400))
- The image type (DARK, BIAS, INTFLAT, PREF, FLAT, KSPOTS, EXTERNAL, EARTH-CALIB, or SPECIAL)
- The filters used
- The predicted preflash time
- The target acquisition mode (00 (null), 01 (ground assisted), 02 (onboard computer assisted), or 03 (fixed simple pointing))
- The orientation of the four CCD chips

As described on page 152, you can use this screen to find all WF/PC observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

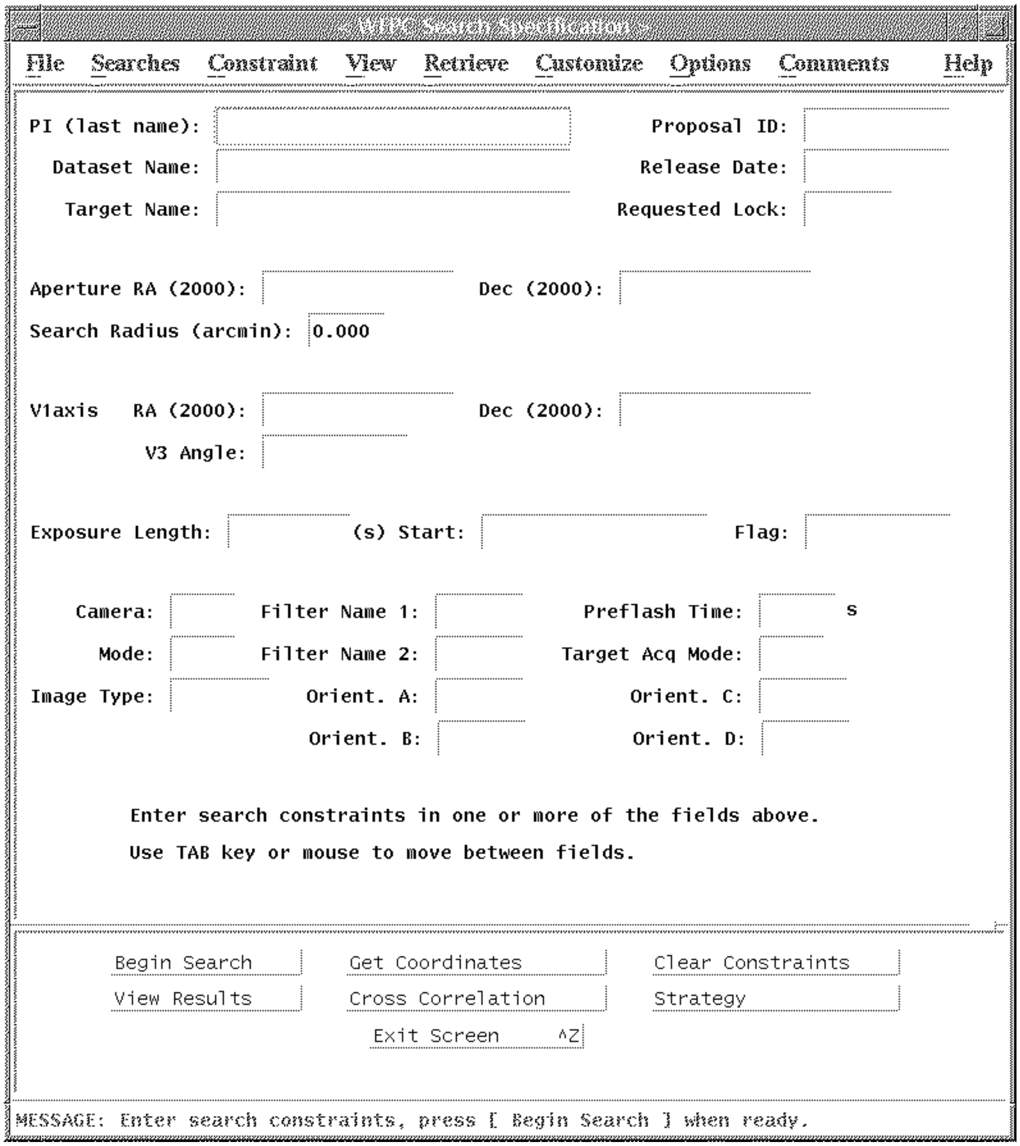


Figure 8.20: <WFPC> Screen

<WFPC-2> Screen

You can use this screen to search the HST catalog for detailed instrument-specific exposure information related to WFPC-2 observations. In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to find:

- The observation mode used (FULL (full resolution, 800 x 800) or AREA (area integration, 400 x 400))
- The image type (DARK, BIAS, INTFLAT, PREF, FLAT, KSPOTS, EXTERNAL, EARTH-CALIB, or SPECIAL)
- The filters used
- The target acquisition mode (00 (null), 01 (ground assisted), 02 (onboard computer assisted), or 03 (fixed simple pointing))
- The orientation of the four CCD chips

As described on page 152, you can use this screen to find all WFPC-2 observations that were made using instrument parameters equal (or similar) to those of a particular observation that you are interested in. Enter the appropriate search constraints in the relevant instrument-specific fields on this search screen to initiate such a catalog search.

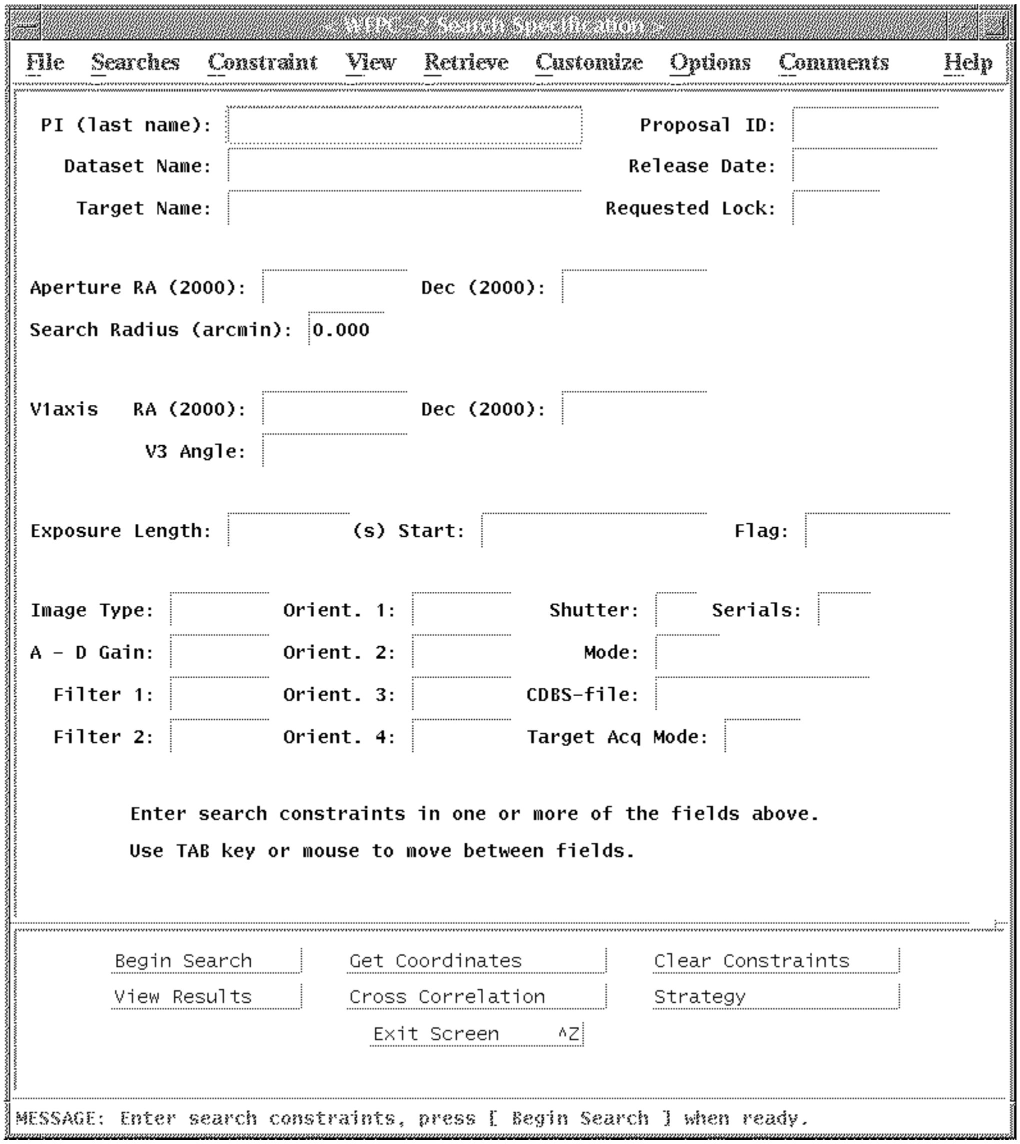


Figure 8.21: <WFPC-2> Screen

Association Screens

The STIS and NICMOS science instruments have posed new expectations and requirements on the processing and archiving of HST data. The association of exposures is in fact the central aspect of the data handling for NICMOS and STIS that permits the compact combination of multiple exposures to produce meta datasets or products.

The most fundamental element within the HST ground system is the “exposure.” First generation HST Science Instruments are commanded to generate single exposures, which result from a distinct sequence of commands to the instrument. The resulting data are then assembled into a single “dataset.” Each of these datasets is given a unique 9 character identifier (see page 214) and is pipeline processed, calibrated, and archived separately from all other datasets.

For STIS and NICMOS, the combination of data from two or more exposures is often necessary to create a scientifically useful data product. Associations simplify the use of HST data by identifying a set of exposures that belong together and depend upon one another. An association permits all these exposures to be calibrated, archived, retrieved, and reprocessed as a set rather than as individual observations.

When a user searches the Archive with StarView for observations involving associations of exposures using the “standard” screens (e.g., the <Quick Search> or <General Search> screens), the search will identify the final association product (the rootnames of association products always end in zero: see Table 9.1 on page 215). If one requests both Calibrated and Uncalibrated data from the Archive (see Figure 8.39 on page 195), one will receive both the association product and the exposures that went into making it. The corresponding association table, located in the file with suffix `_asn` and the same rootname as the association product, will list the exposures belonging to the association. The exposure IDs in the association table share the same `ipppss` sequence as the association rootname, followed by a base 36 number nn (n = 0-9, A-Z) that uniquely identifies each exposure, and a character `t` that denotes the data transmission mode (see Table 9.1).

The <Association> screens are the only means to search the Archive for detailed information about the association status of NICMOS and STIS observations. The NICMOS association screen provides the only means for retrieving individual exposures from within an association. These screens are described below.

<NICMOS Association Search> Screen

The <NICMOS Association Search> screen represents the only way to search the Archive for detailed information about the association status of NICMOS observations. The results of the search request are returned on the <NICMOS Association Results> screen. In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to search on, for example:

- Association ID (if a dataset is not a member of an association, this keyword will be set to NONE)
- Pattern, that is the set of images of the same astronomical target obtained at pointings offset (see the *NICMOS Instrument Handbook* for a list of pre-designed patterns)
- The number of positions used as pointing offsets to form a pattern, Numpos
- Offset, which defines which type of telescope motion will be performed during a pattern in order to dither or chop (see the *NICMOS Instrument Handbook* for a list of available options).

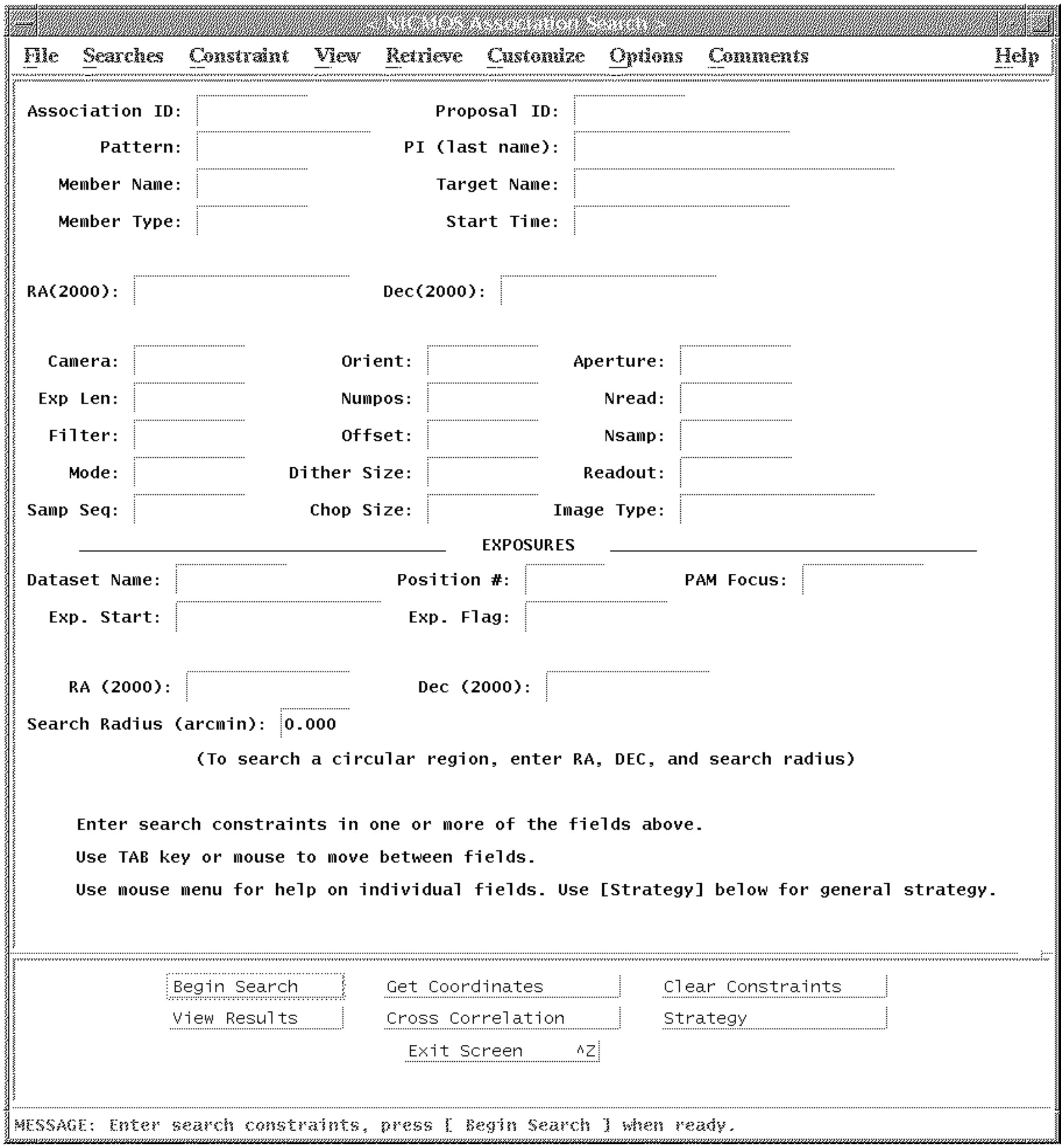


Figure 8.22: <NICMOS Association Search> Screen

<STIS Association Search> Screen

The <STIS Association Search> screen represents the only way to search the Archive for detailed information about the association status of STIS observations. The results of the search request are returned on the <STIS Association Results> screen. In addition to the exposure information that is common to all of the instrument screens (page 152), you can use this screen to search on, for example:

- Association ID (if a dataset is not a member of an association, this keyword will be set to NONE)
- Association Status (COMPLETE if all of its exposures were received, INCOMPLETE otherwise)
- Generation Date
- Association Member Type. This refers to individual image extensions within the file (e.g. CRSPLIT, SINGSCI, RPTOBS, WAVE).

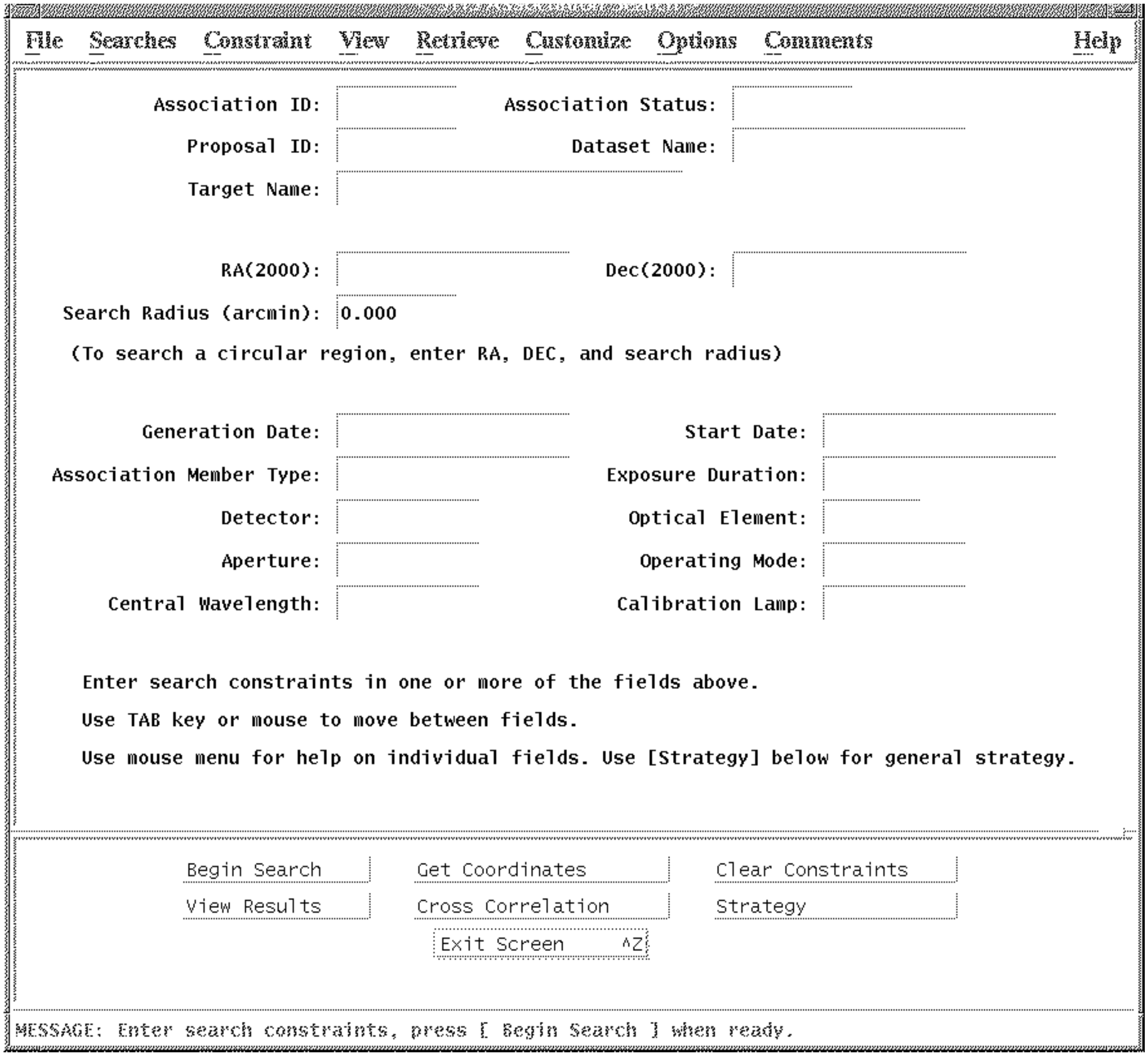


Figure 8.23: <STIS Association Search> Screen

Reference and Calibration Screens

StarView provides several screens that list the reference files that were used to calibrate each of the observations stored in the HST archive, all accessible from the <HST Instrument Searches> Screen. There is one screen per scientific instrument (except for the FGS). These screens also list the calibration reference files that are now determined to be the best files to use in recalibrating each observation. In most cases, the “used” calibration files are the same as the “recommended” files, indicating that it is not necessary to recalibrate those observations.

However, a dataset’s recommended calibration files may differ from those used if, in retrospect, it appears that a better file can now be used. This happens occasionally. However, finding that a file or table has changed doesn’t always mean that you’ll have to recalibrate. That depends very much on which file or table changed, and whether that kind of correction is likely to affect your analysis. This is not always easy to determine. You can find additional information on the significance of the reference files to the calibration process in the *HST Data Handbook*.

Finally, the <HST Instrument Searches> screen provides also access to a set of “Calibration” screens. These are instrument-specific and normally used only by Instrument Scientists.

<FOC Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using the FOC. The different types of information that are available on this screen are: general dataset parameters; instrument-specific exposure parameters; the names of the USED and RECOMMENDED calibration files; the corresponding LEVEL OF CHANGE; and PERFORMED values, indicating whether that calibration step was omitted or completed.

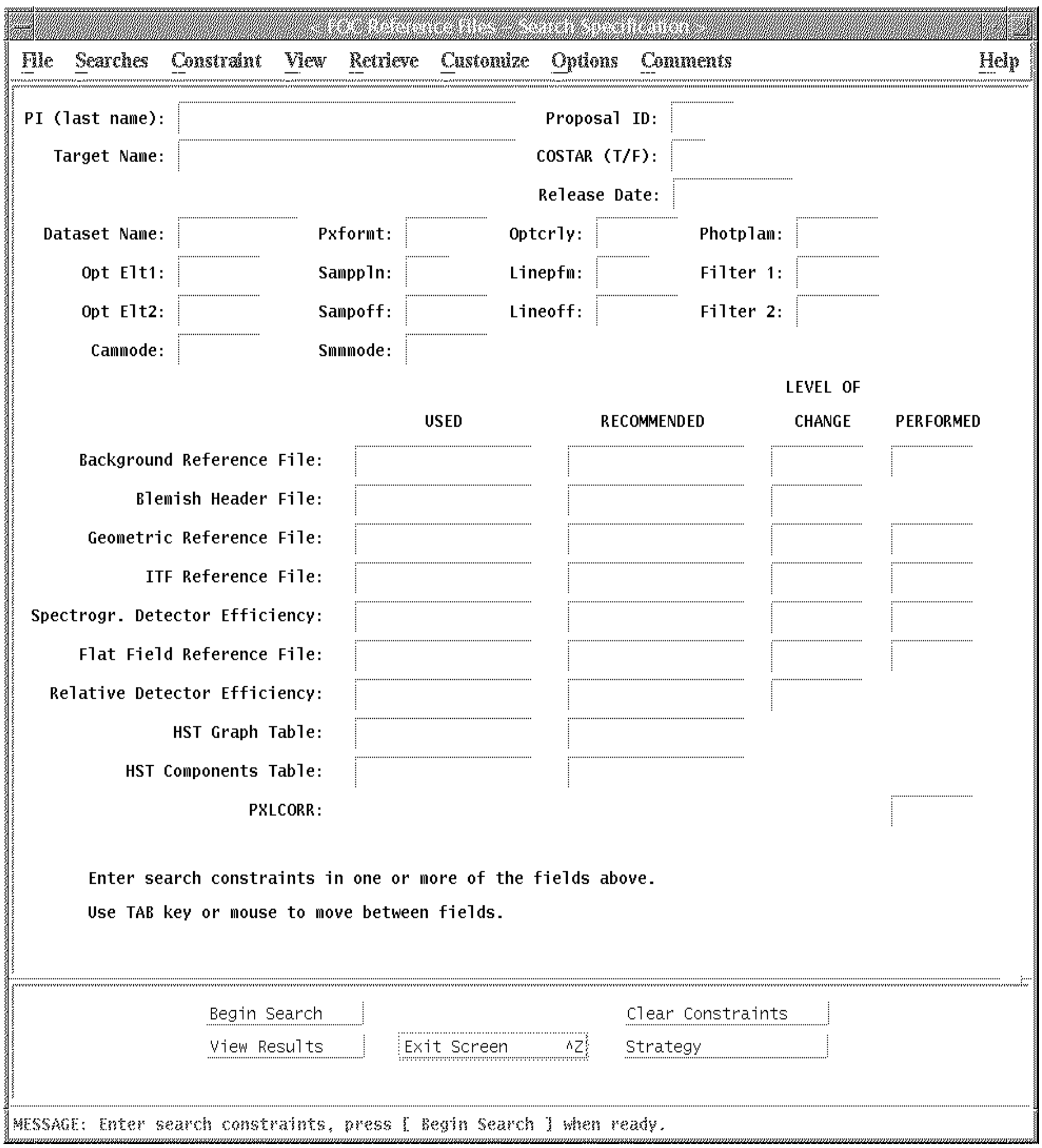


Figure 8.24: <FOC Reference Files> Screen

<FOS Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using the FOS. The different types of information that are available on this screen are: general dataset parameters; instrument-specific exposure parameters; the names of the USED and RECOMMENDED calibration files; the corresponding LEVEL OF CHANGE; and PERFORMED values, indicating whether that calibration step was omitted or completed.

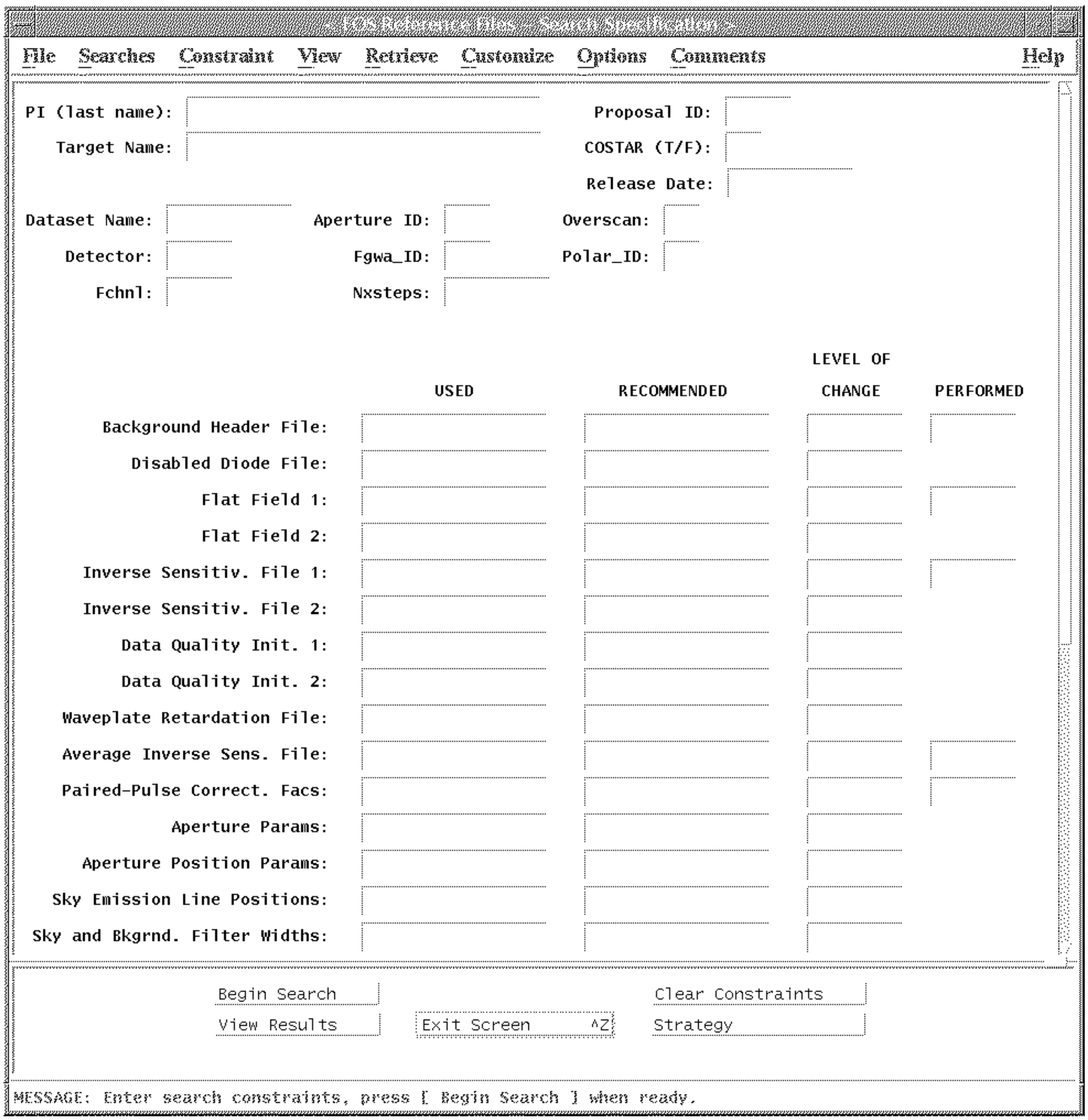


Figure 8.25: <FOS Reference Files> Screen

<GHRS Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using the GHRS. The different types of information that are available on this screen are: general dataset parameters; instrument-specific exposure parameters; the names of the USED and RECOMMENDED calibration files; the corresponding LEVEL OF CHANGE; and PERFORMED values, indicating whether that calibration step was omitted or completed.

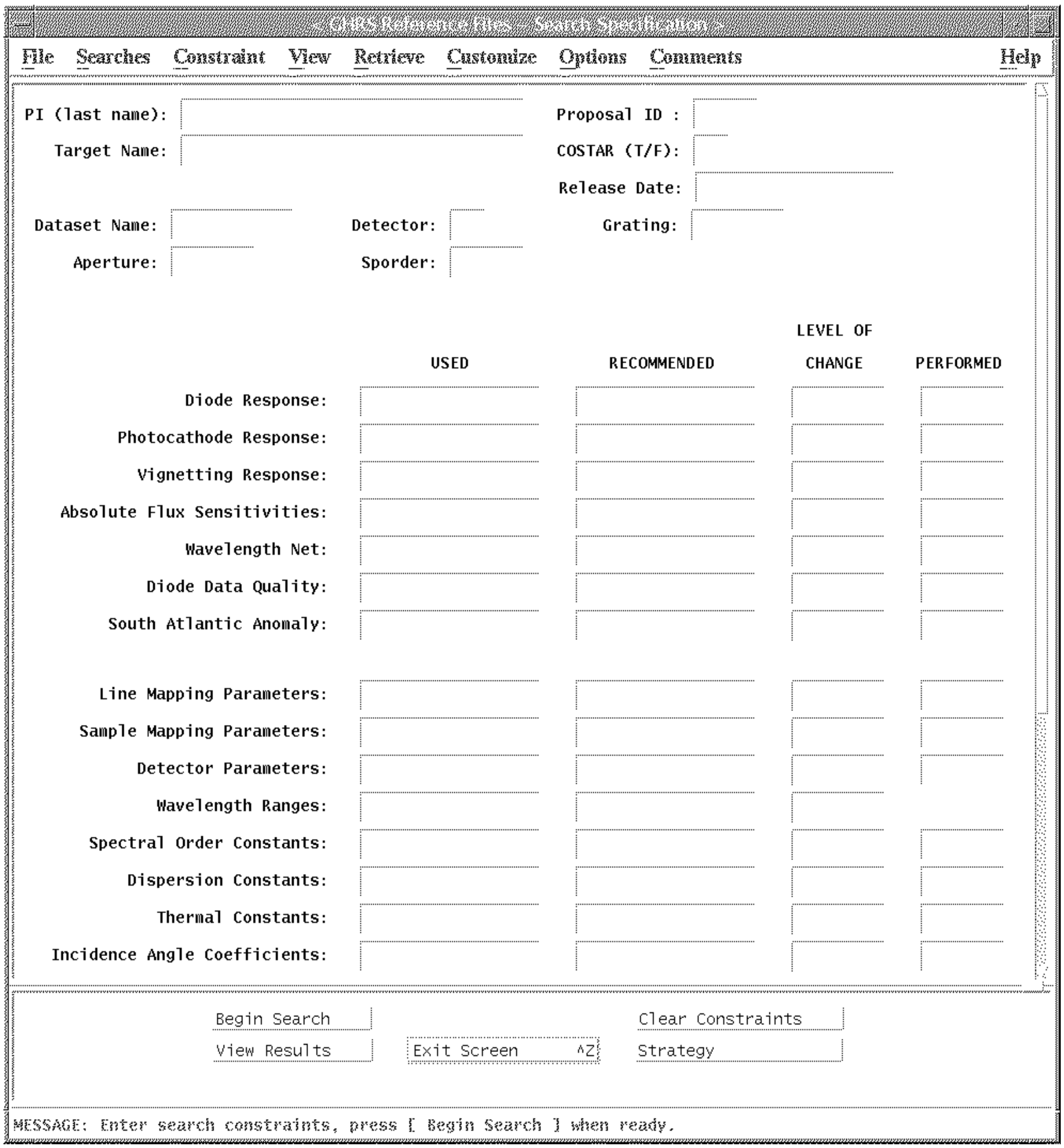


Figure 8.26: <GHRS Reference Files> Screen

<HSP Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using the HSP. The different types of information that are available on this screen are general dataset parameters and the names of the USED and RECOMMENDED calibration files and the corresponding LEVEL OF CHANGE.

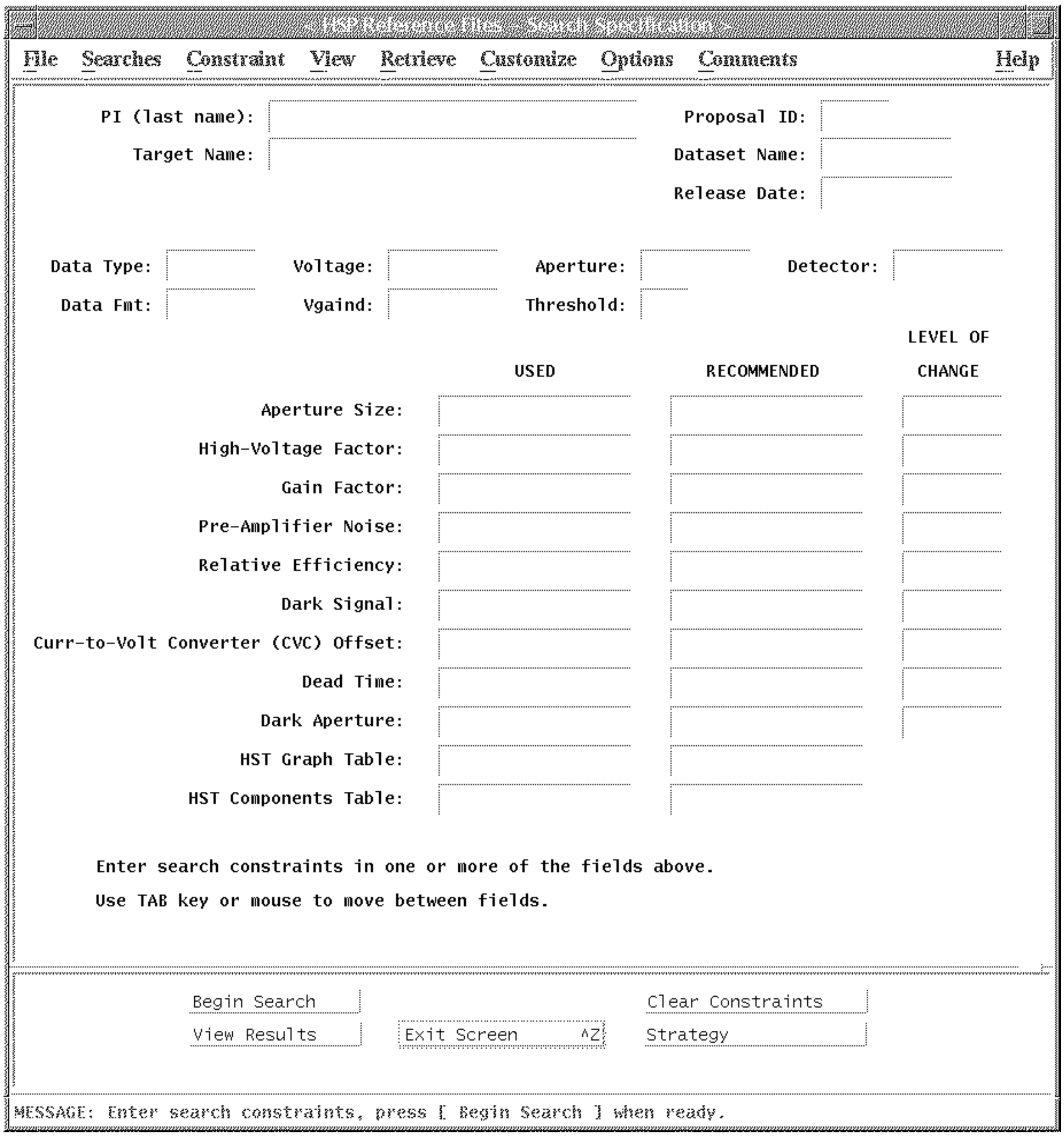


Figure 8.27: <HSP Reference Files> Screen

<NICMOS Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using NICMOS. The different types of information that are available on this screen are: general dataset parameters; instrument-specific exposure parameters; the names of the USED and RECOMMENDED calibration files; the corresponding LEVEL OF CHANGE; and PERFORMED values, indicating whether that calibration step was completed or not.

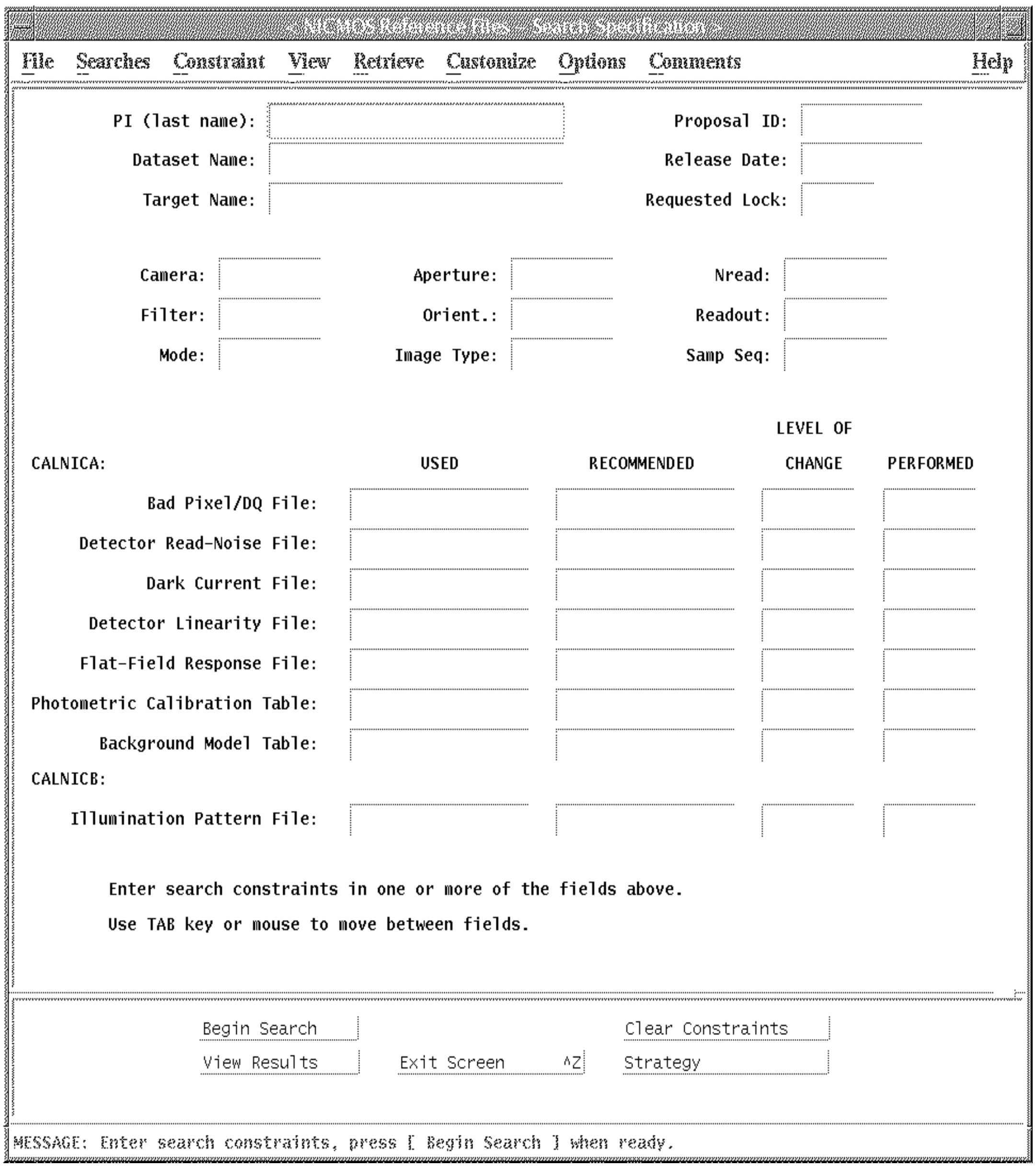


Figure 8.28: <NICMOS Reference Files> Screen

<STIS Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using STIS. The different types of information that are available on this screen are: general dataset parameters; instrument-specific exposure parameters; the names of the USED and RECOMMENDED calibration files; and the corresponding LEVEL OF CHANGE.

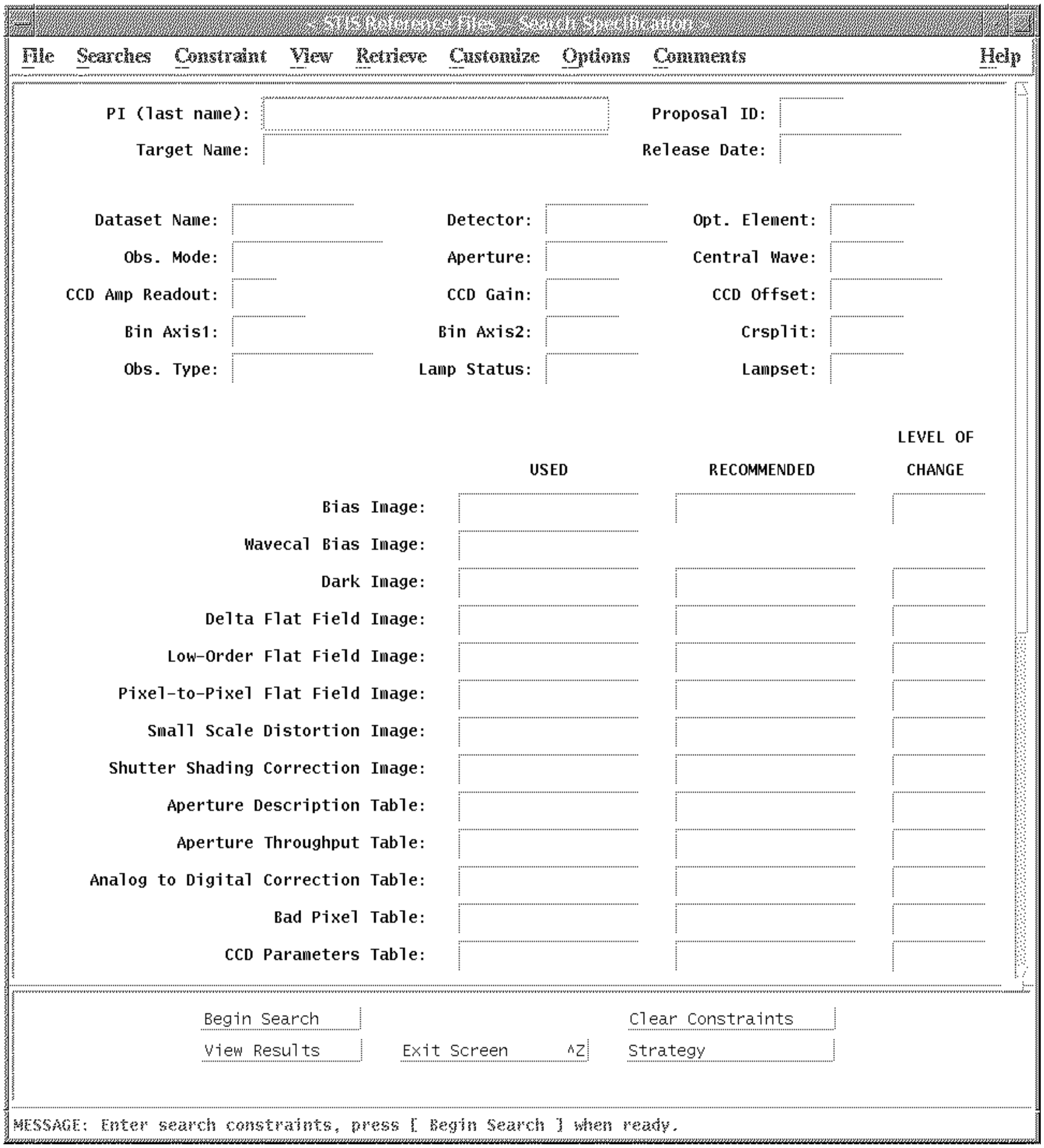


Figure 8.29: <STIS Reference Files> Screen

<WFPC Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using the WF/PC. The different types of information that are available on this screen are: general dataset parameters; instrument-specific exposure parameters; the names of the USED and RECOMMENDED calibration files; the corresponding LEVEL OF CHANGE; and PERFORMED values, indicating whether that calibration step was completed or not.

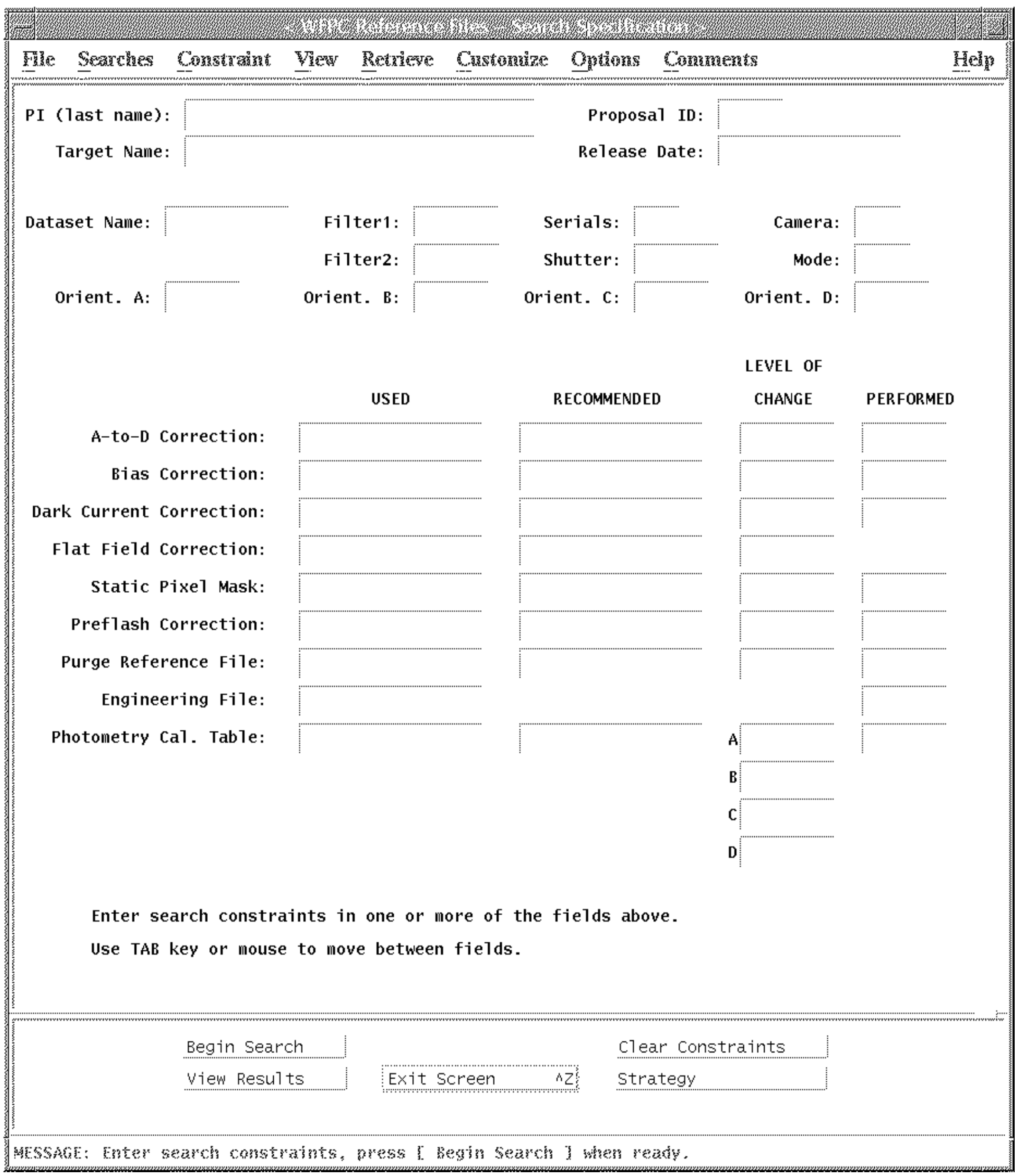


Figure 8.30: <WFPC Reference Files> Screen

<WFPC-2 Reference Files> Screen

You can use this screen to search the HST catalog for detailed instrument-specific information concerning the reference files used in calibrating HST observations using the WFPC-2. The different types of information that are available on this screen are: general dataset parameters; instrument-specific exposure parameters; the names of the USED and RECOMMENDED calibration files; the corresponding LEVEL OF CHANGE; and PERFORMED values, indicating whether that calibration step was completed or not.

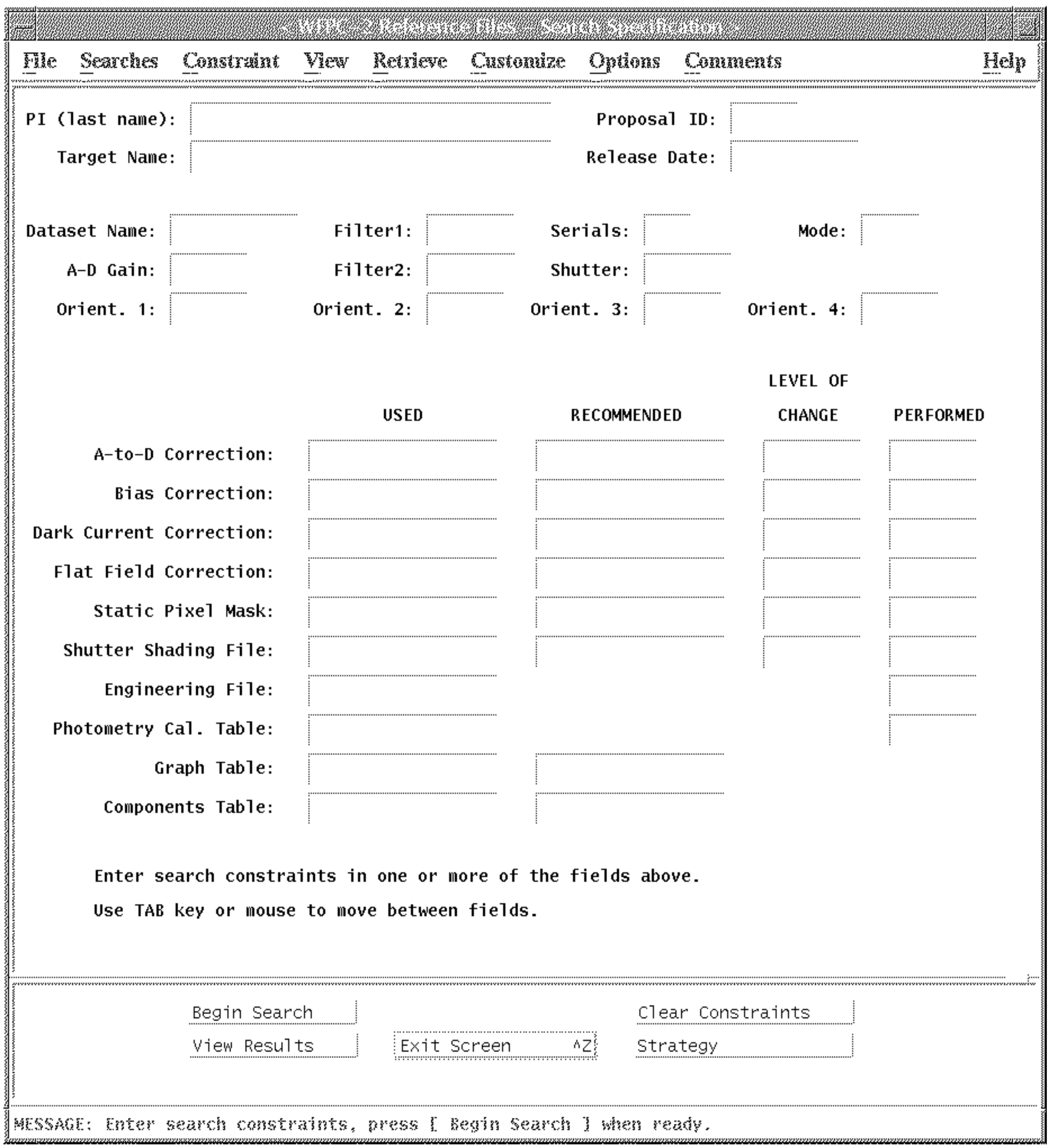


Figure 8.31: <WFPC-2 Reference Files> Screen

On-The-Fly Calibration Screens

The On-The-Fly Calibration (OTFC) service, described on page 135, will provide archival researchers with the ‘‘best’’ calibrated data without requiring them to go through the complex recalibration process themselves. Currently only WFPC-2 and STIS data will be processed in the OTFC pipeline. Eventually OTFC will be applied to NICOMS and future instruments data.

OTFC requests can be made through a modified version of the <Retrieval Request - File Options> screen or via the archive WWW interface, once OTFC is released externally (Fall 1999). Also, dedicated StarView screens for each instrument can be used to extract more information about the recalibration. These screens are also useful for the user interested in following all the steps of the recalibration and in matching each step with its corresponding calibration file. The Instrument OTFC screens can be accessed from the <HST Instrument Searches> screen. We note that the <Retrieval Request - File Options> screen should fulfill the needs of most users.

These OTFC screens are described below.

<Retrieval Request - File Options> Screen

The <Retrieval Request - File Options> screen is a modified version of the retrieval screen described on page 195. The only difference is an **[OTFC]** button used to request that the retrieval process goes through the OTFC pipeline. This screen will be the default when OTFC is released externally to STScI (but the **[OTFC]** button will obviously only work for the relevant instruments, currently STIS and WFPC-2).

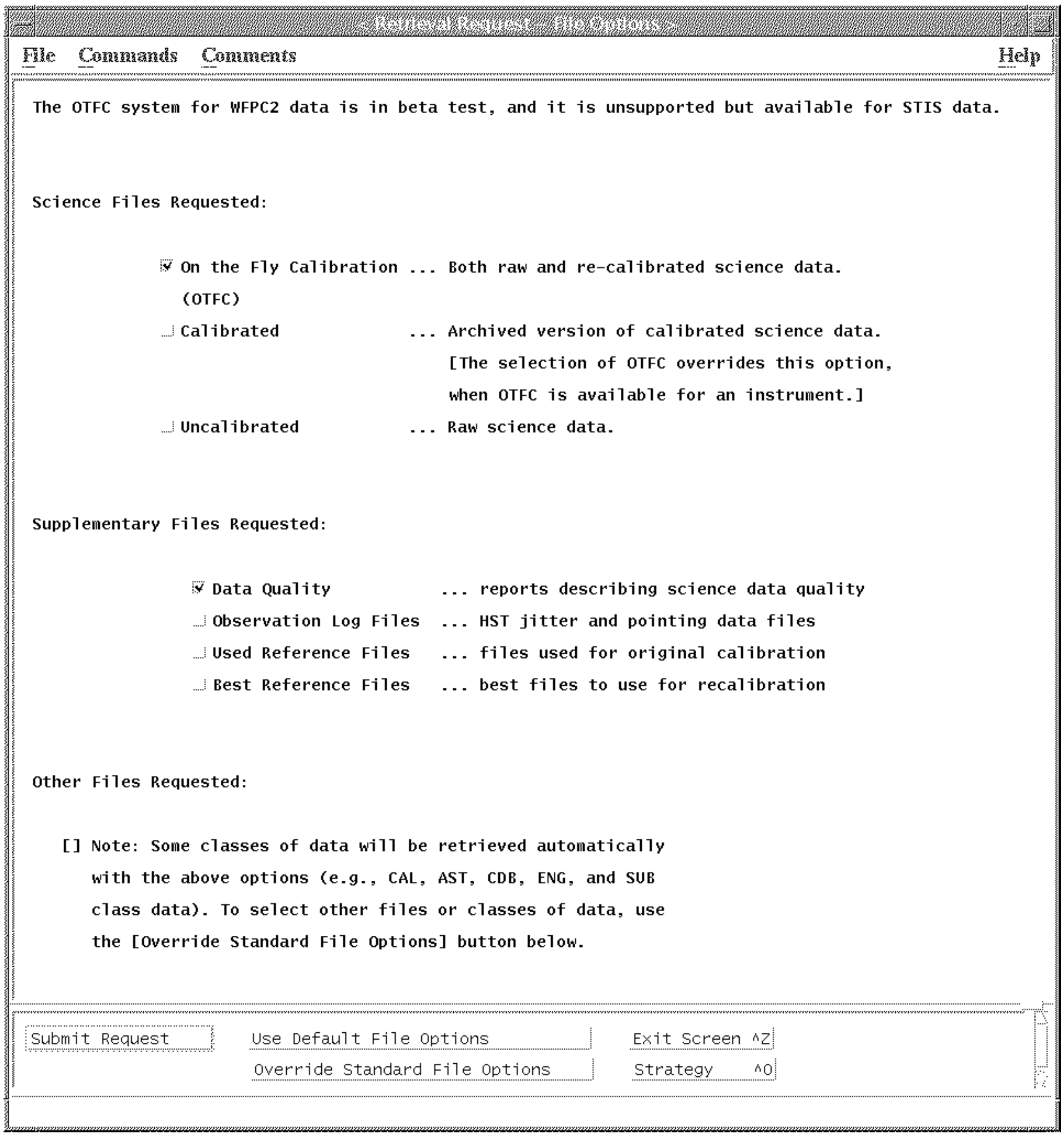


Figure 8.32: <Retrieval Request - File Options> Screen

<STIS OTFC > Screen

The <STIS OTFC> screen can be used to extract more information about recalibration of STIS data, including the date the software was last changed and the latest date of any header keyword update for any dataset (to allow the user to determine if their previously calibrated data need to be requested again through OTFC). Detailed information about each recalibration step, including the relevant file names, is also given.

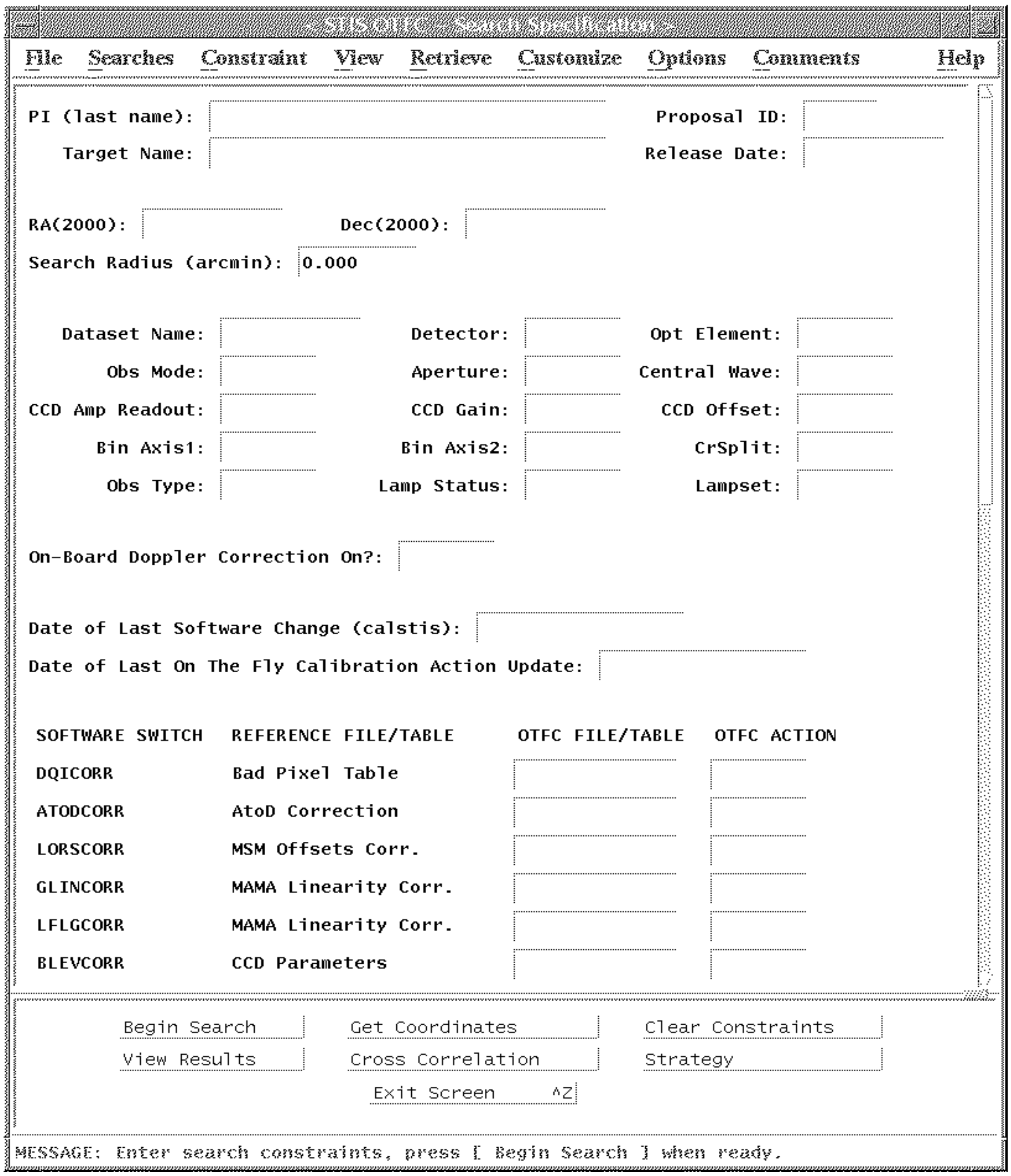


Figure 8.33: <STIS OTFC - Search Specification> Screen

<WFPC-2 OTFC> Screen

The <WFPC-2 OTFC> screen can be used to extract more information about recalibration of WFPC-2 data, including the date the software was last changed and the latest date of any header keyword update for any dataset (to allow the user to determine if their previously calibrated data need to be requested again through OTFC). Detailed information about each recalibration step, including the relevant file names, is also given.

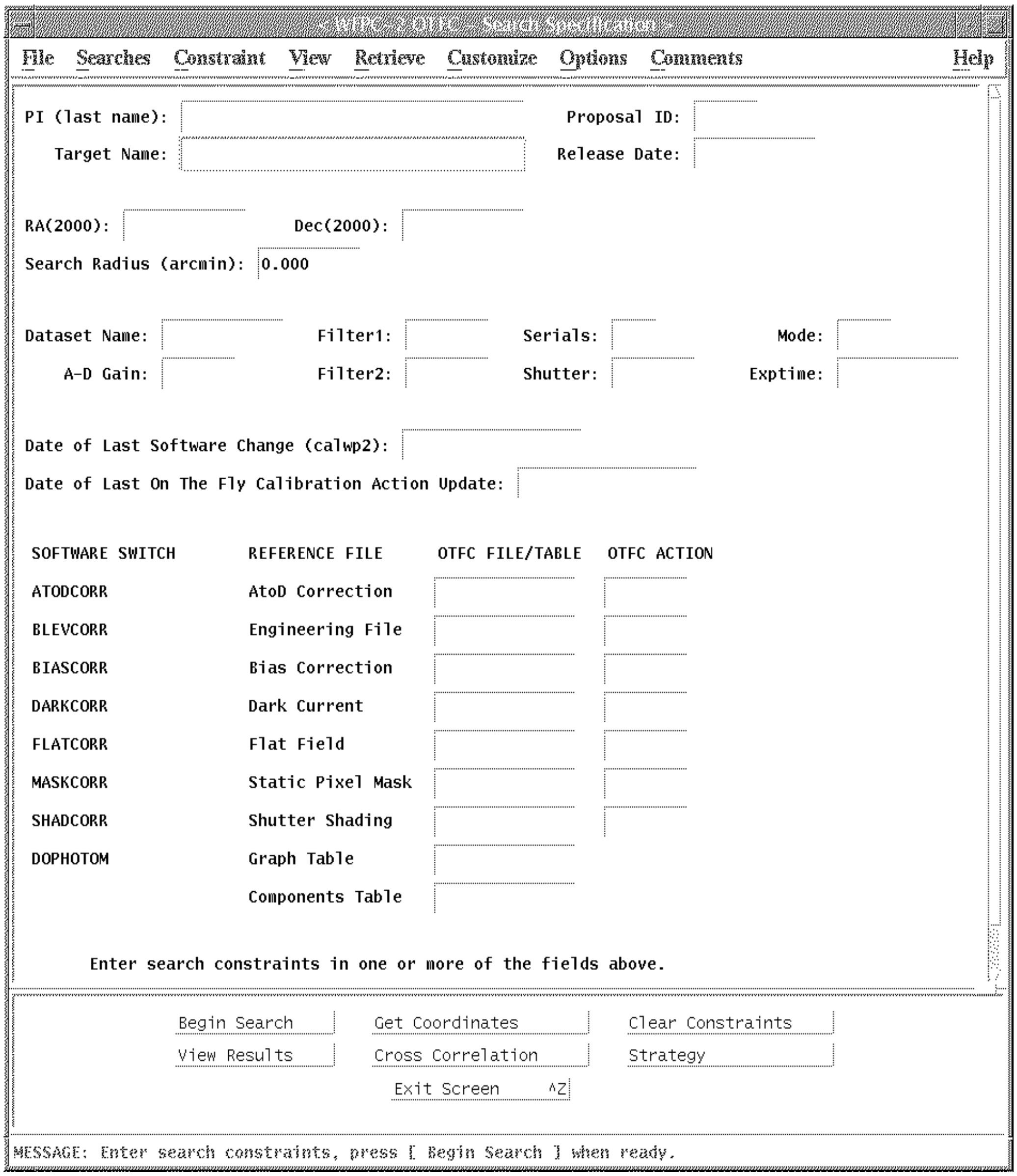


Figure 8.34: <WFPC-2 OTFC - Search Specification> Screen

Archived Files Screens

StarView provides several screens that let you search the HST catalog for information about the files that are stored in the HST archive. For example, you can find out when a dataset was archived, determine which files are available for the different archive classes (in addition to the usual CAL class; see Chapter 9 for details), or read the data quality comments associated with the data files for a given observation. The <Files Search> screen also allows operators to identify the optical disk on which a file is located.

<Dataset Name> Screen

The <Dataset Name Search Specification> screen is used to search the HST Catalog for archiving and distribution information for individual datasets. The results of your search request are returned on the <Dataset Name Search Results> screen.

In particular, you can search for (and mark for retrieval) datasets by dataset name, archive class, or release date. It is especially helpful to use this screen to find non-CAL class datasets (i.e., ASA, AST, CDB, DMP, EDT, ENG, GSP, ORB, SUB, or SUO).

This screen is also used by archive operators to search for datasets by version number, creation date, or archive date

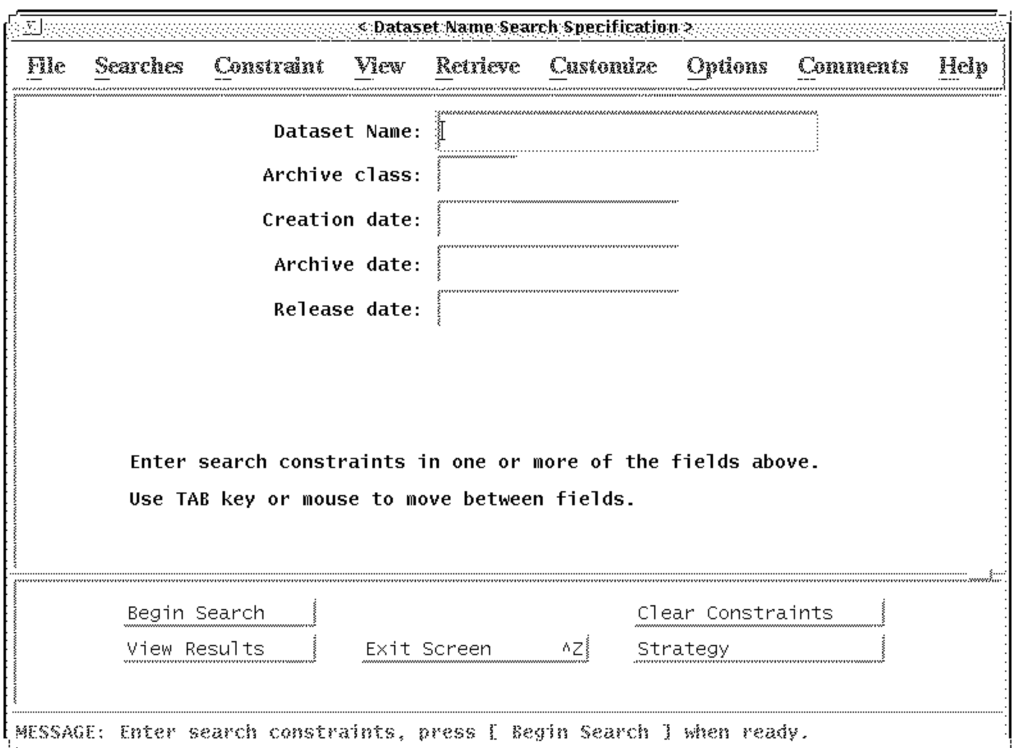


Figure 8.35: <Dataset Name> Screen

<Engineering Screen>

The <Engineering Timeline> screen searches for ephemeris data, engineering and engineering subset data as well as mission schedules, and mission timelines. Typically, you will wish to find a specific type of data corresponding to a typical time period. To do this, first qualify on “DATA TYPE”, entering

- ENG — for engineering data
- MSC — for mission schedule data
- MTL — for mission time lines
- ORB —for ephemeris data
- SUB —for engineering subsets

Next, qualify on the range of dates you are interested in by entering the earliest and latest times in the “DATA START TIME” and “DATA STOP TIME” fields with less than and equal to signs respectively, for example

```
“DATA START TIME” > 04/27/90 05:00:00
“DATA STOP TIME” < 04/27/90 08:00:00
```

Once you have found datasets of interest, you can mark them for retrieval and proceed to submit your retrieval request.

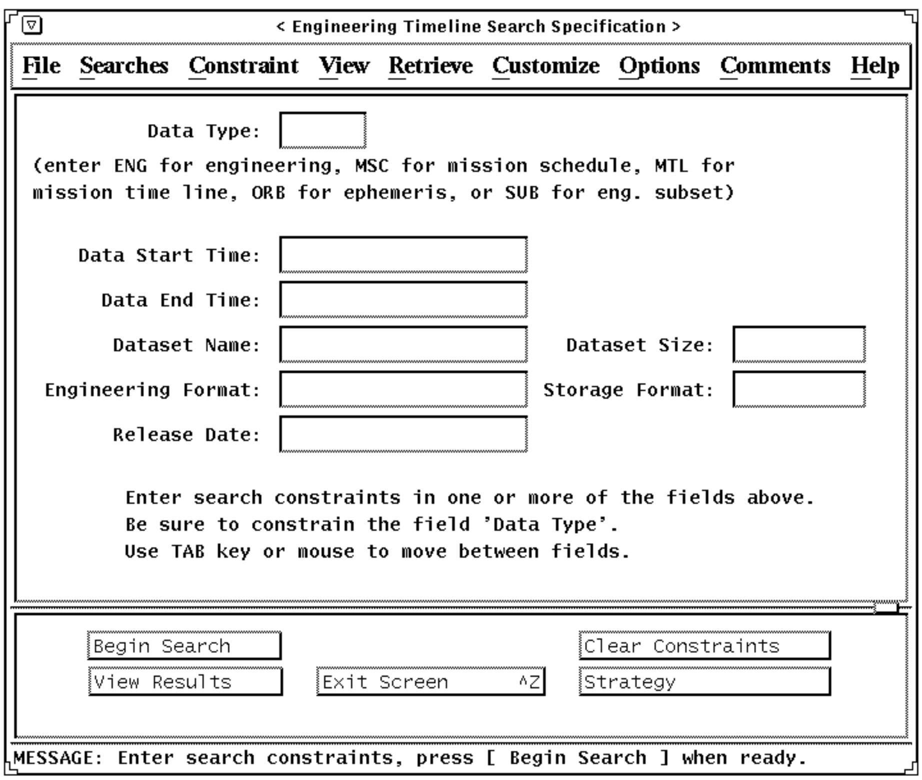


Figure 8.36: <Engineering Screen>

<Files Search> Screen

The <Files Search Specification> Screen is mostly geared to internal users who are retrieving specific files by dataset name or by archive class. It is particularly useful to users of non-CAL archival classes of data. This form is also used by archive operators in order to track down the physical location of datasets on optical disks.

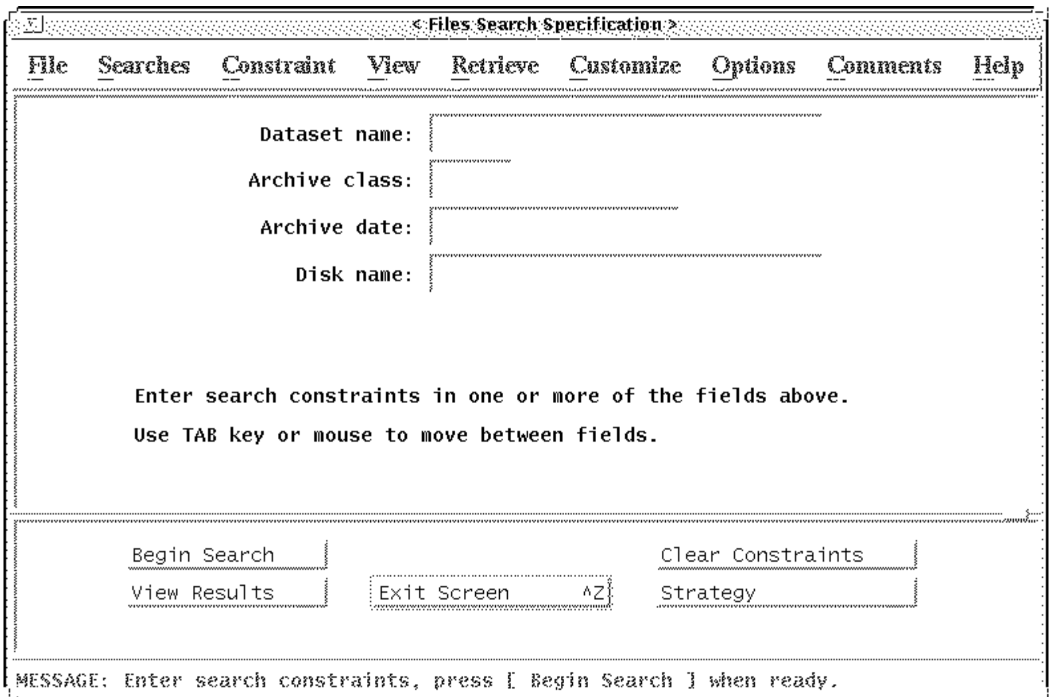


Figure 8.37: Files Search Screen

Archive Retrieval Screens

StarView provides several screens that take you step-by-step through the archive retrieval process. This process includes reviewing your list of marked datasets, selecting which files you want to retrieve, entering your archive user name and password, selecting distribution media and data format options, and finally submitting your retrieval request to the archive request handler for processing. The archive retrieval screens are presented and described in this section. See Chapter 4 for procedures on using these screens.

<Archive Retrieval> Screen

You can use this screen to review and submit the list of datasets that you have marked for retrieval. You can add additional datasets to this list, remove datasets from the list, or write the list to a file prior to submitting your retrieval request to the HST Archive for processing.

This screen displays most of the scientifically useful catalog information about the exposures that you have selected for retrieval. This information is presented in table format. There are a few additional fields that are available for viewing off the screen to the right.

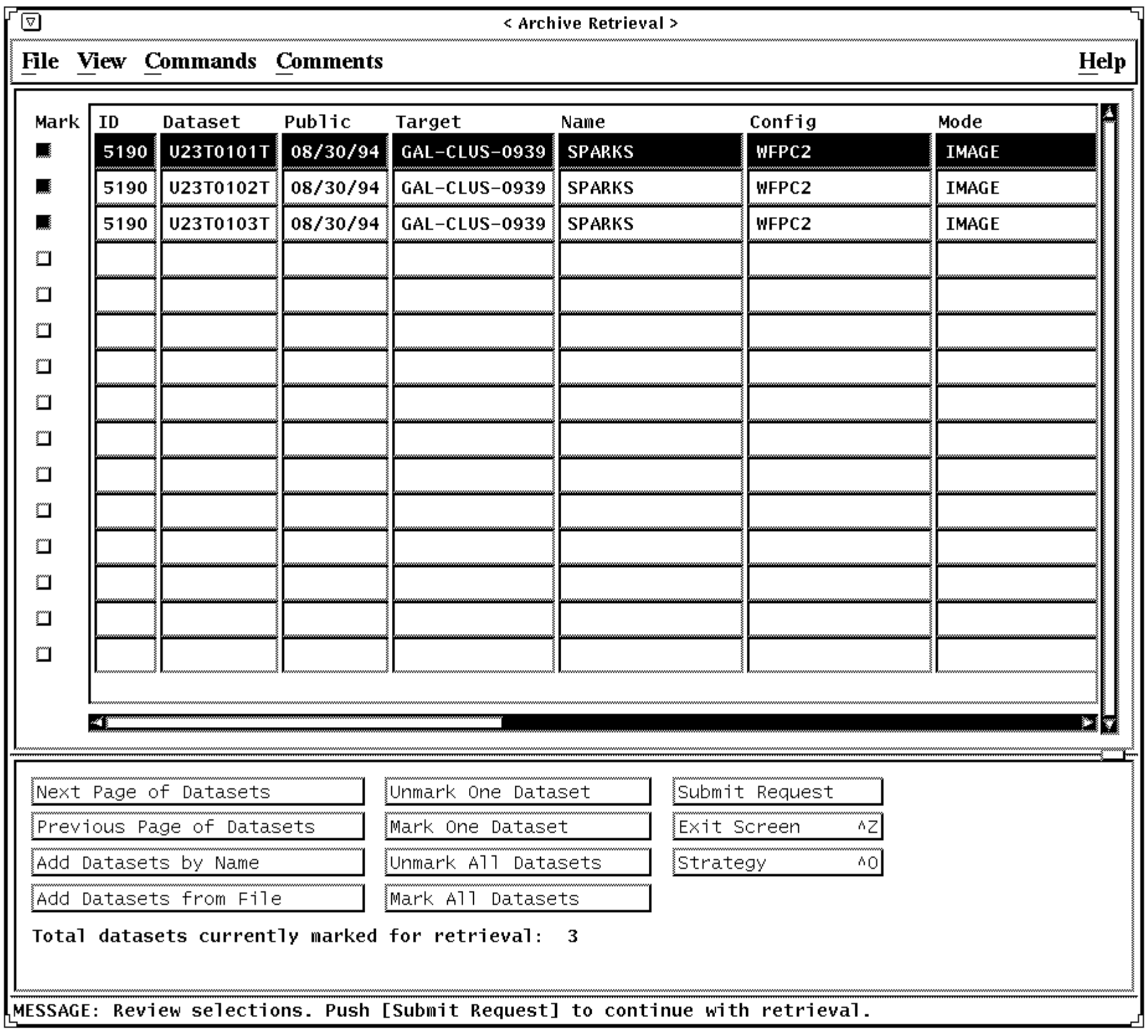


Figure 8.38: <Archive Retrieval> Screen

<Retrieval Request - File Options> Screen

You can use this screen to select the types of science files that you want to retrieve. You can retrieve the calibrated science data files (default), the uncalibrated science data files, and/or the data quality report files (default). Selecting any of the options on this screen will not affect any of the non-science data files that you may have previously marked for retrieval.

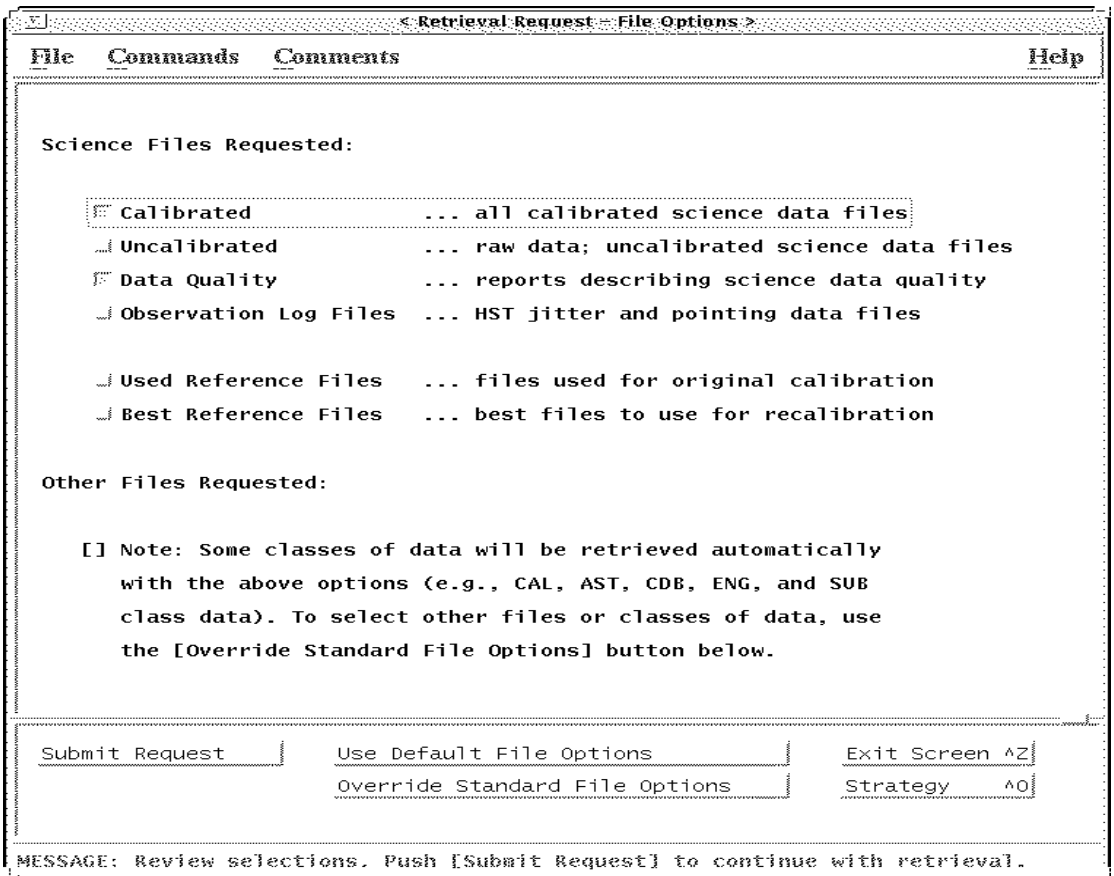


Figure 8.39: <Retrieval Request - File Options> Screen

<Retrieval Request - Media Options> Screen

You can use this screen to enter your archive user name and password, and to select the media type for your retrieved data.

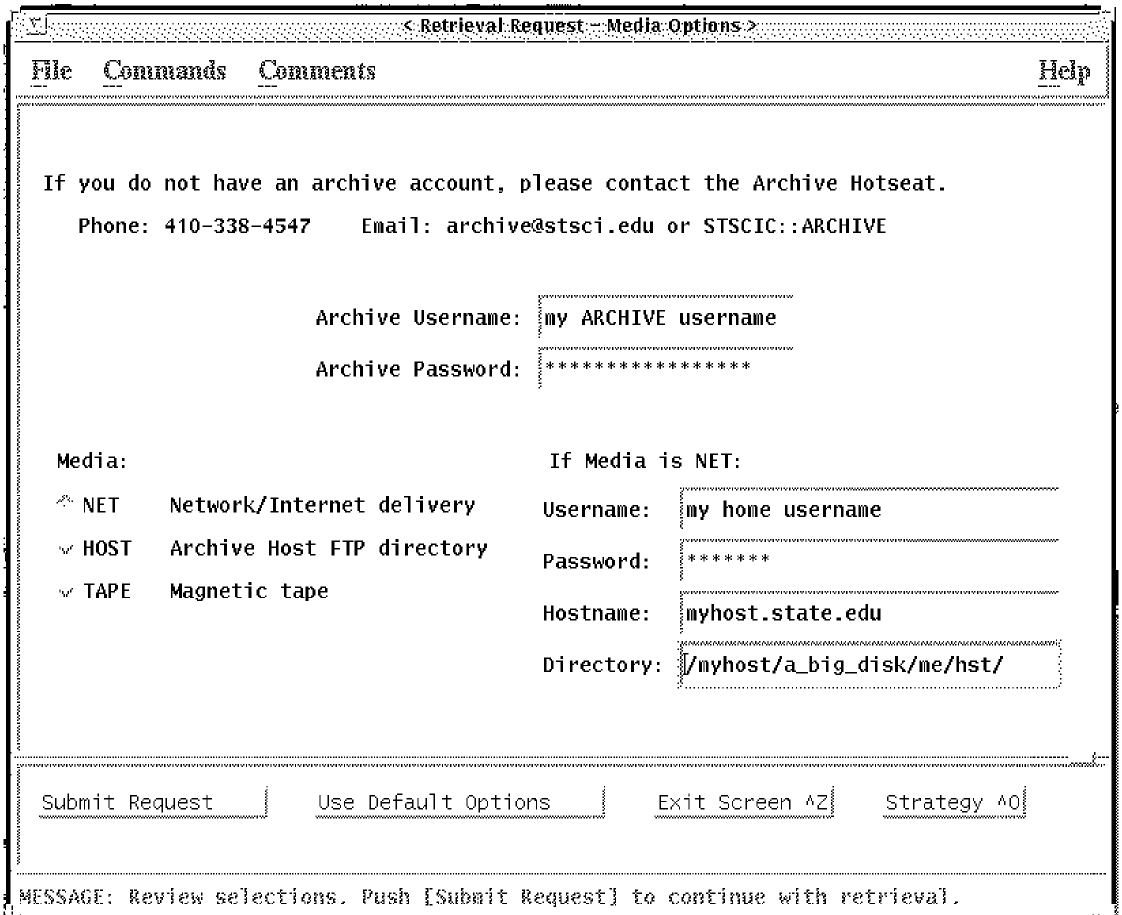


Figure 8.40: <Retrieval Request - Media Options> Screen

<Retrieval Request - Override File Options> Screen

You can use this screen to select a more general variety of files for retrieval. The normal StarView defaults, which you can override on this screen, are to retrieve the calibrated science files and the data quality report files. On this screen, you can select any available version of archived files, files from any archive class, and files with any file extension. For example, you can use this screen to select files that do not belong to the CAL archive class (e.g., FGS/astrometry data files or engineering files), or you can use this screen to select CAL class files that are not among those selected by the defaults identified on the preceding retrieval request screens. In nearly all cases, you will want the most recent version of a file (selected automatically by Version=0).

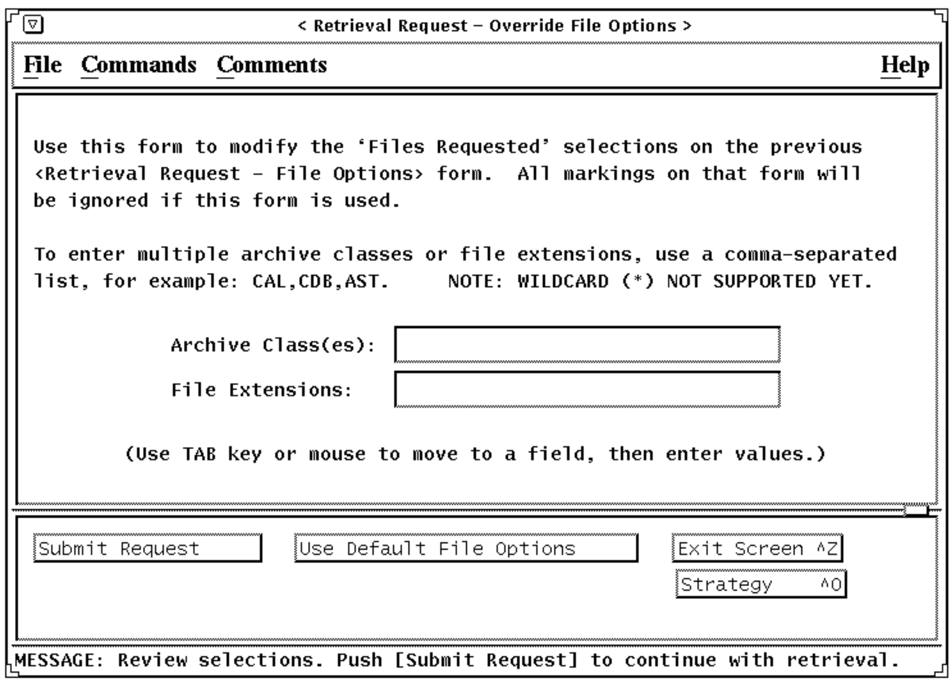


Figure 8.41: <Retrieval Request - Override File Options> Screen

StarView Environment Screens

StarView provides several screens that let you customize the environment in which you are operating StarView. You can set up, save, and restore your own defaults for archive retrieval options, date/time formats, output coordinate systems, and user defaults. The StarView environment screens are presented and described in this section. See Chapter 7 for procedures on using these screens.

<Archive Retrieval Defaults> Screen

This screen lets you modify some of the options used for requesting datasets from the archive. You can change either your default user name and password, the default files that are retrieved when you mark datasets for retrieval, the default distribution medium, or any combination of these items.

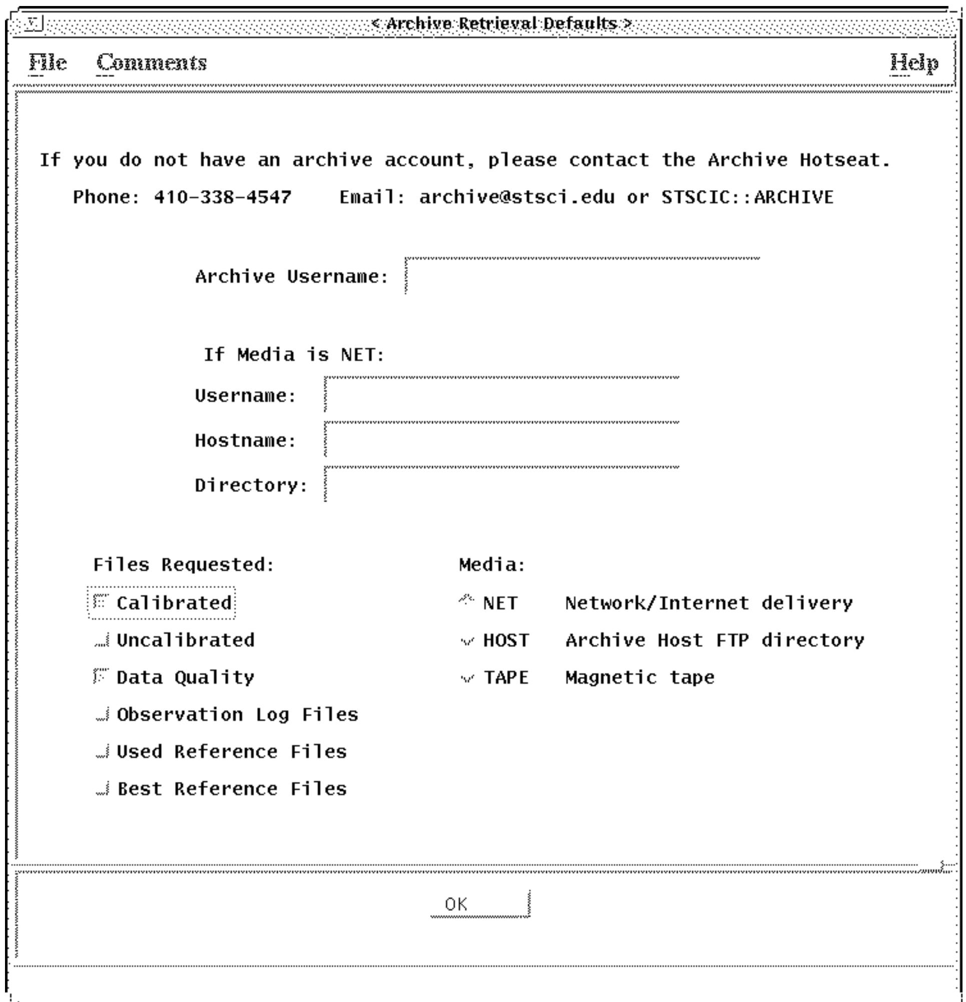


Figure 8.42: <Archive Retrieval Defaults> Screen

<Date/Time Formats> Screen

This screen lets you modify the formats in which dates and times are displayed. You can change the format for any of these: month, day, year, hour, minutes, or seconds. If you do want to change the default date/time formats, then it is best to experiment with the different options on this screen to see which ones you like. For example, you can choose to see times like “12:34:56” or like “12h34m56s.”

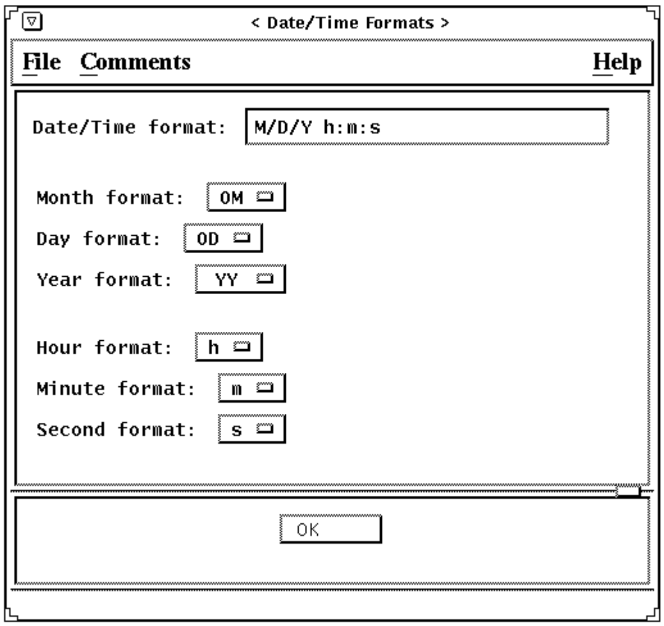


Figure 8.43: <Date/Time Formats> Screen

<Output Coordinates> Screen

This form lets you modify the format in which positional coordinates are displayed. Positional coordinates include RA, longitude, Dec, and latitude. You can change the coordinate system (Equatorial, Ecliptic, Galactic, or Supergalactic), the equinox, the RA/Longitude format, the Dec/Latitude format, or any combination of these. Note that these changes will not affect the field labels on the StarView search specification and results screens. They will still say “RA(2000)” and “Dec(2000)” (or simply “RA” and “Dec” in some cases), even though the catalog values attached to those fields will now be displayed according to your new chosen format.

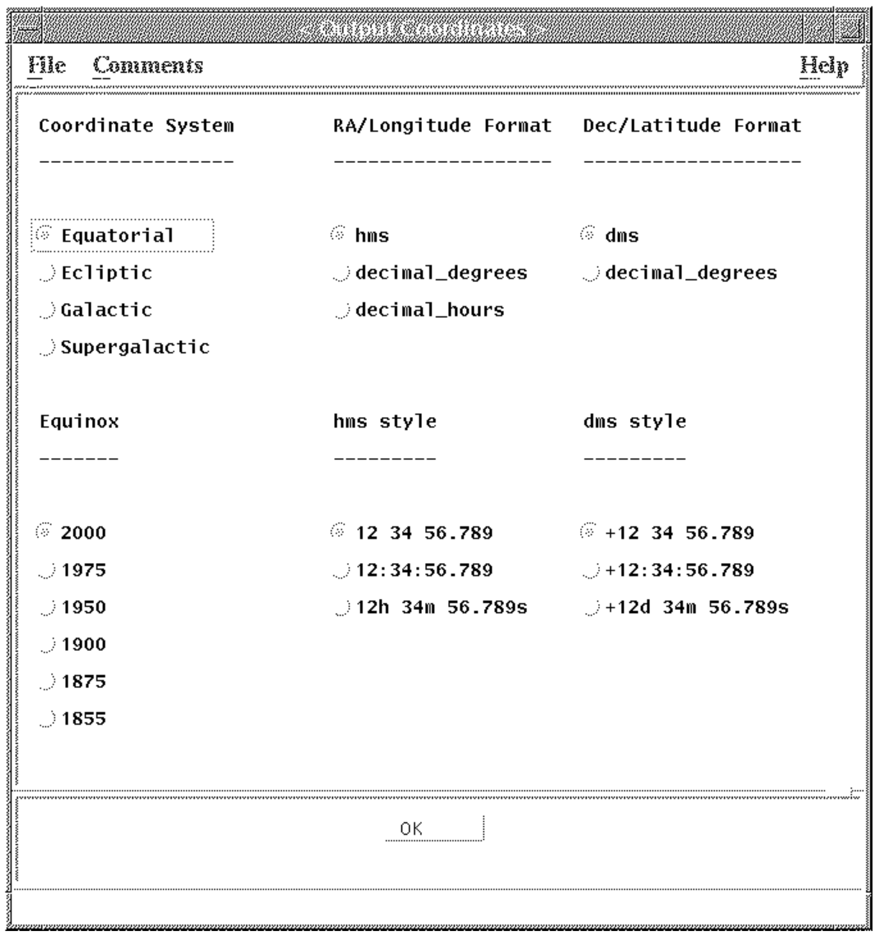


Figure 8.44: <Output Coordinates> Screen

<User Defaults> Screen

This form lets you modify some of the StarView system defaults: the initial form name, catalog, menu options, and basic display formats. For example, you can change the default character string format from uppercase to lowercase, or you can change the default floating number format from decimal format to scientific notation. You can also change the default radius for circular-area searches around specified target positions, and you can change between the SIMBAD and NED coordinate resolvers. Under normal circumstances, however, it should not be necessary for you to change any of the other defaults on this environment screen.

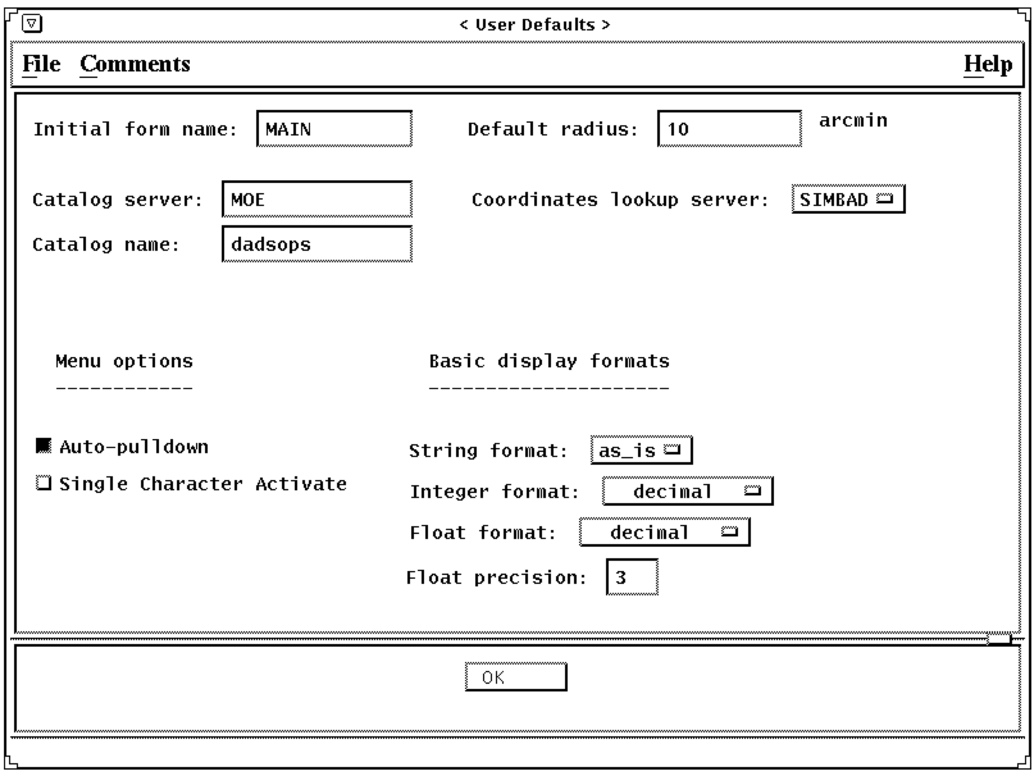


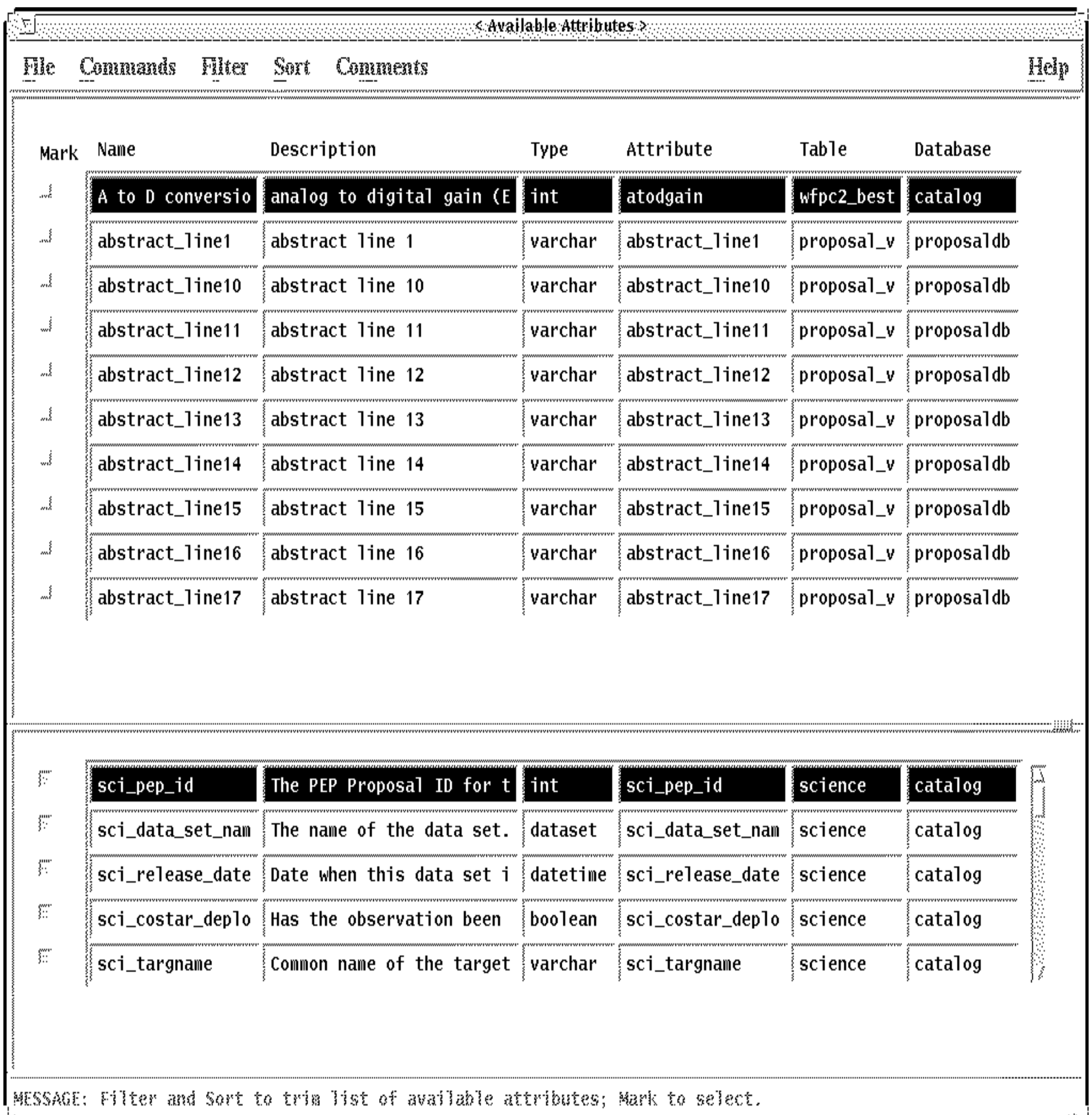
Figure 8.45: <User Defaults> Screen

StarView Utility Screens

StarView provides several utility screens that assist you in using the system, in getting help, in navigating around, in setting up special customized catalog searches, or in viewing and writing search results as a table. These screens are described in this section. You will not need to access all of these utilities to use StarView for simple catalog searches and data retrieval. However, they do represent the range of StarView capabilities: from the introductory <Welcome> and <Help> screens to the sophisticated <SQL Editor> and <Custom Query> screens.

<Custom Query> Screen

This screen lets you construct your own custom queries (i.e., searches) of the HST catalog. Typically, you would do this when the predefined StarView screens do not have the information (i.e., the catalog fields) that you are interested in. With the custom query feature, you can choose to display a wide variety of catalog information on a single screen, picking and choosing from among all of the available fields in the HST catalog. This powerful feature of StarView is described in detail in Chapter 6.



< Available Attributes >

File Commands Filter Sort Comments Help

Mark	Name	Description	Type	Attribute	Table	Database
	A to D conversio	analog to digital gain (E	int	atodgain	wfpc2_best	catalog
	abstract_line1	abstract line 1	varchar	abstract_line1	proposal_v	proposaldb
	abstract_line10	abstract line 10	varchar	abstract_line10	proposal_v	proposaldb
	abstract_line11	abstract line 11	varchar	abstract_line11	proposal_v	proposaldb
	abstract_line12	abstract line 12	varchar	abstract_line12	proposal_v	proposaldb
	abstract_line13	abstract line 13	varchar	abstract_line13	proposal_v	proposaldb
	abstract_line14	abstract line 14	varchar	abstract_line14	proposal_v	proposaldb
	abstract_line15	abstract line 15	varchar	abstract_line15	proposal_v	proposaldb
	abstract_line16	abstract line 16	varchar	abstract_line16	proposal_v	proposaldb
	abstract_line17	abstract line 17	varchar	abstract_line17	proposal_v	proposaldb

	sci_pep_id	The PEP Proposal ID for t	int	sci_pep_id	science	catalog
	sci_data_set_nam	The name of the data set.	dataset	sci_data_set_nam	science	catalog
	sci_release_date	Date when this data set i	datetime	sci_release_date	science	catalog
	sci_costar_deplo	Has the observation been	boolean	sci_costar_deplo	science	catalog
	sci_targname	Common name of the target	varchar	sci_targname	science	catalog

MESSAGE: Filter and Sort to trim list of available attributes; Mark to select.

Figure 8.46: <Custom Query> Screen

<Help> Screen

Help text for a specific topic is displayed in the data area of this screen. There can be many screenfuls of help text. Additional help topics that are related to the displayed topic are listed in the “See Also” box. Both the help text area and “See Also” area are vertically scrollable. See Chapter 4 for procedures on using this screen.

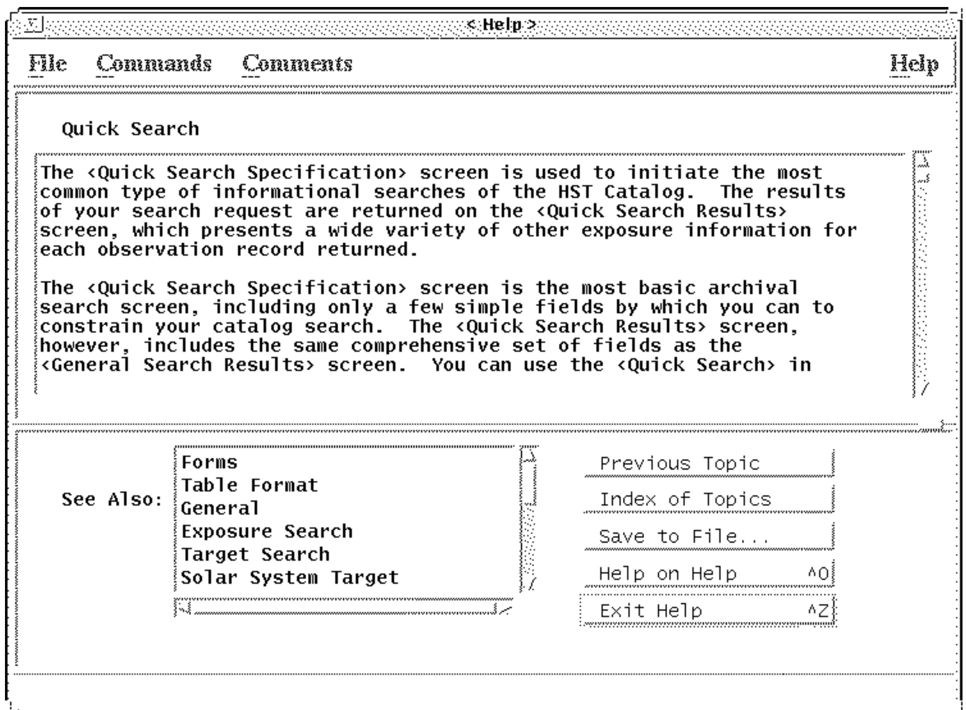


Figure 8.47: <Help> Screen

<Other Searches> Screen

This screen presents a user-selectable list of the predefined search screens. You can use this screen to select one of the listed searches. See Chapter 4 for procedures on using this screen.

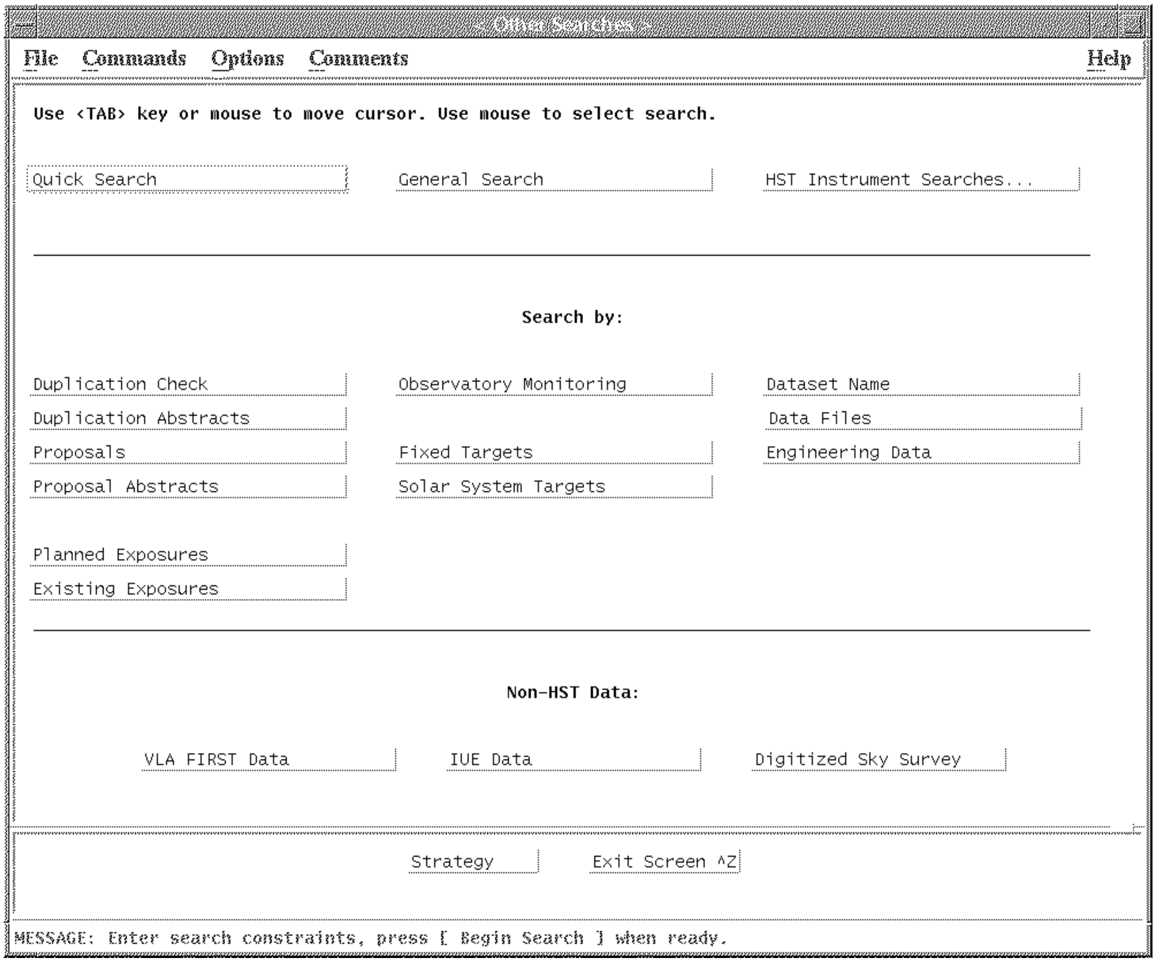


Figure 8.48: <Other Searches> Screen

<SQL Editor> Screen

This screen lets you display and modify the SQL (Structured Query Language) for the current query or for a set of SQL statements copied from an external file. You can also enter your own SQL statements on the screen. Typically, you would do this when you want to make specialized queries of the HST catalog (e.g., to list all unique values of a specific field in the catalog or to impose a complex set of conditions on a catalog search). This special feature of StarView is described in detail in 6. Only those who are experienced in SQL programming should use this feature.

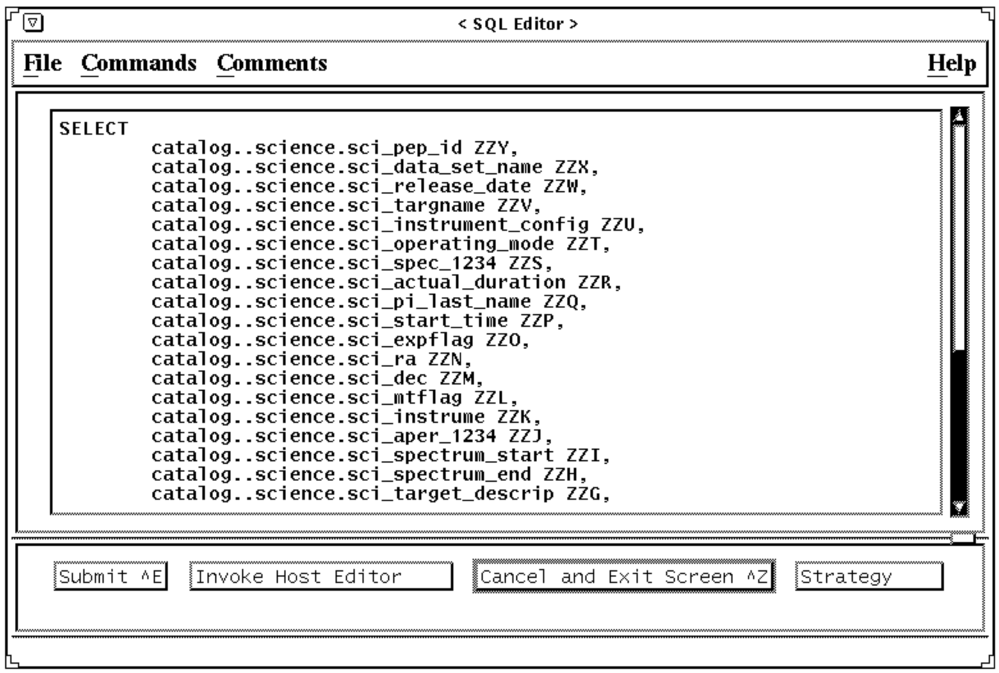


Figure 8.49: <SQL Editor> Screen

<Table Export> Screen

This screen lets you specify the options to use when writing (i.e., exporting) search results to an external file. Your search results are stored automatically by StarView in an internal file, which can then be copied to an external file for your own use. For example, you may wish to store the list of all observations for a certain class of objects in a file that may be used by another archive system to see if there are any target overlaps. You can write this file in ASCII or FITS format, and you can include column headings or other data description information in the file if you wish. This screen tells you how big (in Kbytes), how wide (in bytes), and how long (in records) your output file will be.

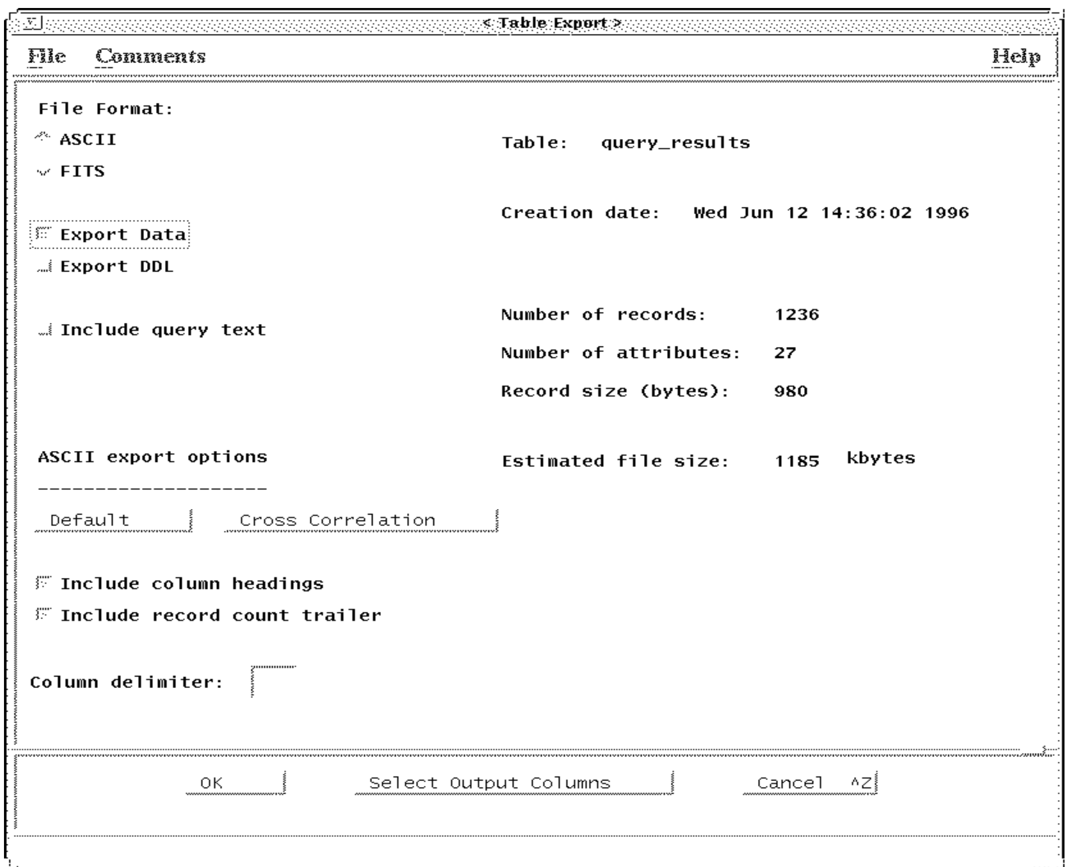


Figure 8.50: <Table Export> Screen

<Table Format> Screen

You can use this screen to initiate searches of the HST catalog and to view the results of catalog searches in a multi-record format. This lets you see a significant portion of your search results at one time. The fields on the <Table Format> screen vary, depending on the preceding screen displayed. See Chapter 4 and 7 for procedures on using this screen, including mouse commands that allow you to rearrange columns, delete columns, and alter column widths.

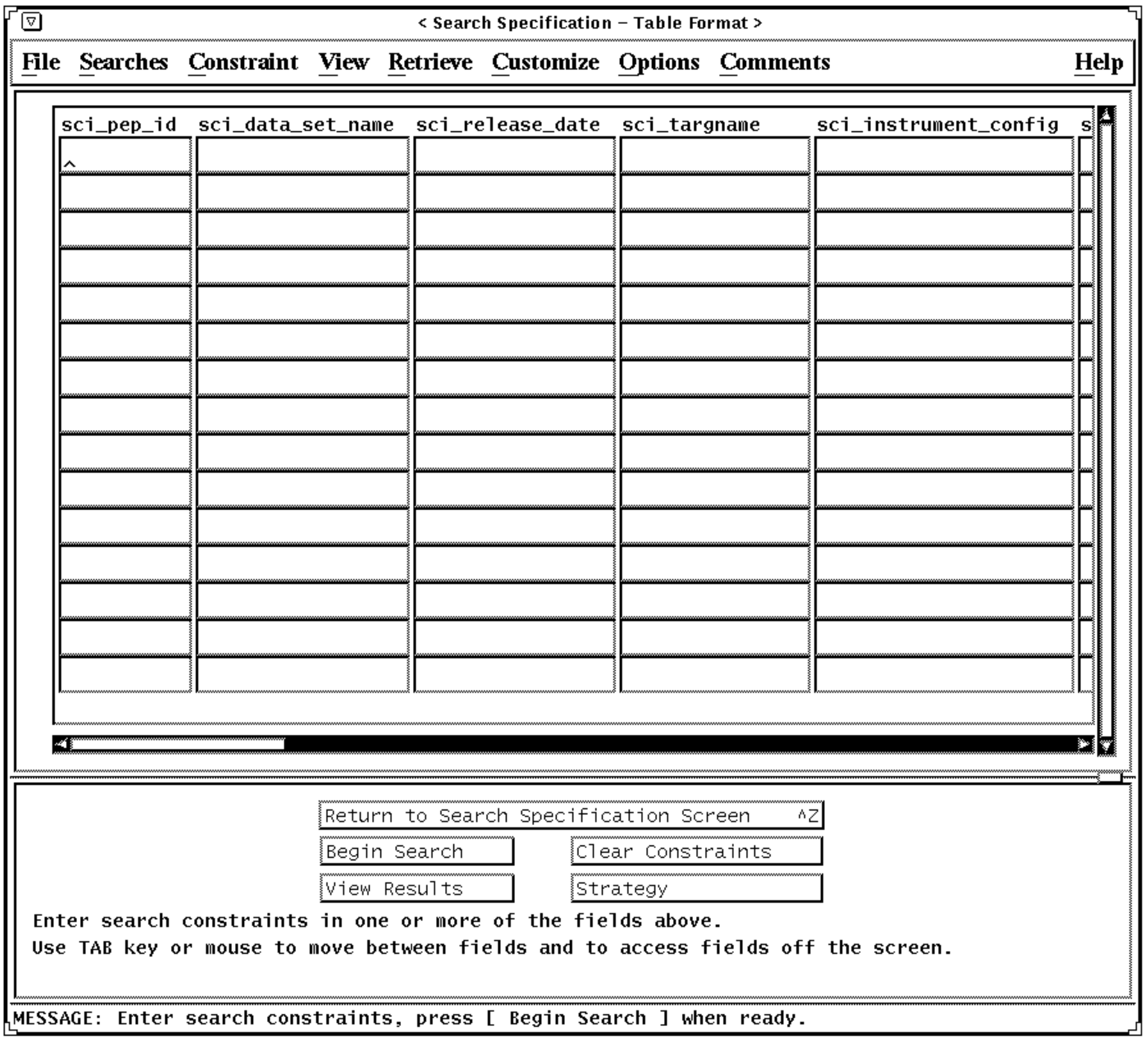


Figure 8.51: <Search Specification - Table Format> Screen

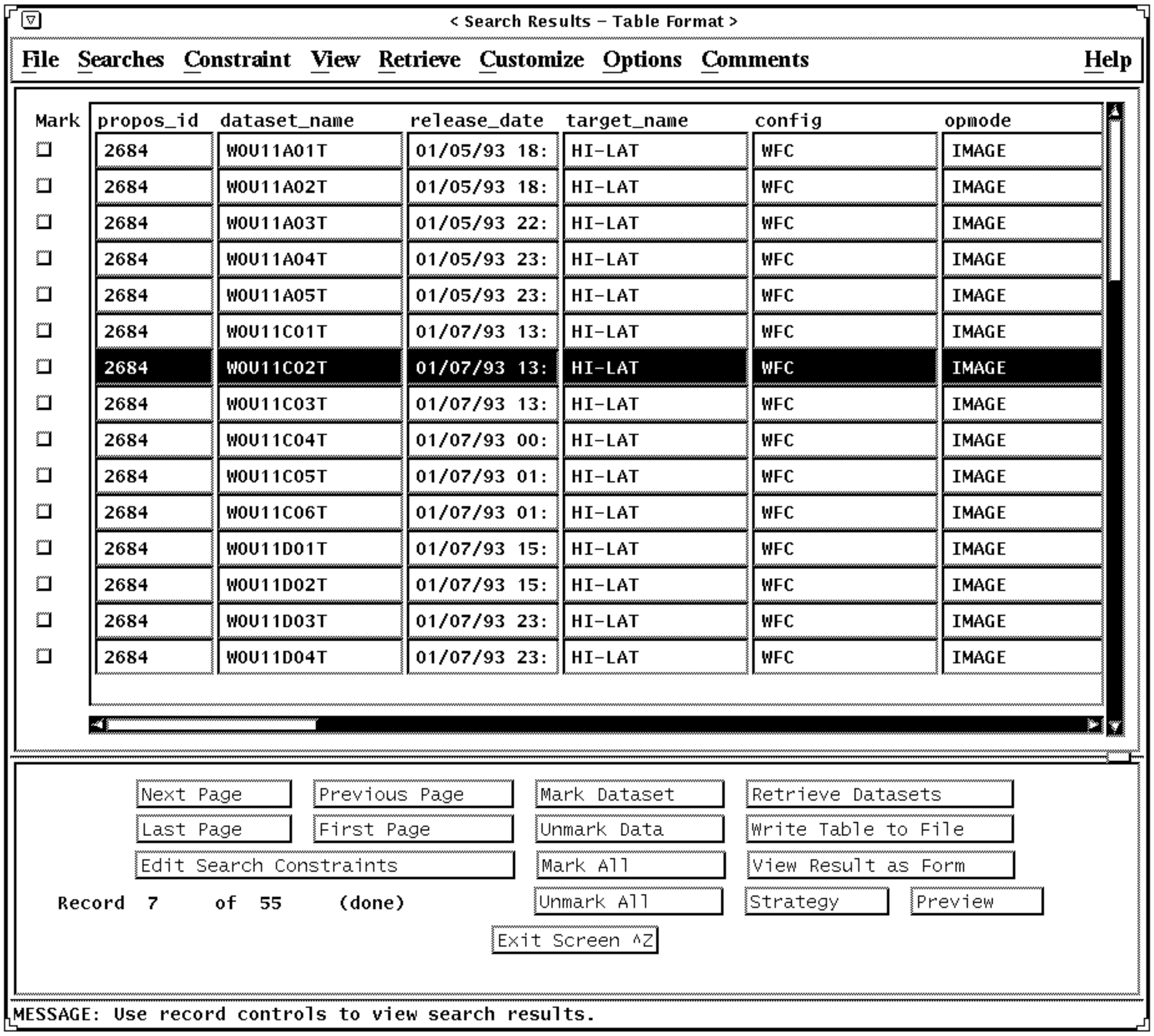


Figure 8.52: <Search Results - Table Format> Screen

<Welcome> Screen

This screen is the first screen that you see when you enter StarView, and it is the end of the chain of screens that are displayed whenever you enter multiple “Exit Screen” commands from any of the other StarView screens. This screen contains both informational messages and instructional text. It is also used to present important message-of-the-day notices. Chapter 4 describes various aspects of this screen and how to navigate around StarView screens in general.

The <Other Searches> screen (see page 206) is only accessible through the <Welcome> screen. In addition, all of the basic StarView commands, utilities, and features are accessible from the menus on the <Welcome> screen. Hence, this screen can be used as the starting point for nearly all StarView operations: catalog searches, data retrieval, checking retrieval status, sending comments to the archive hotseat, getting help, etc.

When you start up StarView, it will take a minute or so to get ready.

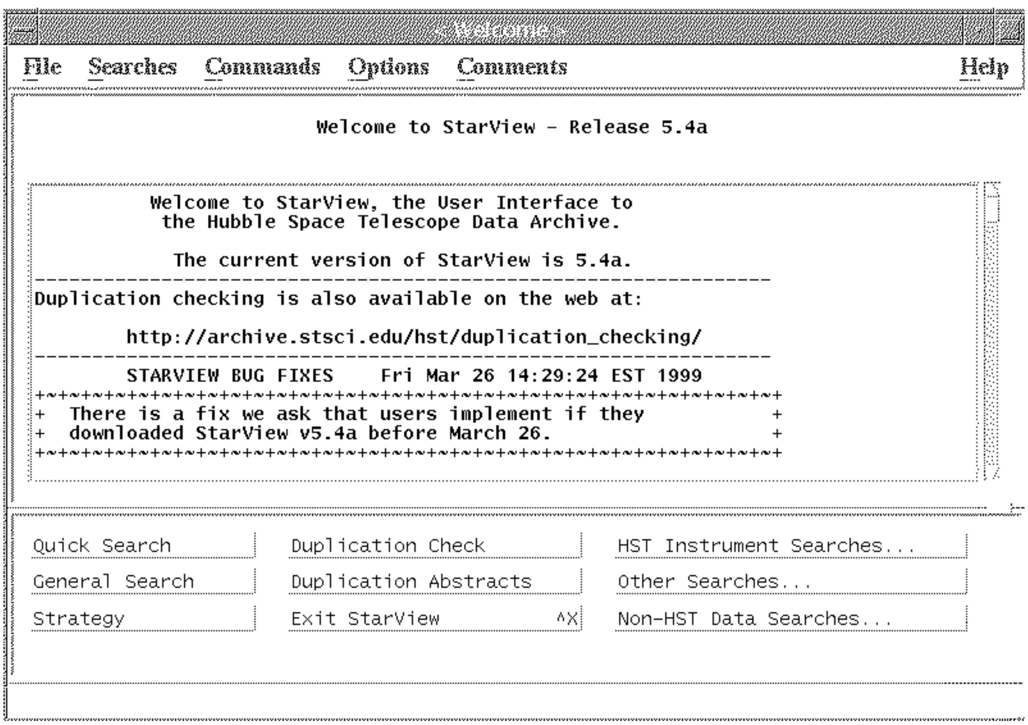


Figure 8.53: <Welcome> Screen

9 Data in the HST Archive

In This Chapter...

This chapter explains how archived Hubble Space Telescope (HST) data are organized, and describes the conventions used to name classes and files in the HST archive.

Overview

Archived HST data are organized according to archive classes that delineate broad categories of data (e.g., science data, calibration data, HST mission schedules, engineering data, ephemeris data, and guide star data). Each of these archive classes contains a specific set of data files. The archive class for a set of files then determines, among other things, the proprietary period of those data files. For science data, the types of files included in the observation dataset depend on the scientific instrument. Each HST observation is identified by a unique dataset name, which becomes the root name for the files in that dataset. Each file then takes on a unique file extension according to the content of the file. There is therefore a list of valid file extensions for each archive class and instrument. When retrieval requests are submitted to the archive request handler, the archive system determines which files to retrieve based upon the class and source of the data being requested.

According to the above prescription, the files stored in the archive all have unique file names, the exception being that recalibrated and reprocessed observations may generate files with names identical to those produced by the original calibration or processing. Such files are distinguished by their generation dates. Typically, only archive operators at the Space Telescope Science Institute (STScI) will be concerned about these different versions.

Archive researchers should use only the most recent versions of the files, which is the default for retrievals.

In the sections below, we describe the conventions used to name the different data files and archive classes in the HST archive.

File Names

File names consist of two parts: the root name and the extension. The way the root name is derived depends on the type of file (its Archive Class: see page 220). For science data, the extension identifies the type of data in a particular file, as each observation may have many associated files with the same root name.

Most of the files that you will encounter in the archive are FITS files containing the science data for an observation. Science data files are described in the next section. There are also non-science data consisting of unidentified science data files, dump data files, engineering data, etc. File naming conventions for these non-science file types are not of interest to the typical archive user. These can be found on the WWW at `http://sesd.stsci.edu/~hopkins/non-science-data.htm`.

Science Data Files

For any HST observation, the STScI data processing pipeline produces not just one data file, but an entire set of files. The FITS files contain the science data for an observation. All files for a particular observation have the same root name. The type of data in each file is identified by its extension.

At a minimum, for each observation the OPUS pipeline produces a standard header packet file, a science data file, and its corresponding data quality file; and stores appropriate engineering data and ancillary information in the unique data log file (UDL).[1] The standard header packet (SHP) contains telemetry data, spacecraft operation data, and instrument-specific data. The UDL contains the command values for each instrument, such as exposure parameters and aperture commands. For the STIS and NICMOS instruments, both the SHP and UDL information are contained in the SPT file. The science data files contain the observed image stored as a FITS file. The number of science data

1. For the Wide Field Planetary Camera (WFPC) and WFPC-2, an extracted engineering data file is produced instead of the unique data log (UDL).

files, the size of those files, and the number of dimensions vary across instruments and observing modes. Each science data file has an accompanying data quality file to identify bad data values in the science data. In addition to these files, additional files are typically produced by the calibration software in the OPUS pipeline.

The dataset root name consists of 9 characters of the form

`IPPPSSOOT`

The IPPPSSOOT file naming convention is applied by OPUS and is defined in Table 9.1. We note that this convention applies only to science data files (ASN, AST, CAL, and PDQ classes: see Table 9.13) and observation log (OMS) files.

Character	Meaning
`I`	Instrument Used, will be one of: ***F*** - Fine Guidance Sensors ***J*** - Advanced Camera for Surveys ***N*** - Near Infrared Camera Multi Object Spectrograph ***O***- Space Telescope Imaging Spectrograph ***U*** - Wide Field Planetary Camera-2 ***V*** - High Speed Photometer ***W*** - Wide Field Planetary Camera ***X*** - Faint Object Camera ***Y*** - Faint Object Spectrograph ***Z*** -High Resolution Spectrograph
`PPP`	Program ID; can be any combination of letters or numbers (46,656 combinations possible)
`SS`	Observation set ID; any combination of letters or numbers (1,296 possible combinations)
`OO`	Observation ID; any combination of letters or numbers (1,296 possible combinations)
`T`	Source of transmission (RSDP environment) ***J***- OMS data ***R***- Real time (not recorded) ***T*** - Tape recorded ***M*** - Merged real time and tape recorded ***N*** - Retransmitted merged real time and tape recorded ***O*** - Retransmitted real time ***P*** - Retransmitted tape recorded 0 - (zero) Primary association product (NICMOS/STIS/ACS) 1-8 NICMOS background association products

Table 9.1: IPPPSSOOT Root File Names

Common Extensions for Instrument Data Files

File name extensions and their contents vary from instrument to instrument. The common extensions for science data files and descriptions of their contents are given in Tables 9.2 through 9.12. For more detailed descriptions of the files and their contents, see the individual instrument handbooks or data product guides (see page 14).

Extension	File Type
_a1f.fits	FGS1 group data file
_a2f.fits	FGS2 group data file
_a3f.fits	FGS3 group data file
_dmf.fits	Science data and proposal information header file. Also, database indices for astrometry and engineering data

Table 9.2: Extensions for FGS Astrometry Data Files

Extension	File Type
_d0f.fits	Uncalibrated data file
_shf.fits	Standard header packet
_q0f.fits	Data quality file[a]
_ulf.fits	Unique data log
*.trl	Trailer file

a. _q*f.fits for FOS.

Table 9.3: Extensions for FOC, FOS, GHRS, WFPC, and WFPC-2 Raw Data Files

Extension	File Type
_c0f.fits	Calibrated science image file
_x0f.fits	Extracted engineering file
_q1f.fits	Data quality for extracted engineering file
_c1f.fits	Data quality for calibrated science image
_c2f.fits	Histogram of science image pixel values
_c3f.fits	Saturated and missing pixel map (WFPC)

Table 9.4: Extensions for WFPC and WFPC-2 Calibrated Data Files

Extension	File Type
_c0f.fits	Dezoomed, geometrically corrected data, with photometry
_c1f.fits	All of the above, plus flatfielded data

Table 9.5: Extensions for FOC Calibrated Data Files

Extension	File Type
_c0f.fits	Calibrated wavelengths
_c1f.fits	Calibrated fluxes
_cqf.fits	Wavelength/flux data quality
_x0f.fits	Extracted data
_xqf.fits	Extracted data quality
_c2f.fits	Propagated statistical errors
_c3f.fits	Calibrated special diodes
_c4f.fits	Special diodes data quality
_c5f.fits	Background
_d1f.fits	Return-to-Brightest acquisition fluxes
_q1f.fits	Return-to-Brightest data quality

Table 9.6: Extensions for GHRS Calibrated Data Files

Extension	File Type
_raw.fits	Raw science data
_spt.fits	File containing SHP and UDL information
_asn.fits	Association table

Table 9.7: Extensions for NICMOS Raw Data Files

Extension	File Type
_cal.fits	Calibrated science data
_ima.fits	Intermediate multiaccum calibrated science data
_mos.fits	Mosaiced target or background images
_asc.fits	Post-calibration association table
_trl.fits	Trailer file
_pdq.fits	Processing Data Quality File

Table 9.8: Extensions for NICMOS Calibrated Data Files

Extension	File Type
_raw.fits	Raw science data
_tag.fits	Timetag event list
_spt.fits	Support file (planning and telemetry information)
_wav.fits	Associate wavecal exposure
_wsp.fits	Wavecal support file (planning and telemetry information)
_asn.fits	Association table
_trl.fits	Trailer file (input)
_lrc.fits	Local rate check image
_lsp.fits	Local rate check support file
_jit.fits	OMS file
_jif.fits	OMS file
_pdq.fits	Processing Data Quality File

Table 9.9: Extensions for STIS Raw Data Files

Extension	File Type
_flt.fits	Flatfielded science data
_crj.fits	Cosmic ray-rejected, flatfielded science data
_sfl.fits	Association table
_x1d.fits	1-D extracted spectra
_x2d.fits	2-D extracted data
_sx1.fits	Summed 1-D extracted spectra
_sx2.fits	Summed 2-D extracted spectra
_trl.fits	Trailer file (output)

Table 9.10: Extensions for STIS Calibrated Data Files

Extension	File Type
_c0f.fits	Calibrated wavelengths
_c1f.fits	Calibrated fluxes
_x0f.fits	Science header line
_xqf.fits	Science header line data quality
_d1f.fits	Science trailer line
_q1f.fits	Science trailer line data quality
_cqf.fits	Calibrated science data quality
_c2f.fits	Propagated statistical errors
_c3f.fits	Special statistics
_c4f.fits	Count rate
_c5f.fits	Flat fielded object spectra
_c6f.fits	Flat fielded sky spectra
_c7f.fits	Background spectra
_c8f.fits	Flatfielded object minus smoothed sky spectra

Table 9.11: Extensions for FOS Calibrated Data Files

Extension	File Type
_d0f.fits	Science data: digital star
_d1f.fits	Science data: digital sky
_d2f.fits	Science data: analog star
_d3f.fits	Science data: analog sky
_q0f.fits	Data quality: digital star
_q1f.fits	Data quality: digital sky
_q2f.fits	Data quality: analog star
_q3f.fits	Data quality: analog sky
_c0f.fits	Calibrated science data: digital star
_c1f.fits	Calibrated science data: digital sky
_c2f.fits	Calibrated science data: analog star
_c3f.fits	Calibrated science data: analog sky

Table 9.12: Extensions for HSP Calibrated Data Files

Archive Classes

Table 9.13 describes the classes of data files in the HST Archive. Most archival researchers will need only the CAL, ASN, AST, and PDQ files.

Class	Contents
ACC	STIS MAMA Accumulated Image Data
ANC	Ancillary data; includes POD files (raw science data)
ASN	Association table (NICMOS, STIS, ACS)
AST	Astrometry data from the Fine Guidance Sensor (FGS)
CAL	Calibrated and uncalibrated science files
CDB	Calibration reference files
CTB	Calibration reference tables
DIA	Engineering NICMOS, STIS and ACS diagnostic FITS memory dumps
DLG	DADS log files
DMP	On-board computer memory dumps (HSP, FOC, FOS)
EDT	Raw edited versions of science files, used by the Post Observation Data Processing System (OPUS) to generate CAL files
ENG	Reconstructed engineering telemetry data
MSC	Mission schedules
MTL	Mission Timeline Data
OCX	Observer comment files
OMS	Observation log files (including HST jitter motion)
ORB	Definitive ephemeris files for HST orbit
PDQ	OPUS data quality comment files
PRB	Problem science data
SMS	Science mission specification files (the command files used to control the observations)
SUB	Engineering subset files
VLA	VLA FIRST data (Faint Images of Radio Sky at 20 cm)

Table 9.13: Archive Classes

A Acronyms

Acronym	Definition
AB	Archive Branch
AEC	Archived Exposures Catalog
AEDP	Astronomy and Engineering Data Processing
ANSI	American National Standards Institute
ARS	area scan
ASCII	American Standard Code for Information Interchange
AURA	Association of Universities for Research in Astronomy
CADC	Canadian Astronomy Data Centre
CDBS	Calibration Database
CDS	Centre de Données Astronomiques de Strasbourg
CRT	cathode ray tube
DCF	Data Capture Facility
DADS	Data Archive Distribution System
Dec	declination
DEC	Digital Equipment Corporation
DDL	Data Definition Language
dms	degrees-minutes-seconds
DSD	Data Systems Division
EC	Exposures Catalog
ESA	European Space Agency
EU	engineering unit
FGS	Fine Guidance Sensor
FITS	Flexible Image Transport System
FOC	Faint Object Camera
FOS	Faint Object Spectrograph

Acronym	Definition
FTP	File Transfer Protocol
GEIS	General Edited Information Set
GHRS	Goddard High Resolution Spectrograph
GO	general observer
GTO	guaranteed time observer
HDA	Hubble Data Archive
hms	hours-minutes-seconds
HSP	High Speed Photometer
HST	Hubble Space Telescope
ICD	interface control document
ID	identification
IRAF	Image Reduction Analysis Facility
LAN	local area network
MAST	Multimission Archive at the Space Telescope Science Institute
NASA	National Aeronautics and Space Administration
NICMOS	Near Infrared Camera Multi Object Spectrometer
OD	optical disk
OMS	Observation Monitoring System
OPUS	OSS/PODPS Unified Systems (new)
OS	operating system
OSS	Observation Support System
OTA	Optical Telescope Assembly
OTFC	On-The-Fly Calibration
PEP	Proposal Entry Processor
PEPSI	Proposal Entry Processor System
PI	principal investigator
PDQ	PODPS (now OPUS) Data Quality
PODPS	Post Observation Data Processing System (obsolete)
QUICK	Quick is a Universal Interface with Conceptual Knowledge
RA	right ascension
RMS	root mean square
SCP	single-color photometry
SHP	standard header packet
SI	science instrument

Acronym	Definition
SOGS	Science Operations Ground System
SQL	Structured Query Language
SSP	star/sky photometry
ST-DADS	Space Telescope Data Archive and Distribution Service
ST-ECF	Space Telescope European Coordinating Facility
STEIS	Space Telescope Electronic Information System
STIS	Space Telescope Imaging Spectrograph
STScI	Space Telescope Science Institute
STSDAS or SDAS	Science Data Analysis System
SV	StarView
TAC	Telescope Allocation Committee
UDL	unique data log
UT	Universal Time
VLA	Very Large Array
WFPC	Wide Field Planetary Camera
WFPC-2	Wide Field Planetary Camera-2
WWW	World Wide Web

B HST Archive Database Description

In This Appendix...

This appendix describes the database structure of the HST archive. It should be particularly useful to those who find the standard StarView screens too limited for a required search and therefore need to design a custom query.

There are three separate databases used by the archive. These are the Catalog, CDBS (Calibration Data Base) and Proposal databases. Each database is a collection of tables which can be thought of as two dimensional arrays. The rows are the data attributes (for example exposure time or instrument name) and the columns are the datasets referenced by the database. The user specifies the values of the attributes which will be considered a match during a search.

The Catalog database contains information on scientific and engineering datasets. Users interested in finding completed scientific observations that match particular criteria (instrument and filter used, target type etc.) will primarily use this database. Because a search across many different tables can be time consuming, a special table has been added to the Catalog database which contains many of the most frequently contained attributes from the other Catalog tables. Users should look first at this “science” table to see if an attribute of interest can be found there. The Catalog database also contains the _ref tables, which give information on the calibration files recommended for use with a particular observation.

The Calibration Data Base provides information on the raw data used to create the recommended reference files. These tables will primarily be of use to STScI staff and those researching particularly subtle calibration issues.

The Proposal database contains information on observations which have been approved but not necessarily taken. This information is gathered from the Phase II proposals of General Observers and from the Phase II and observing proposals of Guaranteed Time Observers, and is updated when observations are taken.

Note that we do not give here details of the HST instrument tables. These, and additional information on data files from the Observatory Monitoring System, can be found on the WWW at `http://archive.stsci.edu/keyword`. The WWW page can also be used to generate a schematic header and view the overall database structure.

Catalog

The following tables are included in the Catalog database:

- **archive_data_set_all**: Provides DADS system information relevant to the archival status of a particular dataset. Primarily intended for the use of STScI staff. Page 231.
- **archive_extensions**: Lists the particular file extensions for the datasets in **archive_data_set_all**. Page 233.
- **assoc_member:** Gives detailed information on each association (members, datasets) and describes the role each member played in it. Page 234.
- **assoc_orphan:** Includes exposures which were supposed to become members of an association but never made it. Page 234.
- **assoc_status**: Gives information on the status of an association. Page 234.
- **fgs_data**: The primary table for information on the instrument configuration used for a particular FGS observation.
- **fixed_target**: Information on a particular fixed (i.e., non-solar system) target (position, proper motion, estimated magnitude, etc.) Page 235.
- **foc_data**: The primary table for obtaining information on the instrument configuation used in an FOC observation.
- **foc_ref_data**: Recommended reference files for calibrating FOC datasets.
- **fos_data**: The primary table for obtaining information on the instrument configuration used in an FOS observation.
- **fos_ref_data**: Recommended reference files for calibrating FOS observation datasets.
- **hrs_data**: The primary table for obtaining information on the instrument configuration used in an HRS observation.

- **hrs_ref_data**: This table provides information on the HRS calibration files recommended for use in the reduction of a given dataset.
- **hsp_data**: The primary table for obtaining information on the instrument configuration used in an HSP observation.
- **hsp_ref_data**: This table provides information on the HSP calibration files recommended for reducing a given dataset.
- **moving_target_position**: Position information on moving (solar-system) targets. Page 235.
- **nicmos_a_data**: The primary table for obtaining information on the instrument configuration used in a NICMOS observation. Given its size, this table is split in three.
- **nicmos_b_data**: Same as **nicmos_a_data**.
- **nicmos_c_data**: Same as **nicmos_a_data**.
- **nicmos_ref_data**: This table provides information on the NICMOS calibration files recommended for reducing a given dataset.
- **nicmos_science**: Association information for NICMOS data which could not make it into the science table.
- **nicmos_times:** Selected information from MULTIACCUM data.
- **oms_data**: Contains values extracted from observation logs. Observation logs have the same names as their corresponding science exposures. Page 236.
- **oms_summary**: same as **oms_data** except this is the information that pertains to the sets of observation logs that correspond to an association. Page 238.
- **otfc_bypass_calibration:** This table includes datasets which should *not* be recalibrated during On-The-Fly calibration (OTFC) requests (see Page 135), for example because they gave problems when they first went through the OPUS pipeline. Page 241.
- **otfc_keyword_repair:** This table controls the changes to keywords and their values, as part of the OTFC service. Page 241.
- **pdq_summary**: contains data quality information extracted from the PDQ file. Page 243.
- **proposal**: Proposal ID, investigator information and SOGS program ID (see the proposal database for a wider variety of proposal information). Page 243.
- **scan_parameters**: Information on the observational details of a scanned observation: Page 243.

- **science**: This table is a composite of frequently used information found in a number of other tables. By combining this information into a single table, the speed of searches through the archive is improved. The table from which each attribute is taken is given, along with the attribute definition. Page 244.
- **shp_data**: The standard header packet contains header keywords common to all observations.Page 247.
- **stis_a_data**: The primary table for obtaining information on the instrument configuration used in a STIS observation. Given its size, this table is split in three.
- **stis_b_data**: Same as **stis_a_data.**
- **stis_c_data**: Same as **stis_a_data.**
- **stis_grand_mama**: This table provides information on the grand_mama, an accumulated image of all the counts that the Multi-Anode Microchannel Array (MAMA) detector has recorded over time.
- **stis_ref_data**: This table provides information on the STIS calibration files recommended for reducing a given dataset.
- **stis_science**: Association information for STIS data which could not make it into the science table.
- **target_keyword**: Target keyword information. Page 252.
- **target_synonym**: Target synonym information. Page 253.
- **wfpc_data**: Information on the state of the WF/PC which is identical for all four chips (e.g., shutter open and close times, filters, reference files used).
- **wfpc_group_data**: Information on the state of the WF/PC which differes from chip-to-chip (e.g., bias levels, orientation, pixel values).
- **wfpc_ref_data**: This table provides information on recommended WF/PC calibration files.
- **wfpc2_primary_data**: This table and the associated **wfpc2_secondary_data** table contain information related to the state of the WFPC2 and the data obtained (e.g., bias values, temperature).
- **wfpc2_ref_data**: This table provides information on recommended WFPC2 calibration files.
- **wfpc2_secondary_data**: This table the **wfpc2_primary_data** table contain information related to the state of the WFPC2 and the data obtained (e.g., background level, histogram width, and skewness).

Table B.1: The *archive_data_set_all* Table

Field	Description	Source
ads_access_time	Date and time when this data set was most recently accessed. (Note: This is internal distribution information for DADS.)	INTERNAL
ads_archive_class	The archive class for this data set type: - ACC: MAMA Accumulated Data - ANC: Ancillary Data - ASN: Association Data - AST: Astrometry - CAL: Calibrated SI Science Data - CDB: SI Calibration Data - CTB: SDAS Calibration and Throughput Tables - DIA: Engineering Diagnostic Data - DLG: DADS Logs - DMP: OBC Dump Data - EDT: Edited SI Science Data - ENG: Engineering Data - MSC: Mission Schedule Data - MTL: Mission Timeline Data - OCX: OSS Data Quality Comments - OMS: Observatory Monitoring System files - ORB: Ephemeris or Definitive Orbit Data - PDQ: OPUS Data Quality Comments - PRB: Problem Science Data (Data that are not validated) - SMS: Science Mission Specification Data - SUB: Engineering Subset Data - VLA: VLA Radio Survey	INPUT
ads_build_num	Build number	INTERNAL
ads_data_receipt_time	Date and time when this data set was received by the DADS system	INTERNAL
ads_data_set_name	Name of the data set.	INPUT
ads_data_set_size	Size of the data set in bytes.	INTERNAL
ads_data_source	Source from which DADS received the data set - e.g., SOGS, SDAS, USER.	INTERNAL
ads_electronic_dist_count	Number of copies of all or part of this data set which have been distributed electronically to users. (Note: This is internal distribution information for DADS.)	INTERNAL
ads_end_time	The end time of the information covered by this data set. The exact meaning is archive class dependent.	GSP.GSH.HISTORY, MTL.POD.END, MSC.POD.END, SMS.POD.END, ENG.DAT.37-48.SPACECRAFT
ads_engineering_format	Telemetry format ID (e.g., AN) (ASCII, left-justified, blank fill).	ENG.DAT.23-24.FORMAT
ads_file_count	Number of files included in the archive data set. (Note: This is internal distribution information for DADS.)	INPUT
ads_file_extension_id	File extension ID	
ads_generation_date	Date and time when the last file in this data set was generated by SOGS.	INPUT
ads_logical_vol	The logical volume of the archive volume (side A or side B) that this data set resides on. (Note: This is internal archive information for DADS.)	INTERNAL

Table B.1: The *archive_data_set_all* Table

Field	Description	Source
ads_naxis1	The number of pixels along the naxis1 for the image that can be subsetted.	AST.A*H.NAXIS1, FOC.C1H/C0H/D0H.NAXIS1, FOS.C1H/D0H.NAXIS1, HRS.C1H/D0H/D1H.NAXIS1, HSP.D0H/D2H/D1H/D3H.NAXIS1, WFPC.C0H/D0H.NAXIS1, WFPC2.C0H/D0H.NAXIS1
ads_naxis2	The number of pixels along the naxis2 for the image that can be subsetted.	FOC.C1H/C0H/D0H.NAXIS2, HRS.C1H/D0H/D1H.NAXIS2, HSP.D0H/D2H/D1H/D3H.NAXIS2, WFPC.C0H/D0H.NAXIS2, WFPC2.C0H/D0H.NAXIS2
ads_obc_dump_type	A character representing the type of data dump from the On Board Computer (OBC). It is represented by the second character of the data set file name.	DMP.filename
ads_obset_id	The Observation Set ID for the observation set to which this observation belongs.	AST.DMH.OBSET_ID, SHH.OBSET_ID
ads_obsnum	Observation number from the SOGS header.	AST.DMH.OBSERVTN, SHH.OBSERVTN
ads_od_dist_count	Number of times that all or part of this data set has been distributed to users on optical disk. (Note: This is internal distribution information for DADS.)	INTERNAL
ads_pep_id	Unique identifier assigned to the proposal by the PEP system.	SHH.PROPOSID
ads_processing_type	The level the data set was reprocessed: (NORMAL, MINOR, or MAJOR).	SHH.PROC_TYP
ads_program_id	The SOGS Program ID for the proposal which requested this observation.	AST.DMH.PROGRMID, SHH.PROGRMID
ads_release_date	Date when this data set is expected to be released from proprietary status. This date is internally calculated when proprietary data set information is stored. A data set is considered to have transitioned from proprietary to non-proprietary status if the release date is earlier than (less than or equal to) the current date. The release is considered an actual release date, if the date is less than or equal to the current date. The operator may modify this release date and set the release date to be any desired date greater than or equal to the system date and time.	INTERNAL, INPUT
ads_retrieval_requests	Number of requests from DADS users for retrieval and distribution of information from this data set. (Note: This is internal distribution information for DADS).	
ads_source_format	The formats that the data is received in. Valid values are: FITS, WFITS, SDAS and OTHER. Data sets are normally stored in FITS format. If a data set fails validation and ads_override is set on, the data set is stored in the format in which it is originally received in.	INTERNAL

Table B.1: The *archive_data_set_all* Table

Field	Description	Source
ads_special_mechanism	The date/time that the special proprietary mechanism process updated this record. A value in this column will ensure that the special proprietary mechanism process does not update this data set more than once. If the proprietary status of this data set is updated manually by the DBA as a result of the proprietary special mechanism (i.e., the special proprietary mechanism had notified the DBA that a manual change was necessary), a date/time of the update should be entered. Entering the value will ensure that the special proprietary mechanism does not continually notify the DBA that a manual update is necessary.	INTERNAL
ads_start_time	Start time of the data in this data set as follows: ENG - SPACECRAFT START TIME Corrected spacecraft (vehicle) time for the first minor frame in the file. SUB - SPACECRAFT START TIME Corrected spacecraft (vehicle) time for the first minor frame in the file. ORB - ORBIT DATE The time of the start of orbit data. GSP - HISTORY Scan start. GSD - GSP_TIME The start time of the guide star use for	SUB, SMS.POD.START, MSC.POD.START, MTL.POD.START, ENG.DAT.25-36.SPACECRAFT, ORB.ORX.datasetname.ORBIT, RTA.POD.datasetname.RTA, DMP.PKX.datasetname.MINOR, GSP.GSH.HISTORY, GSD.GSD.GSP_TIME, MVD.MVD.GSP_TIME
ads_storage_format	Internal storage format.	INTERNAL
ads_tape_dist_count	Number of times that all or part of this data set has been distributed to users on tape. (Note: This is internal distribution information for DADS.)	INTERNAL
ads_volume_id	Unique identifier for the volume. The format for volume ID is: DADSddmmyyhhmmsst where t is the volume type: s = safe store p = primary (Note: This is internal archive information for DADS.)	INTERNAL

Table B.2: The *archive_extensions* Table

Field	Contents Description	Source
aex_file_extension	The extension of the archive file.	INTERNAL
aex_file_extension_id	The extension ID of the archive file	INTERNAL

Table B.3: The *assoc_member* Table

Field	Contents Description
asm_asn_id	Unique identifier assigned to association.
asm_data_set_name	Data set name.
asm_member_name	Member name.
asm_member_type	Role of the Exposure in the Association.
asm_obset_id	The Observation Set ID for the observation set to which this observation belongs.
asm_obsnum	Observation number from the SOGS header.
asm_program_id	The SOGS Program ID for the proposal which requested this observation.

Table B.4: The *assoc_orphan* Table

Field	Contents Description
aso_asn_id	Unique identifier assigned to association.
aso_data_set_name	Data set name.
aso_member_type	Role of the Exposure in the Association.
aso_obset_id	The Observation Set ID for the observation set to which this observation belongs.
aso_obsnum	Observation number from the SOGS header.
aso_orphan_type	
aso_program_id	The SOGS Program ID for the proposal which requested this observation.

Table B.5: The *assoc_status* Table

Field	Contents Description
ast_asn_id	Unique identifier assigned to association.
ast_asn_status	The status of the association (“complete” if all of its exposures were received).
ast_generation_date	The date the association was generated.
ast_products_present	

Table B.6: The *fixed_target* Table

Field	Contents Description	Source
fit_dec_proper_motion	Declination component of target proper motion.	SHH.MU_DEC, AST.DMH.MU_DEC
fit_obset_id	The Observation Set ID for the observation set to which this observation belongs.	SHH.OBSET_ID, AST.DMH.OBSET_ID
fit_obsnum	Observation number from the SOGS header.	SHH.OBSERVTN, AST.DMH.OBSERVTN
fit_parallax	Annual parallax of the target (if provided by the proposers).	SHH.PARALLAX, AST.DMH.PARALLAX
fit_program_id	The SOGS Program ID for the proposal which requested this observation.	SHH.PROGRMID, AST.DMH.PROGRMID
fit_proper_motion	Right ascension component of the target (if provided by the proposers).	SHH.MU_RA, AST.DMH.MU_RA
fit_radial_velocity	Radial velocity of the target in km/sec (if provided by the proposers).	SHH.RAD_VEL, AST.DMH.RAD_VEL
fit_redshitf	The target redshift (if provided by the proposers).	SHH.REDSHIFT, AST.DMH.REDSHIFT
fit_type	If the target is a star, the spectral type and luminosity; if the target is a galaxy, the morphological type. (if provided by the proposers)	SHH.SP_TYPE, AST.DMH.SP_TYPE

Table B.7: The *moving_target_position* Table

Field	Contents Description	Source
mtp_level	The target position level (from 1 to 3) to which this position specification applies.	SHH.MT_LV1_*, AST.DMH.MT_LV*_*
mtp_line_number	The line number for this position specification line.	SHH.MT_LV*_*
mtp_obset_id	The Observation Set ID for the observation set to which this observation belongs.	SHH.OBSET_ID, AST.DMH.OBSET_ID
mtp_obsnum	Observation number from the SOGS header.	SHH.OBSERVTN, AST.DMH.OBSERVTN
mtp_program_id	The SOGS Program ID for the proposal which requested this observation.	SHH.PROGRMID, AST.DMH.PROGRMID
mtp_spec_text	The actual text of the target position specification line. (This text follows the standard format specified in the STScI solar system target list instructions.) The text is made up of three levels. Each level arrives from SOGS in five parts which must be reassembled by DADS before storing the information in the Catalog.	SHH.MT_LV*_*

Table B.8: The *oms_data* Table

Field	Contents Description
oms_acq2fail	Target acquisition failure.
oms_actgssep	Actual Guide Star Separation (arcsec)
oms_altitude	Average altitude during observation (km)
oms_aper_v2	V2 Aperture position in Vehicle frame (arcsec)
oms_aper_v3	V3 Aperture position in Vehicle frame (arcsec)
oms_aperture	Aperture
oms_asn_id	Unique identifier assigned to association
oms_asn_mtyp	Role of the Exposure in the Association
oms_beta_1	Angle from +V3 to image +x(toward +V2)
oms_beta_2	Angle from +V3 to image +y(toward +V2)
oms_cd1_1	Partial of first axis coordinate w.r.t. x (deg/pix)
oms_cd1_2	Partial of first axis coordinate w.r.t. y (deg/pix)
oms_cd2_1	Partial of second axis coordinate w.r.t. x (deg/pixel)
oms_cd2_2	Partial of second axis coordinate w.r.t. y (deg/pixel)
oms_clamperr	Cal lamp may not be enabled
oms_coordsys	Image coordinate system
oms_crpix1	x-coordinate of reference pixel
oms_crpix2	y-coordinate of reference pixel
oms_crval1	First axis value at reference pixel
oms_crval2	Second axis value at reference pixel
oms_ctype1	First coordinate type
oms_ctype2	Second coordinate type
oms_data_set_name	Data set name
oms_datamax	The maximum value of the data
oms_datamin	The minimum value of the data
oms_dcfunchg	DCF number unchanged from previous observation
oms_dec_avg	Average DEC (deg)
oms_endtime	Predicted Observation Window End Time
oms_expname	9 character exposure identifier
oms_extver	Extension version number

Table B.8: The *oms_data* Table

Field	Contents Description
oms_fgs_fail	FGS astrometry target acquisition failed
oms_fos_open	FOS aperture door not open
oms_fw_error	Error occurred with filter wheel
oms_gs_gap	Duration of missing tlm. during GS acquisition
oms_gsacq	Actual time of GS Acquisition Completion
oms_gsfail	Guide star acquisition failure
oms_gsseprms	RMS of Guide Star Separation (milli-arcsec)
oms_guideact	Actual Guiding mode at end of GS acquisition
oms_inherit	Inherit the primary header
oms_lockloss	Total loss of lock time (sec)
oms_los_limb	Average line of sight to Earth limb (deg)
oms_los_moon	Minimum Line Of Sight to Moon (deg)
oms_los_scv	Minimum line of sight to S/C veloc. (deg)
oms_los_sun	Minimum Line Of Sight to Sun (deg)
oms_n_tm_gap	Number of telemetry gaps during observation
oms_nlosses	Number of loss of lock events
oms_no_ephem	No JPL ephemeris available
oms_no_sam	SI requested small angle maneuver rejected
oms_no_slew	NSSC-1 executive refused to honor slew request
oms_no_tlm	No engineering telemetry available for obs.
oms_nrecent	Number of recentering events (sec)
oms_obset_id	Observation set id
oms_obsnum	Observation number (base 36)
oms_proctime	Date-Time When OMS Processed Observation
oms_program_id	Program id (base 36)
oms_proposid	PEP proposal identifier
oms_ra_avg	Average RA (deg)
oms_recentr	Total recentering time
oms_roll_avg	Average Roll (deg)
oms_sd_lost	Science data may be lost due to SI error.
oms_sgstar	Scheduled use of guide star.

Table B.8: The *oms_data* Table

Field	Contents Description
oms_shadoent	Earth shadow last entry (predicted).
oms_shadoex	Earth shadow last exit (predicted)
oms_si_safed	Science instrument safed during this observation
oms_sisuspnd	Science instrument suspended during observation
oms_slewing	Slewing occurred during this observation
oms_startime	Predicted Observation Window Start Time
oms_tapedrop	Possible loss of science data due to ETR problem
oms_tdf_down	Take-data-flag not up during entire exposure
oms_tlm_prob	Problem with the engineering telemetry
oms_tlmform	Telemetry Format
oms_tm_gap	Total duration of missing telemetry (sec.)
oms_v2_p2p	Dominant guide star V2 axis peak to peak (mas)
oms_v2_rms	Dominant guide star V2 axis RMS (mas)
oms_v3_p2p	Dominant guide star V3 axis peak to peak (mas)
oms_v3_rms	Dominant guide star V3 axis RMS (mas)
oms_xpixinc	Plate scale along X in mas per pixel
oms_ypixinc	Plate scale along Y in mas per pixel

Table B.9: The *oms_summary* Table_

Field	Contents Description
oss_acq2fail	Target acquisition failure.
oss_actgssep	Actual Guide Star Separation (arcsec)
oss_altitude	Average altitude during observation (km)
oss_aper_v2	V2 Aperture position in Vehicle frame (arcsec)
oss_aper_v3	V3 Aperture position in Vehicle frame (arcsec)
oss_aperture	Aperture
oss_asn_id	Unique identifier assigned to association
oss_asn_mtyp	Role of the Exposure in the Association
oss_beta_1	Angle from +V3 to image +x(toward +V2)
oss_beta_2	Angle from +V3 to image +y(toward +V2)

Table B.9: The *oms_summary* Table_

Field	Contents Description
oss_cd1_1	Partial of first axis coordinate w.r.t. x (deg/pix)
oss_cd1_2	Partial of first axis coordinate w.r.t. y (deg/pix)
oss_cd2_1	Partial of second axis coordinate w.r.t. x (deg/pixel)
oss_cd2_2	Partial of second axis coordinate w.r.t. y (deg/pixel)
oss_clamperr	Cal lamp may not be enabled
oss_coordsys	Image coordinate system
oss_crpix1	x-coordinate of reference pixel
oss_crpix2	y-coordinate of reference pixel
oss_crval1	First axis value at reference pixe
oss_crval2	Second axis value at reference pixel
oss_ctype1	First coordinate type
oss_ctype2	Second coordinate type
oss_data_set_name	Data set name
oss_datamax	The maximum value of the data
oss_datamin	The minimum value of the data
oss_dcfunchg	DCF number unchanged from previous observation
oss_dec_avg	Average DEC (deg)
oss_endtime	Predicted Observation Window End Time
oss_expname	9 character exposure identifier
oss_extver	xtension version number
oss_fgs_fail	FGS astrometry target acquisition failed
oss_fos_open	FOS aperture door not open
oss_fw_error	Error occurred with filter wheel
oss_gs_gap	Duration of missing tlm. during GS acquisition
oss_gsacq	Actual time of GS Acquisition Completion
oss_gsfail	Guide star acquisition failure
oss_gsseprms	RMS of Guide Star Separation (milli-arcsec)
oss_guideact	Actual Guiding mode at end of GS acquisition
oss_inherit	Inherit the primary header
oss_lockloss	Total loss of lock time (sec)
oss_los_limb	Average line of sight to Earth limb (deg)

Table B.9: The *oms_summary* Table_

Field	Contents Description
oss_los_moon	Minimum Line Of Sight to Moon (deg)
oss_los_scv	Minimum line of sight to S/C veloc. (deg)
oss_los_sun	Minimum Line Of Sight to Sun (deg)
oss_n_tm_gap	Number of telemetry gaps during observation
oss_nlosses	Number of loss of lock events
oss_no_ephem	No JPL ephemeris available
oss_no_sam	SI requested small angle maneuver rejected
oss_no_slew	NSSC-1 executive refused to honor slew request
oss_no_tlm	No engineering telemetry available for obs.
oss_nrecent	Number of recentering events (sec)
oss_obset_id	Observation set id
oss_obsnum	Observation number (base 36)
oss_proctime	Date-Time When OMS Processed Observation
oss_program_id	Program id (base 36)
oss_proposid	PEP proposal identifier
oss_ra_avg	Average RA (deg)
oss_recentr	Total recentering time
oss_roll_avg	Average Roll (deg)
oss_sd_lost	Science data may be lost due to SI error.
oss_sgstar	Scheduled use of guide star.
oss_shadoent	Earth shadow last entry (predicted).
oss_shadoex	Earth shadow last exit (predicted)
oss_si_safed	Science instrument safed during this observation
oss_sisuspnd	Science instrument suspended during observation
oss_slewing	Slewing occurred during this observation
oss_startime	Predicted Observation Window Start Time
oss_tapedrop	Possible loss of science data due to ETR problem
oss_tdf_down	Take-data-flag not up during entire exposure
oss_tlm_prob	Problem with the engineering telemetry
oss_tlmform	Telemetry Format
oss_tm_gap	Total duration of missing telemetry (sec.)

Table B.9: The *oms_summary* Table_

Field	Contents Description
oss_v2_p2p	Dominant guide star V2 axis peak to peak (mas)
oss_v2_rms	Dominant guide star V2 axis RMS (mas)
oss_v3_p2p	Dominant guide star V3 axis peak to peak (mas)
oss_v3_rms	Dominant guide star V3 axis RMS (mas)
oss_xpixinc	Plate scale along X in mas per pixel
oss_ypixinc	Plate scale along Y in mas per pixel

Table B.10: The *otfc_bypass_calibration* Table

Field	Contents Description
obc_comment	Comment about this entry.
obc_data_set_name	The DADS dataset name (rootname).
obc_entry_date	The date the entry was made.
obc_inactive_date	The date on which the entry was deactivated. Only filled in for inactive states.
obc_instrument	The instrument name.
obc_pr_number	The pr number associated with this uncalibratable dataset. This number is assigned by the STScI OPR system, which contains the documentation on the problem.
obc_problem	The reason the dataset should not be calibrated. Possible values are: CORRUPTED_DATA, TOO_MUCH_TIME, SWITCH_OVERRIDE, CAL_SW_PROBLEM, OTHER
obc_state	This can be ACTIVE, INACTIVE or MISTAKE. ACTIVE refers to active entries, i.e., currently in use by OTFC, INACTIVE refers to inactive entries (no longer in use; these entries are maintained to provide a history of changes to OTFC processing). MISTAKE refers to when an operator inadvertently puts an entry in the table. When entry is set to INACTIVE or MISTAKE, obc_inactive_date is populated.
okr_user_name	User name of person requesting the change.

Table B.11: The *otfc_keyword_repair* Table

Field	Contents Description
okr_active_date	The date the keyword repair becomes ACTIVE. This happens after the corresponding DADS database field has been updated with the new value when there is a corresponding field.
okr_dads_change_date	The date this change was last applied to DADS (NULL if not yet applied). This field will be updated by the DADS Update Tools.

Table B.11: The *otfc_keyword_repair* Table

Field	Contents Description
okr_data_set_name	The DADS dataset name (rootname).
okr_entry_date	The date the repair is entered in the database in the NEW state.
okr_extname	It is the value of the EXTNAME keyword for that image extension. Used for the case of data in which changes are outside the primary header. It is used to identify the data within the imset, e.g., SCI for STIS. In the case of the primary header, it is set to a null string.
okr_extver	The value of the EXTVER keyword for that imset. In the case of the primary header, it is set to a value of zero. This is in one-to-one correspondence with the imset_value.
okr_file_extension	The file extension for the change (e.g., RAW, DOH, SPT).
okr_imset_name	Used for the case of associated data in which changes are outside the primary header. It designates the keyword name in the various headers that are used to identify the imsets in a scientifically useful way, e.g., EXPNAME for STIS, SAMPNUM for NICMOS. In the case of the primary header, it is set to PRIMARY.
okr_imset_value	Used for the case of associated data in which changes are outside the primary header. The value of the imset identifier, e.g., the value of the EXPNAME for STIS, the value of the SAMPNUM for NICMOS, and the CCD(?) for ACS. In the case of the primary header, it is set to a null string.
okr_inactive_comment	The reason why the repair was deactivated. This field is only filled in for deactivated entries.
okr_inactive_date	The date on which the repair deactivated.
okr_instrument	The instrument name.
okr_keyword	Name of keyword to be updated in headers. For best switch entries, which are not filled by keywords, this is the name of the keyword that fills the corresponding original switch field.
okr_new_keyword_value	The desired value of the keyword.
okr_old_keyword_value	The value of the keyword before the change is applied. Filled from the DADS database by the load tool.
okr_operation	What to do with the keyword. Possible values: UPDATE, INSERT, DELETE. Insert means that the keyword and new value will be added to the dataset header, if not already present. If already present, the insert will modify the keyword value to the new value. Update is the same as insert, but will not add any new keywords. Delete sets the keyword value to an empty string, but leaves the keyword in the header. It causes a value of a keyword in the DADS catalog to be set to null if the field is present.
okr_pr_number	The pr number associated with this keyword change. This number is assigned by the STScI OPR system, which contains the documentation on the problem.
okr_state	This can be NEW, ACTIVE, INACTIVE. NEW refers to new repairs that have not yet been applied to the DADS catalog, ACTIVE refers to active repairs, i.e., currently in use by OTFC, while INACTIVE refers to inactive repairs. These repairs were at one time active, but are no longer in use. These entries are maintained to provide a history of changes to OTFC processing. Such entries are useful in user support.

Table B.12: The *pdq_summary* Table

Field	Contents Description
pdq_asn_id	Unique identifier assigned to association.
pdq_comment_1	Descriptive comments about the data.
pdq_comment_2	Additional descriptive comments about the data.
pdq_comment_3	Additional descriptive comments about the data.
pdq_data_set_name	Data set name.
pdq_obset_id	The Observation Set ID for the observation set to which this observation belongs.
pdq_obsnum	Observation number from the SOGS header.
pdq_program_id	The SOGS Program ID for the proposal which requested this observation.
pdq_quality	One word summary of data quality from a standard list defined by OPUS.

Table B.13: The *proposal* Table

Field	Contents Description	Source
pro_pep_id	Unique identifier assigned to the proposal by the PEP system.	SHH.PROPOSID, AST.DMH.PROPOSID
pro_pi_first_name	The investigator's first name.	SHH.PR_INV_F, AST.DMH.PR_INV_F
pro_pi_initial	The investigator's middle initial.	SHH.PR_INV_M, AST.DMH.PR_INV_M
pro_pi_last_name	The investigator's last name.	SHH.PR_INV_L, AST.DMH.PR_INV_L
pro_program_id	The SOGS Program ID for the proposal which requested this observation.	SHH.PROGRMID, AST.DMH.PROGRMID
pro_proposal_title	The proposal title.	SHH.PROPTTL1, SHH.PROPTTL2
pro_proposal_type	The proposal type.	SHH.PROP_TYP

Table B.14: The *scan_parameters* Table

Field	Contents Description	Source
scp_angle_between_sides	The angle between the sides of the parallelogram formed by the first and last scan lines and the lines passing through the endpoints of the scan lines.	SHH.ANG_SIDE, AST.DMH.ANG_SIDE

Table B.14: The *scan_parameters* Table

Field	Contents Description	Source
scp_number_of_line	The number of scan lines.	SHH.NO_LINES, AST.DMH.NO_LINES
scp_obset_id	The Observation Set ID for the observation set to which this observation belongs.	SHH.OBSET_ID, AST.DMH.OBSET_ID
scp_obsnum	Observation number from the SOGS header.	SHH.OBSERVTN, AST.DMH.OBSERVTN
scp_points_per_line	The number of dwell points per scan line (if this is a dwell scan).	SHH.DWELL_LN, AST.DMH.DWELL_LN
scp_position_angle	Position angle of the first scan line with respect to either spacecraft or celestial coordinate system.	SHH.SCAN_ANG, AST.DMH.SCAN_ANG
scp_program_id	The SOGS Program ID for the proposal which requested this observation.	SHH.PROGRMID, AST.DMH.PROGRMID
scp_scan_coord	The frame of reference selected by the investigator for the spatial scan indicating whether the scan is to be carried out in celestial coordinates or spacecraft coordinates.	SHH.SCAN_COR, AST.DMH.SCAN_COR
scp_scan_length	The length of each scan line in arc-seconds.	SHH.SCAN_LEN, AST.DMH.SCAN_LEN
scp_scan_rate	The rate at which the spacecraft is to scan the designated part of the sky, in arc-seconds per second.	SHH.SCAN_RAT, AST.DMH.SCAN_RAT
scp_scan_type	Type of scan (e.g., Dwell or Continuous).	SHH.SCAN_TYP, AST.DMH.SCAN_TYP
scp_scan_width	The width of the specified spatial scan in arcseconds.	SHH.SCAN_WID, AST.DMH.SCAN_WID
scp_seconds_per_dwell	The number of seconds during which the spacecraft must remain stationary at each dwell point (if this is a dwell scan).	SHH.DWELL_TM, AST.DMH.DWELL_TM

Table B.15: The *science* Table

Field	Contents Description	Source
sci_actual_duration	The actual duration of the exposure in seconds.	data header keywords
sci_aper_1234	Concatenated identifier for the 1-4 aperture elements used in the given optical configuration.	data header keywords

Table B.15: The *science* Table

Field	Contents Description	Source
sci_archive_class	The archive class for this data set type: - ACC: MAMA Accumulated Data - ANC: Ancillary Data - ASN: Association Data - AST: Astrometry - CAL: Calibrated SI Science Data - CDB: SI Calibration Data - CTB: SDAS Calibration and Throughput Tables - DIA: Engineering Diagnostic Data - DLG: DADS Logs - DMP: OBC Dump Data - EDT: Edited SI Science Data - ENG: Engineering Data - MSC: Mission Schedule Data - MTL: Mission Timeline Data - OCX: OSS Data Quality Comments - OMS: Observatory Monitoring System files - ORB: Ephemeris or Definitive Orbit Data - PDQ: OPUS Data Quality Comments - PRB: Problem Science Data (Data that are not validated) - SMS: Science Mission Specification Data - SUB: Engineering Subset Data - VLA: VLA Radio Survey.	data header keywords
sci_asn_id	Unique identifier assigned to association.	data header keywords
sci_bandwidth	Bandwidth of the data (STIS) or RMS bandwidth of the photmode (NICMOS).	data header keywords
sci_broad_category	The broad category to which the target for a given observation belongs, e.g., Star, Galaxy, Quasar, Planet.	data header keywords
sci_central_wavelength	Central wavelength of the data (STIS) or pivot wavelength of the photmode (NICMOS).	data header keywords
sci_costar_deploy	Was COSTAR deployed at the time the dataset was obtained? (i.e. after the servicing mission) (T/F).	data header keywords
sci_data_set_name	The name of the data set.	data header keywords
sci_dec	The declination value for this location, in decimal degrees.	data header keywords
sci_dec_v1	The 0.0 declination of v1 axis of ST (deg).	data header keywords
sci_dispersion	The dispersion for an HST spectrographic observation.	data header keywords
sci_ecliptic_latitude	The ecliptic latitude value for this location, in decimal degrees.	data header keywords
sci_ecliptic_longitude	The ecliptic longitude value for this location, in decimal degrees.	data header keywords
sci_expflag	The exposure interruption indicator.	data header keywords
sci_fgslock	The commanded FGS lock (FINE, COARSE, GYROS, UNKOWN).	data header keywords
sci_fov_config	Field of view configuration.	data header keywords
sci_galactic_latitude	The galactic latitude value for this location, in decimal degrees.	data header keywords
sci_galactic_longitude	The galactic longitude value for this location, in decimal degrees.	data header keywords
sci_generation_date	The date the exposure was generated.	data header keywords
sci_instrume	Instrument in use.	data header keywords

Table B.15: The *science* Table

Field	Contents Description	Source
sci_instrument_config	Name of the instrument configuration for this optical configuration, e.g.: - FOC/288 (F/288 FOC configuration) - FOS/RD (Red-range FOS detector).	data header keywords
sci_mtflag	The moving target flag; T if it is a moving target.	data header keywords
sci_obset_id	The Observation Set ID for the observation set to which the observation belongs.	data header keywords
sci_obsnum	Observation number from the SOGS header.	data header keywords
sci_operating_mode	The HST instrument data mode used to make the exposure.	data header keywords
sci_pa_aper	Position angle of aperture used with target.	data header keywords
sci_pep_id	The PEP Proposal ID for the proposal which includes this exposure.	data header keywords
sci_pi_last_name	The principal investigator's last name.	data header keywords
sci_pixel_res	Plate scale (arcsec/pixel).	data header keywords
sci_pep_expnum	The Exposure ID assigned by PEP to the exposure to which this observation corresponds.	data header keywords
sci_program_id	The SOGS Program ID for the proposal that requested the data.	data header keywords
sci_ra	The Right Ascension value for this location, in decimal degrees.	data header keywords
sci_ra_v1	The 0.0 right ascension of v1 axis of ST (deg).	data header keywords
sci_release_date	Date when this data set is expected to be released from proprietary status. This date is internally calculated when proprietary data set information is stored. A data set is considered to have transitioned from proprietary to non-proprietary status if the release date is earlier than (less than or equal to) the current date. The release is considered an actual release date, if the date is less than or equal to the current date. The operator may modify this release date and set the release date to be any desired date greater than or equal to the system date and time.	data header keywords
sci_spec_1234	Concatenated identifier for the 1-4 spectral elements used in the given optical configuration.	data header keywords
sci_spectral_res	Spectral resolution for this optical configuration (for spectra).	data header keywords
sci_spectrum_end	Maximum wavelength for this HST spectrum.	data header keywords
sci_spectrum_start	Minimum wavelength for this HST spectrum.	data header keywords
sci_start_time	Exposure start time (Modified Julian Date) or start time of 1st exposure in file (STIS).	data header keywords
sci_stop_time	Exposure end time (Modified Julian Date) or start time of last exposure in file (STIS).	data header keywords
sci_sun_alt	Altitude of the sun above Earth's limb (deg).	data header keywords

Table B.15: The *science* Table

Field	Contents Description	Source
sci_targname	Common name of the target.	data header keywords
sci_target_descrip	Descriptive information about the target of this observation. This information is received in two parts. DADS concatenates them so that the description is stored in the Catalog as one value.	data header keywords
sci_v3_pos_angle	V3 position angle.	data header keywords

Table B.16: The *shp_data* Table

Field	Contents Description	Source
shp_accpdate	The proposal acceptance date (YD= yyyyddd).	SHH.ACCPDATE, AST.DMH.ACCPDATE
shp_anglesep	The angle separation of target from reference object (arcsecond).	SHH.ANGLESEP, AST.DMH.ANGLESEP
shp_annparra	The parallax shift in position, non- solar system target.	SHH.ANNPARRA, AST.DMH.ANNPARRA
shp_aperobj	The SI object aperture id.	SHH.APEROBJ, AST.DMH.APEROBJ
shp_aperoffx	The x component of object offset in aperture (arcsec).	SHH.APEROFFX, AST.DMH.APEROFFX
shp_aperoffy	The y component of object offset in aperture (arcsec).	SHH.APEROFFY, AST.DMH.APEROFFY
shp_apersky	The SI sky aperture id.	SHH.APERSKY, AST.DMH.APERSKY
shp_apertype	The aperture type (SICS, SIAS, SIDS).	SHH.APERTYPE AST.DMH.APERTYPE
shp_archive_class	The archive class of the data associated with this data set.	INPUT
shp_argperig	The argument of perigee (revolutions/ second).	SHH.ARGPERIG, AST.DMH.ARGPERIG
shp_asn_id	Unique identifier assigned to association.	
shp_cal_ver	CALSTIS (STIS) or CALNIC (NICMOS) code version.	
shp_calibrat	The Calibrate data flag.	SHH.CALIBRAT, AST.DMH.CALIBRAT
shp_calibtyp	The calibration type: E, I, or Blank.	SHH.CALIBTYP, AST.DMH.CALIBTYP
shp_cdbsdata	The CDBS notification flag.	SHH.CDBSDATA, AST.DMH.CDBSDATA
shp_cirveloc	The circular orbit linear velocity (meters/seconds).	SHH.CIRVELOC, AST.DMH.CIRVELOC
shp_clkdrftr	The spacecraft clock drift rate.	SHH.CLKDRFTR
shp_clkrate	The spacecraft clock rate.	SHH.CLKRATE

Table B.16: The *shp_data* Table

Field	Contents Description	Source
shp_cmd_exp	Commanded time per exposure (from TRANS).	
shp_col_b_v	Expected B-V color.	
shp_col_u_b	Expected U-B color.	
shp_col_v_r	Expected V-R color.	
shp_cosincli	The cosine of inclination.	SHH.COSINCLI, AST.DMH.COSINCLI
shp_data_set_name	The name of the data set.	INPUT
shp_dcfobsn	The Data Capture Facility (DCF) observation number in the SHP.	SHH.DCFOBSN
shp_dec_moon	The declination of the moon (deg).	SHH.DEC_MOON, AST.DMH.DEC_MOON
shp_dec_ref	The declination of reference object (deg).	SHH.DEC_REF, AST.DMH.DEC_REF
shp_dec_sun	The declination of the sun (deg).	SHH.DEC_SUN, AST.DMH.DEC_SUN
shp_dec_targ	The declination of the target (deg).	SHH.DEC_TARG, AST.DMH.DEC_TARG
shp_dec_v1	The 0.0 declination of v1 axis of ST (deg).	SHH.DEC_V1, AST.DMH.DEC_V1
shp_dgestar	The Fine Guidance Sensor (FGS) ID (F1, F2, F3) concatenated with dominate guide star id.	SHH.DGESTAR, AST.DMH.DGESTAR
shp_e_b_v	E(B-V).	
shp_ecbdx3	The eccentricity cubed times 3.	SHH.ECBDX3, AST.DMH.ECBDX3
shp_ecbdx4d3	The eccentricity cubed times 4/3.	SHH.ECBDX4D3, AST.DMH.ECBDX4D3
shp_eccentry	The eccentricity.	SHH.ECCENTRY, AST.DMH.ECCENTRY
shp_eccentx2	The eccentricity times 2.	SHH.ECCENTX2, AST.DMH.ECCENTX2
shp_epchtime	The epoch time of parameters (ES= Elapsed seconds since 1/1/85).	SHH.EPCHTIME, AST.DMH.EPCHTIME
shp_eplongpm	The epoch of longitude of prime meridian (sec).	SHH.EPLONGPM, AST.DMH.EPLONGPM
shp_eqradtrg	The equatorial radius of target (km).	SHH.EQRADTRG, AST.DMH.EQRADTRG
shp_esqdx5d2	The eccentricity squared times 5/2.	SHH.ESQDX5D2, AST.DMH.ESQDX5D2
shp_expacket	The expected number of source packets.	SHH.EXPACKET, AST.DMH.EXPACKET
shp_extnct_v	Extinction in V.	

Table B.16: The *shp_data* Table

Field	Contents Description	Source
shp_fdmeanan	The 1st derivative coefficient for mean anomaly (revs/sec).	SHH.FDMEANAN, AST.DMH.FDMEANAN
shp_flatntrg	The flattening of target.	SHH.FLATNTRG, AST.DMH.FLATNTRG
shp_fltswver	Flight software version number.	
shp_hsthorb	Half the duration of the ST orbit (seconds).	SHH.HSTHORB, AST.DMH.HSTHORB
shp_instrume	The instrument used in the observation. Valid values are: FGS, FOC, FOS, HRS, HSP, WFPC. NOTE: NULL values are not allowed.	SHH.INSTRUME, AST.DMH.INSTRUME, WFPC2.C0H/D0H.INSTRUME
shp_linenum	Proposal logsheet line number.	
shp_longpmer	The longitude of prime meridian (deg).	SHH.LONGPMER, AST.DMH.LONGPMER
shp_mag_b	Expected B Magnitude.	
shp_mag_r	Expected R Magnitude.	
shp_mag_u	Expected U Magnitude.	
shp_mag_v	Expected V Magnitude.	
shp_meananom	The mean anomaly (radians).	SHH.MEANANOM, AST.DMH.MEANANOM
shp_mu_epoch	Epoch of proper motion from proposal.	
shp_obset_id	The Observation Set Id for the observation set to which this observation belongs.	SHH.OBSET_ID, AST.DMH.OBSET_ID
shp_obsnum	Observation number (base 36) from the SOGS header.	SHH.OBSNUM, AST.DMH.OBSNUM
shp_obsstrtt	The predicted observation start time (ES= Elapsed seconds since 1/1/85).	SHH.OBSSTRTT, AST.DMH.OBSSTRTT
shp_opformat	The output product format specification.	SHH.OPFORMAT, AST.DMH.OPFORMAT
shp_opus_ver	OPUS software system version number.	
shp_pa_ref	The position angle of target from reference object (degrees).	SHH.PA_REF, AST.DMH.PA_REF
shp_par_corr	The parallax correction used (T or F).	SHH.PAR_CORR, AST.DMH.PAR_CORR
shp_parentid	PEP proposal identifier of the parent proposal	
shp_pep_expo	The Exposure Id assigned by PEP to the exposure to which this observation corresponds.	SHH.PEP_EXPO, AST.DMH.PEP_EXPO
shp_postnstx	The position of space telescope x axis (km).	SHH.POSTNSTX, AST.DMH.POSTNSTX
shp_postnsty	The position of space telescope y axis (km).	SHH.POSTNSTY, AST.DMH.POSTNSTY
shp_postnstz	The position of space telescope z axis (km).	SHH.POSTNSTZ, AST.DMH.POSTNSTZ

Table B.16: The *shp_data* Table

Field	Contents Description	Source
shp_prodtype	The output product medium type.	SHH.PRODTYPE, AST.DMH.PRODTYPE
shp_program_id	The SOGS program id (base 36) for the proposal which requested this observation.	SHH.PROGRMID, AST.DMH.PROGRMID
shp_proposid	The PEP Proposal Id for the proposal that requested this observation.	SHH.PROPOSID, AST.DMH.PROPOSID
shp_pstptime	The predicted observation stop time (J= Julian format).	SHH.PSTPTIME, AST.DMH.PSTPTIME
shp_pstrtime	The predicted observation start time (J= Julian format).	SHH.PSTRTIME, AST.DMH.PSTRTIME
shp_ra_moon	The right ascension of the moon (deg).	SHH.RA_MOON, AST.DMH.RA_MOON
shp_ra_ref	The right ascension of reference object (deg).	SHH.RA_REF, AST.DMH.RA_REF
shp_ra_sun	The right ascension of the sun (deg).	SHH.RA_SUN, AST.DMH.RA_SUN
shp_ra_targ	The right ascension of the target (deg).	SHH.RA_TARG, AST.DMH.RA_TARG
shp_ra_v1	The 0.0 right ascension of v1 axis of ST (deg).	SHH.RA_V1, AST.DMH.RA_V1
shp_rascascn	The right ascension of ascending node (revolutions).	SHH.RASCASCN, AST.DMH.RASCASCN
shp_rcargper	The rate change of argument of perigee (revs/sec).	SHH.RCARGPER, AST.DMH.RCARGPER
shp_rcascnrd	The rate change right ascension ascend node (rads/sec).	SHH.RCASCNRD, AST.DMH.RCASCNRD
shp_rcascnrv	The rate change right ascension ascend node (revs/sec).	SHH.RCASCNRV, AST.DMH.RCASCNRV
shp_rotrttrg	The rotation rate of target.	SHH.ROTRTTRG, AST.DMH.ROTRTTRG
shp_rtamatch	The above f&i match RTA (TRUE, FALSE, NO RTA F&I AVL).	SHH.RTAMATCH
shp_saaavoid	The SAA model for SAA Avoidance (range 02-99).	SHH.SAAAVOID, AST.DMH.SAAAVOID
shp_sdma3sq	The calculation: 3*(shp_mean_anomaly_coef_2**2) radians/second**2.	SHH.SDMA3SQ, AST.DMH.SDMA3SQ
shp_sdmeanan	The 2nd derivative coefficient for mean anomaly (revs/sec/sec).	SHH.SDMEANAN, AST.DMH.SDMEANAN
shp_semilrec	The semi-latus rectum (meters).	SHH.SEMILREC, AST.DMH.SEMILREC
shp_seqline	PEP line number of defined sequence.	
shp_seqname	PEP define/use sequence name.	
shp_sgestar	The FGS ID (F1, F2, F3) concatenated with subdominate guide star id.	SHH.SGESTAR, AST.DMH.SGESTAR

Table B.16: The *shp_data* Table

Field	Contents Description	Source
shp_sineincl	The sine of inclination.	SHH.SINEINCL, AST.DMH.SINEINCL
shp_spclincn	The spacecraft clock at Coordinated Universal Time (UtCO).	SHH.SPCLINCN
shp_surf_b	Expected B surface brightness.	
shp_surf_r	Expected R surface brightness.	
shp_surf_u	Expected U surface brightness.	
shp_surf_v	Expected V surface brightness.	
shp_t51_angl	The position angle of motion of aperture (deg).	SHH.T51_ANGL, AST.DMH.T51_ANGL
shp_t51_rate	The rate of motion commanded (arcsecs/ sec).	SHH.T51_RATE, AST.DMH.T51_RATE
shp_tar_type	Target type.	
shp_taraqmod	The target acquisition mode (values 00, 01, 02, 03).	SHH.TARAQMOD, AST.DMH.TARAQMOD
shp_targ_id	SPSS target ID from proposal+target number.	
shp_targdist	The distance to target from Earth center (km).	SHH.TARGDIST, AST.DMH.TARGDIST
shp_timeffec	The time parameters took effect (ES= seconds since 1/1/85).	SHH.TIMEFFEC, AST.DMH.TIMEFFEC
shp_trk_type	The track 48 or track 51 commanding used (T48, T51).	SHH.TRK_TYPE, AST.DMH.TRK_TYPE
shp_utc0	Coordinated Universal Time (MJ= Modified Julian Date format).	SHH.UTC0
shp_utco1	Bytes 5-8 of the Coordinated Universal Time (UTC0) (MJD).	SHH.UTCO1
shp_utco2	Bytes 1-4 of the Coordinated Universal Time (UTC0) (MJD).	SHH.UTCO2
shp_v2aperce	The V2 offset of target from aperture center (arcsec).	SHH.V2APERCE, AST.DMH.V2APERCE
shp_v3aperce	The V3 offset of target from aperture center (arcsec).	SHH.V3APERCE, AST.DMH.V3APERCE
shp_velabbra	The aberration in position of the target.	SHH.VELABBRA, AST.DMH.VELABBRA
shp_velocstx	The velocity of space telescope along x axis (km/sec).	SHH.VELOCSTX, AST.DMH.VELOCSTX
shp_velocsty	The velocity of space telescope along y axis (km/sec).	SHH.VELOCSTY, AST.DMH.VELOCSTY
shp_velocstz	The velocity of space telescope along z axis (km/sec).	SHH.VELOCSTZ, AST.DMH.VELOCSTZ
shp_wrd11_14	Numerical identifier used to group packets together to form an observation (The word 11/14 (0-225)).	SHH.WRD11_14, AST.DMH.WRD11_14

Table B.17: The *sms_data* Table

Field	Contents Description	Source
sms_archive_class	The archive class for the Science Mission.	INPUT
sms_calendar	The SPSS calendar identifier.	SMS.POD.CALENDAR
sms_data_set_name	The name of the data set.	INPUT
sms_generation_date	Date and time when the last file in this dataset was generated by SOGS.	INPUT
sms_data sms_pdb_id	A mnemonic identifier for the ST project database.	SMS.POD.PDB_ID

Table B.18: The *target_keyword* Table

Field	Contents Description	Source
tak_broad_category	The broad category to which the target for a given observation belongs, e.g.: - Star - Galaxy - Quasar - Planet.	AST.DMH.TARGCAT, SHH.TARGCAT, SHH.TARGCAT2, AST.DMH.TARGCAT2
tak_keyword_text	The actual keyword(s). Up to ten (10) different keywords may exist for each target.	DBA, SHH.TARKEY1, through SHH.TARKEY10, AST.DMH.TARKEY1 through AST.DMH.TARKEY10
tak_obset_id	The Observation Set ID for the observation set to which this observation belongs.	SHH.OBSET_ID, AST.DMH.OBSET_ID
tak_obsnum	Observation number from the SOGS header.	SHH.OBSERVTN, AST.DMH.OBSERVTN
tak_program_id	The SOGS Program ID for the proposal which requested this observation.	SHH.PROGRMID, AST.DMH.PROGRMID

Table B.19: The *target_synonym* Table

Field	Contents Description	Source
tsy_name	The text of the target synonym.	AST.DMH.ALIAS1, AST.DMH.ALIAS2,SHH.ALIAS2, SHH.ALIAS1, SHH.TARGNAME1, AST.DMH.TARGNAME, FOC.C1H/C0H/D0H.TARGNAME, FOS.C1H/D0H.TARGNAME, HRS.C1H/D0H/D1H.TARGNAM HSP.D0H/D2H/D1H/D3H.TARGN AME, WFPC.C0H/D0H.TARGNAME, WFPC2.C0H/D0H.TARGNAME
tsy_obset_id	The Observation Set ID for the observation set to which this observation belongs.	SHH.OBSET_ID, AST.DMH.OBSET_ID
tsy_obsnum	Observation number from the SOGS header.	SHH.OBSERVTN, AST.DMH.OBSERVTN
tsy_program_id	The SOGS Program ID for the proposal which requested this observation.	SHH.PROGRMID, AST.DMH.PROGRMID

Calibration Database

The Calibration Database (CDBS) contains information on the raw data used to create the recommended reference files. While you can access the entire CDBS from the <Custom Query> screen, formatted StarView screens only use some of the tables in this database. Users interested in obtaining more information should consult the CDBS WWW page at `http://www.stsci.edu/instruments/observatory/cdbs/cdbs.html`. Tables in the CDBS are organized as follows: each instrument has an associated _file and _row level table. The _file level tables contain a description of the calibration file as a whole, while the _row level tables contain a description of the contents of the calibration file. In the case of calibration tables the _row files describe the important information of the individual rows of the calibration table. Tables in the CDBS are:

- **foc_file**
- **foc_row**
- **fos_file**
- **fos_row**
- **hrs_file**
- **hrs_row**
- **hsp_file**
- **hsp_row**
- **nic_file**
- **nic_row**
- **stis_file**
- **stis_row**
- **synphot_file**
- **synphot_row**
- **wfpc2_file**
- **wfpc2_row**
- **wfpc_file**
- **wfpc_row**

Proposal Database

The tables in the Proposal database allow users to examine information provided by observers in their Phase II proposals. This includes administrative information such as the proposers' names and addresses, scientific justification provided in the abstract, and detailed scheduling information such as target positions, exposure times, and filters and gratings selected. We give here a detailed description of the **conflicts** table only. Tables and views (or virtual tables) in the Proposal database include:

- **abstract**: This table contains the summary description of the proposed observation strategy for all approved HST programs.
- **address_view**: This view contains both physical and e-mail address information for PIs and COIs and is associated with their respective proposal ids. It is a view of the address and investigator tables in the ASSIST database.
- **conflicts**: This table contains exposure level information on completed, planned, and GTO protected targets. Information in the table is used by prospective HST observers for duplication checking prior to phase I proposal submissions. Page 256.
- **conflicts_abstract**: This table contains summary description of proposed observation strategy information on completed, planned and GTO protected.
- **coverpage**: This table contains proposal level information for all approved HST programs including title, scientific category and proposal type (i.e., GO, GTO/STIS, CAL/WF2, etc.).
- **exposure**: This table contains phase II exposure level information related to the structure of exposures for all approved HST programs.
- **proposals**: Information in the table is used by prospective HST observers for duplication checking prior to phase I proposal submissions.
- **prop_track:** This table contains proposal level information for tracking the processing status/progress of approved HST programs from PI submission to flight ready to completion.
- **su_track**: This table contains visit level information for tracking the processing status/progress of visits from submission to flight ready to completion.
- **tar_fixedpos_j2000**: This table contains information on the right ascension and declination of fixed targets (fixed, generic and solar system) of all approved HST programs.
- **targets:** This table contains target description information on all fixed targets (fixed, generic and solar system) of approved HST programs.

Table B.20: The *conflicts* Table

Field	Contents Description
con_actual_duration	Actual exposure time (seconds).
con_aper_1234	Instrument aperture.
con_central_wavelength	Central wavelength.
con_conflict_type	Type of conflict.
con_data_set_name	Data set name.
con_dec	Declination of target as given in proposal (deg) (J2000)
con_exp_num	Exposure number.
con_exp_status	Exposure status.
con_instrume	Instrument used for observation.
con_instrument_config	Configuration of instrument.
con_number_of_exposures	Number of exposures.
con_number_of_visits	Number of visits.
con_operating_mode	Operation mode.
con_pdq_comment_1	PODPS Data Quality comment one.
con_pdq_comment_2	PODPS Data Quality comment two.
con_pdq_comment_3	PODPS Data Quality comment three.
con_pep_id	Proposal Identification number in PEPSI database.
con_pi_last_name	Principal Investigator last name.
con_prop_type	Proposal type. Examples: GO, GTO, SNAP, GTO/WF2, GTO/NIC, CAL/FOC, ...
con_proposal_cycle	Proposal cycle.
con_ra	Right ascension of target as given in proposal (deg) (J2000).
con_release_date	Release date.
con_sci_category	Scientific category.
con_spec_1234	Spectral elements.
con_start_time	Start time of exposure.
con_target_descrip	Target description.
con_targname	Proposer supplied target name.
con_visit_id	Visit ID.

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HST Data Handbook

February 2002

The HST Data Handbook describes datasets produced by each instrument aboard the Hubble Space Telescope. Techniques for reading, displaying, understanding, calibrating, and analyzing datasets are presented for all data sent to observers or available through the HST Data Archive.

Introduction	A general look at file formats, tools and methods for reducing and analyzing HST data PDF version (1.29 Mb) [Introductory and appendix material common to all Instruments]
ACS	Advanced Camera for Surveys PDF version (1.55 Mb) [instrument only]
FGS	Fine Guidance Sensors PDF version (1.48 Mb) [instrument only]
NICMOS	Near Infrared Camera and Multi Object Spectrometer PDF version (3.13 Mb) [instrument only]
STIS	Space Telescope Imaging Spectrograph PDF version (1.47 Mb) [instrument only]
WFPC2	Wide Field Planetary Camera 2 PDF version (2.07 Mb) [instrument only]
Appendix	References to IRAF, file naming, & observation logs. PDF version (1.29 Mb) [Introductory and appendix material common to all Instruments]

Volume 2: Heritage Instruments

March 1998

This volume focuses on the instruments that are no longer onboard the spacecraft-the heritage instruments. These instruments are: FOS, GHRS, HSP, and WF/PC-1.

Preface	How to use this Handbook PDF version (123 Kb)
FOS	Faint Object Spectrograph PDF version (1.9 Mb)
GHRS	Goddard High Resolution Spectrograph PDF version (1.7 Mb)
HSP	High Speed Photometer PDF version (178 Kb)
WFPC1	Wide Field Planetary Camera 1 PDF version (798 Kb)
Appendices	internet resources, task examples, and index PDF version (381 Kb)

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January 17, 1995   Space Telescope Science Institute   Volume   1

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* StarView Version 3.8 Installed
* Distributed StarView Export Restriction Lifted
* New Archive Manual Available Soon
* VLA FIRST Survey Archived at STScI
* New Archive WWW Pages

StarView Version 3.8 Installed

We are pleased to announce the installation of StarView Version 3.8.

Several bug fixes are incorporated into this new version, as well as several new features:

* An improved table-format screen for search results, which lets you delete and resize columns. The table also has a smoother vertical scroll.

* A screen for the newly archived VLA FIRST Survey.

* A facility for using custom-designed search screens.

StarView 3.8 will be installed this morning (Tuesday, Jan 17) on STScI's internal computers, and on the Archive Host machines, stdata.stsci.edu and stdatu.stsci.edu.

Distributed StarView 3.8 will be available by Wednesday, Jan 18. You may download the software via FTP from stdatu.stsci.edu (username: starftp, password: your email address), or through the HST Archive's World Wide Web Server (http://stdatu.stsci.edu/dist_starview.html; be sure to set the "load to local disk" option on your browser before downloading.)

One change you may need to make in your environment.dat file, if you have one, is to append "other_sci_data" to the "catalogDDLList" and "initialAdHocDBs" lines. (environment.dat is a file created by StarView when you save any changes you've made through the "Options" menu. The file resides in a subdirectory of your directory called .svdata in Unix, [.SVDATA] in VMS.) The lines should then read:

```
catalogDDLList:         catalog,proposaldb,cdb1,other_sci_data
...
initialAdHocDBs:                catalog,proposaldb,cdb1,other_sci_data
```

For more information, contact the HST Archive Hotseat.

Distributed StarView Export Restriction Lifted

Formerly, exportation of Distributed StarView was limited because of some encryption software it contains. (Distributed StarView is a version of the X-StarView software that users may run on their own machines; see http://stdatu.stsci.edu/dist_starview.html.) However, this export restriction has been lifted for Distributed StarView, and the software is now available to users outside the US and Canada.

Please be sure to register when downloading the Distributed StarView software. While registration is optional, it will allow us to keep you informed of new releases of StarView.

New Archive Manual Available Soon

Version 5.0 of the Archive Manual will be available January 20. It is fully updated for DADS, including a complete description of the DADS database. The Archive Primer has not been updated, and will still serve as an general guide for StarView users; the Manual describes higher-level functions of StarView for the advanced user, and includes a description of the DADS database.

You may request printed copies of the Archive Manual by contacting the Archive Hotseat at the address below, or see http://stdatu.stsci.edu/documents.html for more information.

VLA FIRST Survey Archived at STScI

The first 1039 coadded images from the VLA FIRST Survey's 1993 observations have been imported into the HST Archive. A description of the survey is available at http://sundog.stsci.edu/.

The files are available for retrieval through StarView. StarView Version 3.8 has a VLA screen especially for the Survey, in which you can search for files covering specified areas of the sky, and mark them for retrieval. When retrieving, override the standard file options and specify 'VLA' for the archive class.

For more information about accessing the files, see http://stdatu.stsci.edu/first_data.html, or contact the Archive Hotseat.

New Archive WWW Pages

The HST Archive has a new set of World-Wide Web pages:

    http://www.stsci.edu/archive.html

If you have any questions or comments about StarView or the HST Archive, contact the Archive Hotseat:

Internet: archive@stsci.edu
SPAN: STSCIC::ARCHIVE or 6559::ARCHIVE
Phone: (410) 338-4547.

Archive, SCARS Division
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218

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March 21, 1995   Space Telescope Science Institute   Volume   2

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* StarView Version 3.9 Installed
* Archive Manual 5.1 Available

StarView Version 3.9 Installed

We are pleased to announce the installation of StarView Version 3.9.

This new version fixes some bugs, and features a separate button for selecting OMS files for retrieval.

StarView 3.9 will be installed this morning (Tuesday, Mar 21) on STScI's internal computers, and on the Archive Host machines, stdata.stsci.edu and stdatu.stsci.edu. Along with the StarView installation, the DADS Archive software is being upgraded, too (the Archive will be out of service all day for the installation). As part of the upgrade, the per-request limit on the number of datasets has been tripled.

Distributed StarView 3.9 will be available by Wednesday, Mar 22. You may download the software via FTP from stdatu.stsci.edu (username: starftp, password: your email address), or through the HST Archive's World Wide Web Server (http://stdatu.stsci.edu/dist_starview.html; be sure to set the "load to local disk" option on your browser before downloading.)

For more information, contact the HST Archive Hotseat.

Archive Manual 5.1 Available

Version 5.1 of the Archive Manual is now available. It fixes some documentation bugs, like tables that were left out of the Database Description in Appendix D.

You may request printed copies of the Archive Manual by contacting the Archive Hotseat at the address below, or see http://stdatu.stsci.edu/documents.html for more information.

If you have any questions or comments about StarView or the HST Archive, contact the Archive Hotseat:

Internet: archive@stsci.edu
SPAN: STSCIC::ARCHIVE or 6559::ARCHIVE
Phone: (410) 338-4547.

Archive Branch, Data Systems Division
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218

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May 23, 1995   Space Telescope Science Institute   Volume   3

* StarView Version 4.0 Installed
* WWW Access to the Digitized Sky Survey

StarView Version 4.0 Installed

We are pleased to announce the installation of StarView Version 4.0.

StarView 4.0 features:

* A screen for extracting scans from the complete Digitized Sky Survey CD-ROMS (disks 1-102).
* A new version of SAOimage that displays world coordinates in the preview images.
* Output from a screen may be written to a file to be used as cross-correlation input in another screen.

Users of Distributed StarView will notice that the package is a little smaller now. That's because StarView now fetches the screen definitions and help files from STScI via http. This will help us keep the screen files updated and corrected here, without requiring you to install them at your site.

You may download the software via FTP from stdatu.stsci.edu (username: starftp, password: your email address), or through the HST Archive's World Wide Web Server (http://stdatu.stsci.edu/dist_starview.html; be sure to set the "load to local disk" option on your browser before downloading.)

WWW Access to the Digitized Sky Survey

In addition to accessing the Digitized Sky Survey CD-ROMs through StarView (see above), you can now access them through the World Wide Web. Point your browser to

http://stdatu.stsci.edu/dss/dss_form.html

You can enter either an RA & Dec, or you can use this form's target name resolver to get the RA/Dec for you, either from SIMBAD or NED. Scans of up to 60 x 60 arcminutes may be retrieved, with a default of 15 x 15. (This default scan yields a FITS file of about a little over 500 kilobytes.)

Image formats available are: FITS (uncompressed, gzip compressed, or Unix compressed), FITS with a generic mime type (to make your browser save the file to disk instead of trying to display it), and GIF.

If you have any questions or comments about StarView or the HST Archive, contact the Archive Hotseat:

Internet: archive@stsci.edu
SPAN: STSCIC::ARCHIVE or 6559::ARCHIVE
Phone: (410) 338-4547.

Archive Branch, Data Systems Division
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218

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December 12, 1995   Space Telescope Science Institute   Volume   4

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* HST ARCHIVE USER SURVEY

* STARVIEW 4.2

* NEW FEATURES OF DADS
  + Retrieve Data Directly To Your Home Site.
  + PIs May Retrieve Their Own Data.

* THE HUBBLE DEEP FIELD: AVAILABILTY OF REDUCED DATA

* WWW ACCESS TO THE 2ND-GENERATION DIGITIZED SKY SURVEY

* UPGRADE OF STDATU TO SOLARIS 2.4

-=-

HST ARCHIVE USER SURVEY

From now trough January 1996, we're conducting a survey through the World Wide Web of our archive users. We'd like to hear your suggestions and comments on recalibration, GO/GTO data media, and Archive services. The survey is located at

http://stdatu.stsci.edu/survey/

and will be running from now until January 31, 1996. If you do not have access to the World Wide Web but would like to participate in the survey, contact the Archive Hotseat for an ASCII version of the survey form.

-=-

STARVIEW 4.2

The new version of StarView, version 4.2, includes some new features.

+ New Table Export Editing Features

When saving the results of a StarView search into a file, you can now customize the file's width and column order. Simply hit the "View Results as Table" button to bring up the results of your search in table format, and customize the table format: Use the third mouse button on a column to delete or resize the width of a column, or use the second mouse button on a column name to drag-and-drop that column to another place in the table. When you save the table to a file, the customizations you make will be applied.

+ Overlay the HST Field of View onto DSS Scans

StarView now allows you not only to access the Digitized Sky Survey, but to overlay the HST field of view on it as well. In the DSS screen, specify the RA and Dec of the center of the FOV, and a roll angle (counterclockwise degrees). StarView will fetch a scan from the DSS, compute the FOV, and display the field in SAOimage with the field of view displayed on the field.

In addition, each search screen now has an "Overlay" button. After finding a dataset, simply press the "Overlay" button, and StarView will fetch and display that area of the sky from the DSS with the FOV overlaid onto the field.

+ The New Observatory Monitoring (OMS) screen.

This screen facilitates the retrieval of OMS jitter files and includes the ability to search under many new and previously unavailable fields, including:

- o The average telescope roll angle at time of observation.
- o The angles between the line of sight and the Earth and Sun limbs.
- o The jitter amplitude limits.

The Search Results screen also includes information about the line of sight to the Moon. The OMS Search screen can be found on the Other Searches screen.

+ Distributed StarView Platforms

Distributed StarView is now available for the following platforms

- o SunOS 4.1.3
- o Solaris 2.4
- o Digital UNIX on Alpha (DEC OSF/1)
- o OpenVMS VAX V6.1
- o OpenVMS Alpha V6.1 *** new! ***

Distributed StarView is available via anonymous FTP at stdatu.stsci.edu, in the directory pub/starview, or via the World Wide Web at http://stdatu.stsci.edu/dist_starview.html.

-=-

NEW FEATURES OF DADS

We have installed the next release of the software for DADS, the Space Telescope Data Archiving and Distribution System. Here are some of the new features that are part of this new release:

+ Retrieve Data Directly To Your Home Site

External users may now retrieve data directly to their home site, instead of retrieving to an archive host staging disk.

Guest users on stdata.stsci.edu and stdatu.stsci.edu, and users of Distributed StarView, will need to set an environment variable before running StarView to enable this feature; for Unix versions, do

```
% setenv SV_NETDIST_OK YES
```

and on OpenVMS, do

```
$ DEFINE SV_NETDIST_OK YES
```

Then start up StarView. While building a retrieval request, the Media Options screen (where you give your archive username and password) will contain some new fields for the destination and directory, and for your username and password on that node. Simply specify in these fields the nodename and directory of the machine to which you'd like your data delivered, and your account name and password on that machine.

The destination information will be encrypted before it is sent to the Archive, and remains encrypted while your request is being processed. However, if you wish to augment this security, and if you have access to an incoming directory on an anonymous FTP server, you can use this feature to have the data sent there. Alternatively, you can still retrieve to the Archive host staging disk by pressing the HOST button on the Media Options screen.

+ PIs May Retrieve Their Own Data

Principal investigators (PIs) and PI-designated co-workers will now be able to access their proprietary data electronically. Any individual who wants electronic access to his or her own proprietary data must be both a registered and an authorized user of the Archive.

Registration allows access only to non-proprietary data; authorization additionally allows a PI and individuals selected by the PI to have access to the PI's proprietary data. You can become a registered user by filling out the World Wide Web registration form at

http://stdatu.stsci.edu/registration.html

or contact the Archive Hotseat at archive@stsci.edu. To become an authorized user, contact the Archive Hotseat.

Authorization requests will be inspected very carefully. For this reason, authorization, which allows access to proprietary data, may take a little longer than simple registration. We strongly encourage PIs desiring this option to become registered and authorized *well in advance* of the execution of their program.

We also encourage all PIs, whether or not yet registered users of the Archive, to participate in the Archive survey on the World Wide Web. Issues regarding data distribution and electronic access are being decided now with the help of user input via the survey.

+ AutoPI: New Format for GO/GTO Tapes

We're using a new tool to generate GO/GTO tapes: AutoPI. AutoPI automates work formerly done by our human operators, letting them concentrate on quality control. Also, AutoPI allows us to include more information on your tapes. For example, OMS files ("jitter" files) will now be included for every observation on every GO/GTO tape.

+ File Extension Change: .fit to .fits

Files retrieved from the Archive will now carry the extension .fits instead of .fit, to help streamline their use in FITS processing packages.

+ Request Names Will Be Longer

Request names in the Archive will be lengthened, to include the first 16 (instead of 4) characters of your archive username.

-=-

THE HUBBLE DEEP FIELD: AVAILABILTY OF REDUCED DATA

CR-rejected, coadded images for each of the four passbands of the Hubble Deep Field will be made available through anonymous FTP from stdatu.stsci.edu, about the time of the AAS meeting in January. Watch the Archive What's new page for the announcement (http://stdatu.stsci.edu/whats_new.html).

-=-

WWW ACCESS TO THE 2ND-GENERATION DIGITIZED SKY SURVEY

Our popular WWW access to the Digitized Sky Survey now provides an option to retrieve scans from the 2nd Generation of the Palomar Sky Survey. The 2nd Generation Survey is currently an ongoing project, so images from this survey will be loaded into the jukebox as they become available.

-=-

UPGRADE OF STDATU TO SOLARIS 2.4

In December, we'll be upgrading our archive host stdatu.stsci.edu to Solaris 2.4, to allow us to mount a much larger staging disk. This may result in a short period of downtime for stdatu, but we'll try to keep it to a minimum.

-=-

If you have any questions or comments about the HST Archive, contact the Archive Hotseat:

Internet: archive@stsci.edu
SPAN: STSCIC::ARCHIVE or 6559::ARCHIVE
Phone: (410) 338-4547.

Archive Branch, Data Systems Division
Space Telescope Science Institute
3700 San Martin Drive
Baltimore, MD 21218

HST Archive Documentation

The HST Archive Manual

Provides extensive information on how to access the HST and Multimission archives via two user interfaces, StarView and the World Wide Web. Gives advice on search strategies; higher level functions of StarView; descriptions of StarView screens and the HST catalog; nomenclature convention for HST data.

Version 7.0 of the Archive Manual was released in June 1999.

PDF version (3.9 Mb),

On-line version

Postscript version (gzipped) (2.1 Mb).

Users will find the PDF version more flexible and quicker to use. Loading of some chapters with the on-line version might take some time.

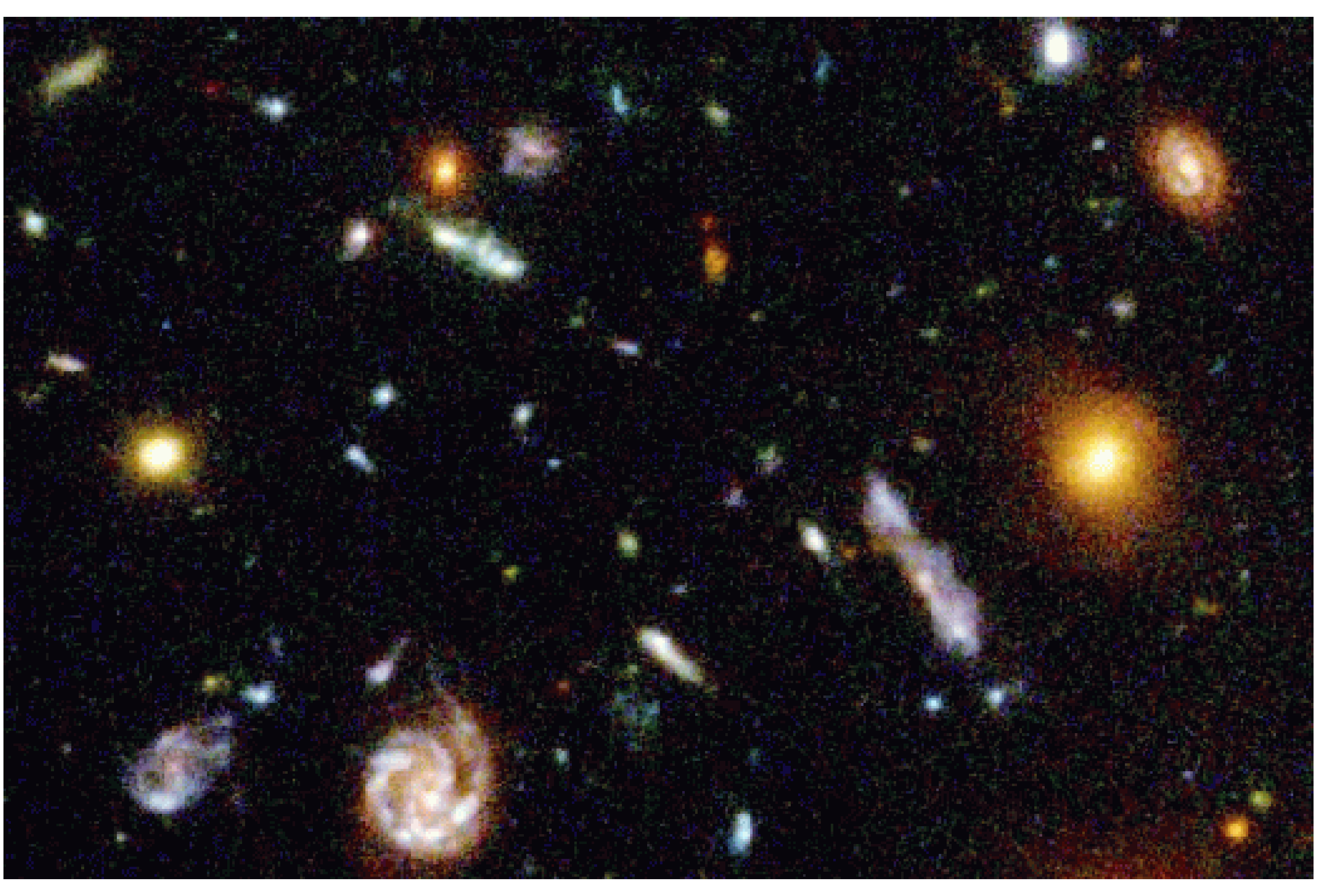
The HST Data Handbook

The comprehensive guide to calibrating, reducing, and analyzing HST data.

Archive Newsletters

The electronic newsletters provide information about the various archives supported by the Multi-mission Archive at STScI (MAST), including HST

Old HST Archive Newsletters [incomplete]:
January 17, 1995
March 21, 1995
May 23, 1995
December 12, 1995



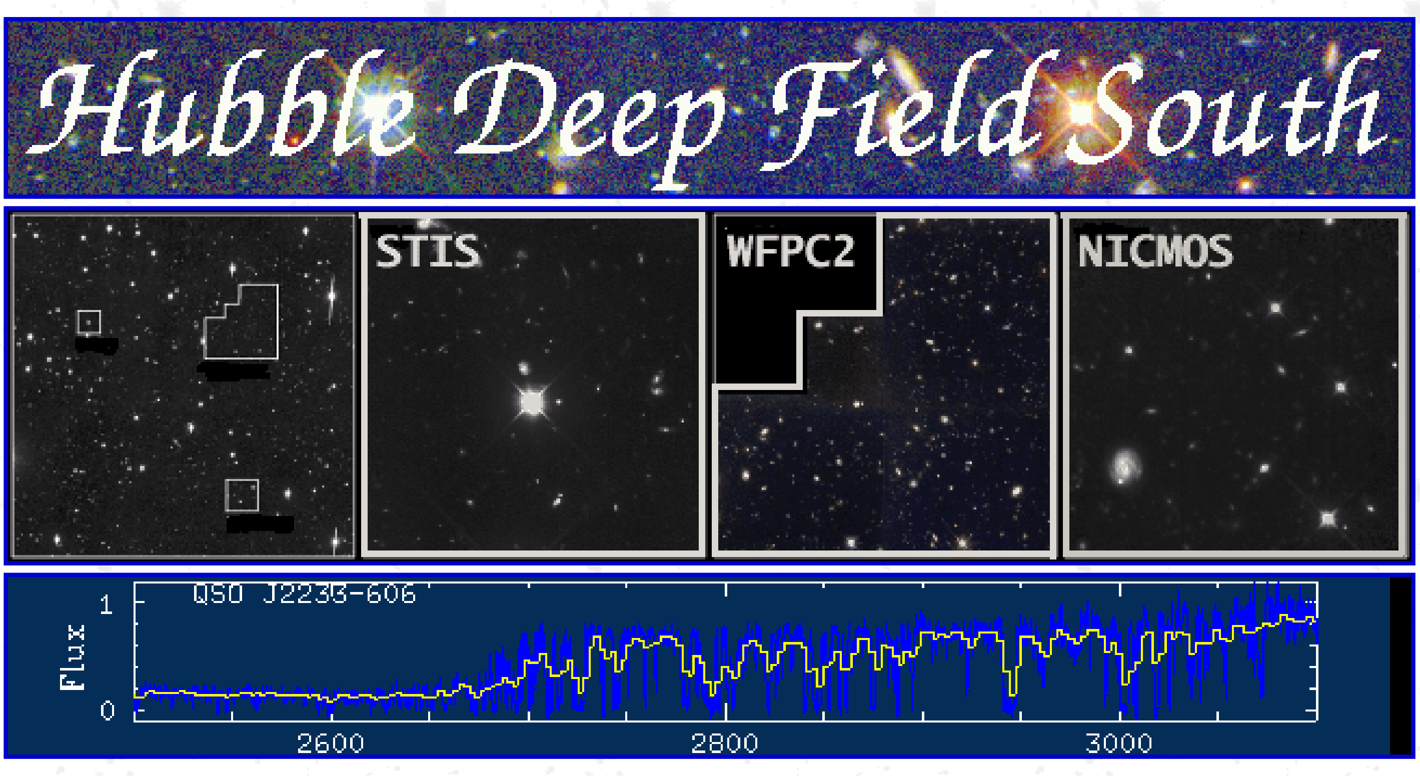
The Hubble Deep Field

- What's new ?

- The HDF Project.
- Pretty Pictures.
- Coordinates.
- How to obtain the data & catalogs.
- Observing logs and ancillary information.
- Technical information on the data reduction pipeline.
- Technical information on image registration and combination.
- Technical information on source detection and photometry.
- HDF Clearinghouse -- followup observations and analysis.
- The HDF Working Group.
- References.
- Hubble Deep Field Academy -- Educational Resource for Middle School students
- Hubble Deep Field South

The Space Telescope Science Institute home page.

Harry Ferguson ferguson@stsci.edu 10/09/01



If you are already familiar with the HDF-S, you may just want to check out **what's new**. If you are not yet familiar with the project, you may want to start by studying the **HDF-S public outreach materials and release pictures**, or by reading more about the first HST Deep Field, the **HDF (North)**. The raw, calibrated and processed HST observations of the Hubble Deep Field South (HDF-S) were released on November 23, 1998.

Project

- HDF-S Project description and Motivation.
- The HDFS Working Group.
- References.

Public Outreach

- Public Release materials and Pretty Pictures.
- Hubble Deep Field Academy (Educational Resource for Middle School students based on the HDF-N)

Data products

- How to obtain the data.
- Warnings and Advisories.
- Source Catalogs.
- Absorption Line List for QSO J2233-606.

Observational Details

- Coordinates.
- Observing strategy discussion.
- Phase 2 proposal information.
- pdf or postscript Observing timeline: graphical representation of the orbit by orbit breakdown.
- Observing logs and ancillary information:
  - STIS , WFPC2 , NICMOS , STIS-Flanking , WFPC2-Flanking , NICMOS-Flanking , SAA crossing table

Data reduction / Technical information

- STIS , WFPC2 , NICMOS , Flanking Fields

Preparatory and follow-up observations

- HDF-S Clearinghouse.

Miscellaneous

- Listing of all .html files on this web site.
- Press reports on the HDF-S.

Send us your *feedback or questions*.
Visit the Hubble Deep Field South *main page*.
Visit the Space Telescope Science Institute *home page*.

This page was last updated on March 5, 1999.

Hubble Space Telescope

The Medium Deep Survey (MDS) is an international project that uses the Hubble Space Telescope (HST) in Pure parallel mode to study the nature of faint galaxies in the deepest regions of the universe.

This site created by the MDS group at Carnegie Mellon University (CMU) gives access to data from the MDS CDROMS on a Jukebox at the Space telescope Science Institute (STScI). These now non-proprietary post-HST-refurbishment observations cover the period from February 1994 to January 1998. More MDS cdroms will be released when processed.

The released MDS database contains model fits for over 210,000 objects in over 522 WFPC2 fields, observed in most cases using the F814W (498 in I), F606W (358 in V), and for few in F450W (55 in B) photometric filters. Some fields overlap each other and duplicate observations of the same object has not yet been cross-identified.

- CMU MDS group Home-page
- Bibliography of MDS Science Publication
- Documentation
- Search the WFPC2 MDS Database at STScI (Help).
- Direct access to MDS Database on CDROM at STScI
- Clickable MDS Data of Hubble Deep Field North in color
- Top Ten Gravitational lens candidates found by MDS

Please note:
Any use of this data in a publication should reference Ratnatunga, Griffiths and Ostrander **118** 86-107 ; 1999AJ....118...86R, and make the following acknowledgment.

The Medium Deep Survey catalog is based on observations with the NASA/ESA Hubble Space Telescope, obtained at the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555. The Medium-Deep Survey analysis was funded by the HST WFPC2 Team and STScI grants GO2684, GO6951, GO7536, and GO8384 to Prof. Richard Griffiths and Dr Kavan Ratnatunga at Carnegie Mellon University.

The initial search of database is done from disk. However access to the images and specific files from the cdroms, particularly the load time to access a new cdrom and the image transformations can take an extra minutes.This could sometime timeout the html request giving an almost blank page. Reloading should recover full page. Files and images extracted from cdrom and older than one hour are deleted from the scratch disk space.

The data is provide on the web via this cgi-driver for any preliminary study of what is available on the MDS-CDROMS. Any astronomer wishing to make extensive use of this data should request a CDROM copy. Sets of copies of the CDROMS will be made after we roughly know the demand for them. There are currently 19 CDROMs and the cost of production of a full set is estimated at about US$200/-

Last modified: 4 February 1999

Please send any questions or comments to:
Kavan U. Ratnatunga

IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

UV Atlas Home | Project Info | NEWSIPS Atlas | IUESIPS Atlas | IUE Links

Project Information

- About This Project
- Observations
  - "Normal" stars
  - Star Spatial Distribution
  - Star Spectral Type Distribution
- Data Reduction
  - MXLO Data
  - New Tools
  - Image Combine
- Final Products: Catalogues and Spectra
  - Atlas
  - UV Spectra
- Acknowledgment

IUE NEWSIPS Atlas

- **Standard Star Atlas : 476 "normal" stars**
  - Standard Stars, sorted by Spectral Type
  - Standard Stars, sorted by HD Number
- **Subluminous Star Atlas : 38 Subdwarfs and White Dwarfs**
  - Subluminous Stars, sorted by Spectral Type
  - Subluminous Stars, sorted by Right Ascension

IUESIPS Atlas Addendum I & II

- Atlas Addendum I (service provided by NASA/GSFC ADF)
- Atlas Addendum II (service provided by STScI)

Related Publications & IUE Links

- Related Publications
- IUE Archive at STScI
- NASA ADF IUE
- ESA IUE

jinger@stsci.edu
last updated: **Feb. 29, 2000**

Library of *IUE* NEWSIPS SWP Echelle Spectra for White Dwarfs

---

Introduction

This site contains final processed IUE SWP echelle spectra for all 55 hot white dwarfs from the IUE Final Archive. These spectra are processed versions of the 213 NEWSIPS MXHI files as well as all the coadded spectra discussed in Holberg, Barstow and Sion (1998).

This page is organized by the McCook and Sion (1998) WD number for each star. Clicking on the WD number will lead to a list of processed spectra for that star. That list identifies individual processed NEWSIPS spectra for the selected star (by SWP number) and also any coadded spectra which were produced. All spectra are in a standard FITS format which contains wavelength, flux, flux uncertainty, and error flag vectors for the 1150 Angstroms to 1950 Angstroms range. The data set and data analysis procedures are described in Holberg, Barstow and Sion (1998). Spectra can be graphically displayed or retreived as FITS files via ftp.

Related Papers (Preprint Versions)

Sirius B: A New More Accurate View

Far UV *STIS* Spectra of the White Dwarf REJ 1032+532 I: Interstellar Line of Sight

Far UV *STIS* Spectra of the White Dwarf REJ 1032+532 II: Stellar Spectrum

A Determination of the Local Density of White Dwarf Stars

Contents of the Library

WD Number	Alternate Name	Type	V	Teff (K)	log g
H-Rich Degenerates					
WD0004+330	GD 2	DA1	13.85	49,360	7.63
WD0050-332	GD 659	DA1.5	13.36	36,000	7.68
WD0134+833	GD 419	DA2.5	13.11	18,300	7.94
WD0205+250	EG 15	DA2.5	13.22	20,000	7.7
WD0232+035	Feige 24	DA1+dMe	12.25	62,950	7.20
WD0343-007	KUV343-7	DA1	14.91	65,780	7.67
WD0346-011	GD 50	DAO1	14.06	43,200	9.2
WD0347+171	V 471 Tau	DA1.5+K2V	13.64	32,400	8.27
WD0413-077	40 Eri B	DA3	9.51	16,400	7.85
WD0441+467	S 216	DAO1	12.67	83,800	7.17
WD0455-282	REJ0457-281	DA1	13.95	57,200	7.88
WD0501+527	G191-B2B	DA1	11.73	56,000	7.5
WD0512+326	KW Aur C	DA1+F4V	13.9	46,550	8
WD0518-105	REJ0521-102	DA1.5	15.89	33,000	8.7
WD0549+158	GD 71	DA1.5	13.03	32,750	7.68
WD0612+177	EG 46	DA2	13.37	25,165	7.83
WD0621-376	REJ0623-374	DA1	12.09	60,300	7.34
WD0642-166	Sirius B	DA2+AOV	8.44	24,790	8.57
WD0644+375	EG 50	DA2.5	12.05	21,000	8.04
WD1013-050	REJ1016-053	DAO+dMe	14.21	56,400	7.74
WD1031-114	EG 70	DA2	13.02	25,800	7.94
WD1134+300	GD 140	DA2	12.49	21,700	8.5
WD1148-230	EC1148-2	DAO	11.76	>50,000	8
WD1202+608	Feige 55	DAO+D?	13.61	58,300	7.15
WD1210+533	PG1210+533	DAO1	14.12	44,800	7.89
WD1234+481	HS1234+481	DA1	14.42	56,400	7.67
WD1254+223	GD 153	DA1.5	13.35	38,686	7.66
WD1302+597	GD 323	DAB1.5	14.52	28,750	8
WD1314+293	HZ 43	DA1	12.91	50,560	7.95
WD1337+705	EG 102	DA2.5	12.77	20,230	7.9
WD1615-154	EG 118	DA1.5	13.42	29,732	7.94
WD1620-391	CD-38 10980	DA2	11.01	24,800	8.05
WD1631+781	REJ1629+780	DA1+dMe	14.1	44,560	7.79
WD1800+685	KUV	DA1	14.72	46,000	7.68
WD1845+019	Lanning 18	DA1.5	12.95	29,450	7.84
WD2004-605	REJ2009-602	DA1	13.59	44,200	8.14
WD2028+390	GD 391	DA2	13.39	24,300	7.89
WD2032+248	Wolf 1346	DA2.5	11.53	20,000	7.9
WD2111+498	GD 394	DA1.5	13.09	37,360	7.83
WD2117+539	G231-40	DA3.5	12.33	14,490	7.85
WD2211-495	REJ2214-491	DA1	11.71	63,500	7.5
WD2309+105	GD 246	DA1	13.10	58,700	7.81
WD2331-475	REJ2334-471	DA1	13.44	55,800	8.07
WD2350-706	HD223816B	DA1+F5IV	14.4	69,300	8
He-Rich Degenerates					
WD0005+511	KPD0005+5106	DO	13.32	120,000	7
WD0044-121	NGC 246	PNN	13.40	150,000	5.7
WD0112+104	PG0112+104	DB1.5	15.36	30,800	7.8
WD0501-289	REJ0503-289	DO	13.90	70,000	7.5
WD1034+001	PG1034+001	DO	13.22	100,000	7.5
WD1159-034	PG1159-035	PG1159	14.87	140,000	7
WD1211+332	HZ 21	DO2	14.22	53,000	7.8
WD1634-573	HD149499B	DO+KOV	11.7	49,500	8
WD1645+325	GD 358	DB2	13.62	27,000	8
WD1821+643	K1-16	PG1159	15.04	140,000	6.1
WD2117+342	RXJ2117.1+341	PG1159	13.16	170,000	6

VizieR Service

NEW **The GSC-II is now accessible**

Browsing through Catalogues · Output Preferences — FAQ · More about VizieR

Direct access to Catalogues from Name or Designation (tips and examples)

[Clear] [ ] [Find Catalogue]

Find catalogues or Data (tips and examples)

Find catalogues among 3367 available

Words matching author's name, word(s) from title, description, etc.

☐ Use LISTs of Targets

Select from **Wavelength**, **Mission**, and controlled **Astronomical** keywords:

Wavelength	Mission	Astronomical
Radio	ANS	AGN
IR	ASCA	Abundances
optical	BeppoSAX	Ages
UV	CGRO	Associations
EUV	COBE	Atomic_Data
X-ray	Chandra	BL_Lac_objects
Gamma-ray	Copernicus	Binaries:cataclysmic
	EUVE	Binaries:eclipsing

[Find Catalogues] [Clear]

Target Name (resolved by SIMBAD) or **Position**: J2000 — Target radius: 10 arcmin

[Find Data] around **Target**

Position in ◉ Sexagesimal, or ○ Decimal ° — ◉ Radius or ○ Box size

Search by Position across 2928 tables

Output preferences (usage)

Maximum Entries per table: 50 — Output layout: HTML Table — **ALL** columns ☐ — [Reset All]

	r	x,y	Position	Galactic	J2000	B1950
Compute	☑	☐	☑	☐	☐	☐
Sort by	◉	○	○	○	○	○

r and **x,y** are the distance to the Target; **Position** is in the same coordinate system as **Target**.

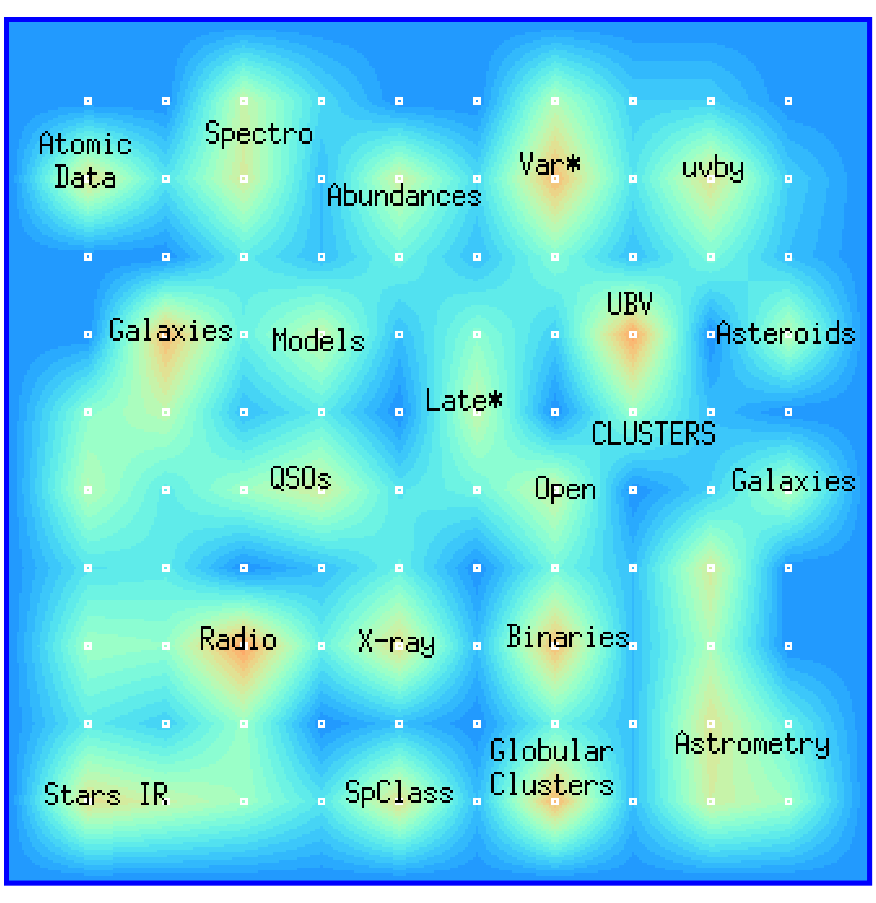
This *Bookmark Button* will help you for bookmarking: by clicking on this button, the current page, completed with your input, will be reloaded to be safely included into your bookmark or favorite list [B]

Browsing through Catalogues

Browsing modes via: Designations · Acronyms · Favorites · Date · Images/Spectra

This **Kohonen Self-Organizing Map** is based on a neural network analysis of the keywords associated to the catalogues (see Poinçot et al., 1998A&AS..130..183P; and Lesteven et al., 1996VA.....40..395L)

Each dot marks a map area; colour denotes the *density* or the *clustering tendency* of the documents; deep blue areas have the lowest density. Just click any area on the map to get the corresponding list of catalogues found in that area.



Other Installations of VizieR

Some other installation of VizieR could be closer to you, and answer faster:

NASA/ADC, USA · Tokyo, Japan · IUCAA, India · CADC, Canada · Cambridge, UK · INASAN, Russia · Bejing Obs., China

MAST Prepared Science Products

The following is a listing of sites of highly processed datasets from missions supported by MAST. These are datasets consisting of atlases, images, and/or the data themselves which have been placed on the web either as final data products or as appendices referenced in recent published papers. These data are in the public domain and/or will soon be published. The datasets are organized by type of observation (survey, individual objects, time series) and will include a growing number of catalogs with links to the data and in some cases spectra and/or images.

Deep Sky Surveys

- Hubble Deep Field
- Hubble Deep Field South
- Medium Deep Survey

Wide Field Survey Catalogs

- Magellanic Clouds Planetary Nebulae (HST)
- SDSS Quasar Catalog

Spectral Atlases: multi-object samples

- Ultraviolet Spectral Atlas of Standard Stars (IUE)
- Library of Copernicus Atlases of Selected Stars
- Far-Ultraviolet Spectral Atlas of Stars (EUVE)
- Library of IUE NEWSIPS SWP Echelle Spectra for White Dwarfs
- FOS Composite Quasar Spectrum (FOS)

Spectral Atlases: individual objects

- High S/N GHRS LSA G160M Observations of 10 Lacertae (HST)
- High S/N GHRS SSA Echelle Observations of chi Lupi (HST)
- High S/N GHRS SSA Observations of Chromospheric lines in Procyon (HST)
- High S/N GHRS LSA G270M Observations of alpha Ori (HST)

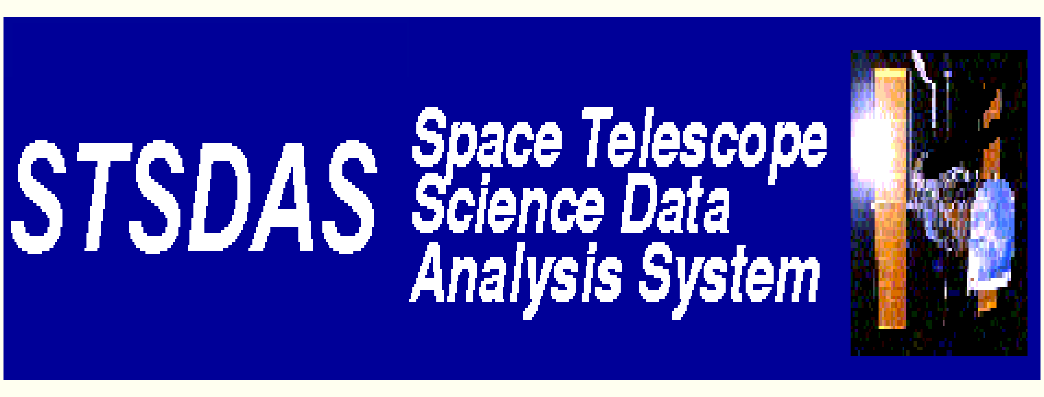
Time-Dependent Spectra

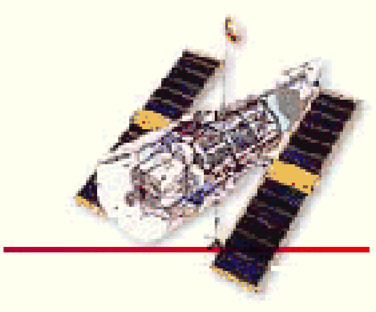
- Grayscale of Time Variations of gamma Cas near SiIV Doublet (HST)

Guidelines for authors of new prepared science products

For further information see: VizieR astronomical catalogs

Search • Topics • Index





STSDAS is the software for reducing and analyzing data from the Hubble Space Telescope. It is layered on top of IRAF and provides general purpose tools for astronomical data analysis as well as routines specifically designed for HST analysis.

About STSDAS/TABLES	Description of STSDAS and TABLES software.
STSDAS/TABLES v2.3	**Announcing the release of STSDAS/TABLES version v2.3 20 June 2001**
Download TABLES & STSDAS	**Download STSDAS/TABLES software.**
Documentation	Manuals are provided for online viewing, or can be downloaded for printing. Quick reference cards are also available.
Previous news items on STSDAS	Updated 17 May 2001
Getting Help	Contacting the HST Helpdesk and STSDAS Group; as well as other user support services.
Online help	The online help system can be browsed from within the web environment.

Related Sites:

SSG Home Page
STSDAS Home Page
Pyraf Home Page
IRAF
Archive
ST-ECF
Observing with HST
Proposing
Resources for Observers
Schedule
Search · Topics · Index

Eric W. Wyckoff, - - wyckoff@stsci.edu

Last updated: 14 *December 2001*

The links on this page cover the major topics on this Web site; they are arranged like a book index.

webmaster@stsci.edu
Last updated: 14 October 1999

ST ScI Web by Topic

About ...	Pictures & News Releases	Education Activities	Observing with HST	Data Archive	Science Resources
About HST & NGST NASA description of HST Technical HST overview **About STScI** The organization STScI & the Astronomical Community Related Organizations Staff Our Web site Employment Opportunities	Latest pictures Pictures by subject Greatest Hits Animations Background information	Amazing Space Trading Cards Hubble Academy Student Astronaut Challenge ExInEd Electronic Picturebooks Open Night Live from HST	Proposing to use HST Resources for Observers Program Status Info Observatory ACS FGS FOC FOS GHRS NICMOS STIS WFPC2 WFPC1 Future Generation	HST Data Archive DSS Guide Star Catalog (GSC) StarView What's New HST Pure Parallels	AstroWeb Library & Publications STSDAS Data Handbook Conference Proceedings Richardson - Lucy Deconvolution (JPL) Software at ST-ECF
About ...	Pictures & News Releases	Education Activities	Observing with HST	Data Archive	Science Resources

Harry Payne (webmaster@stsci.edu)
Last updated: 28 October 1998

Search for: [ ] Submit Options

Perform a search through the text of on-line Web documents. Enter some keywords and press return. Phrases should be enclosed in double quotes or hyphenated.

If you get too many hits, try entering more keywords, changing the proximity control if your keywords should appear together, or excluding terms by preceeding them with a minus sign. For example, to search for exposure time calculators other than the one for NICMOS, try the query

> "exposure time calculator" -nicmos

If you get too few hits, try fewer keywords, and check your spelling. More extensive help is available by following this link:

Help

INFORMATION

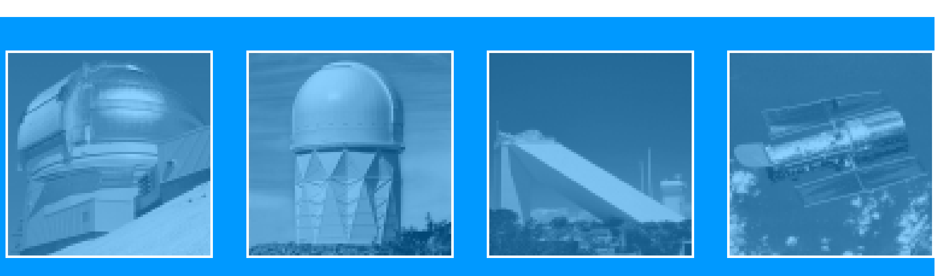
See our FAQ page for AURA copyright permission, university programs, and employment.

EDUCATION

Looking for educational astronomy info? See our Astronomy Info and Resources page.
New: Astronomy Education Review

SEARCH

GO
provided by Atomz.com

AURA


Association of Universities for Research in Astronomy

WHO WE ARE who we are, our astronomy centers, astronomy info and resources, frequently asked questions, AURA directory, message from our president, corporate office info

NEWS&VIEWS news and updates, policy papers, reports and projects

MEMBERSHIP membership in AURA, member institutions and representatives, membership guidelines

FELLOWSHIPS AURA fellowship programs, Claudio Anguita fellowships, U.S. Gemini fellowships

MEETINGS listing of upcoming meetings and events

GOVERNANCE Board of Directors, AOC-G, OC, SOC, STIC, ACCORD, distinguished advisors

AURAnet for the employees and governance of AURA and its centers (restricted)

WHAT'S NEW

AURA announces U.S. Gemini Fellowship Award

AURA Dedicates Gemini South Telescope

On January 18th, AURA formally dedicated the Gemini South Telescope completing the Gemini Observatory construction. The Dedication was attended by **President Lagos**, **Rita Colwell**, and other partner representatives. A selection of statements, images, and materials can be found by at the **Gemini Website**.

AURA Establishes Schommer Educational Fund

On December 19, friends and colleagues from around the world commemorated the life and contributions of Bob Schommer who died this month. **Bob Schommer, Director of the U.S. Gemini Science Center**, was known for his dedication to science and his energetic support for Gemini and CTIO users. This site includes statements and testimonials to Bob's contributions to astronomy. In addition, AURA has established the **Schommer Children's Fund** to assist the Schommer family in meeting the future educational expenses of the children Robert, Andrea, and Paulina. Friends and colleagues are invited to contribute to this fund.

First Announcement

Hubble's Science Legacy: Future Optical-UV Astronomy from Space, April 2-5, 2002
University of Chicago

A workshop on the science opportunities, performance requirements and technology developments needed for a large Optical-UV space telescope, in the decade following the de-orbiting of the Hubble Space Telescope when NGST is launched.

March 22, 2002
Text Only Version

NASA's Vision
(*Flash* movie)

Sean O'Keefe, Administrator

The President's Management Agenda

Search NASA's Web
Enter search words

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Search Options

Find It on the NASA Web

Navigating NASA's Strategic Enterprises
- Aerospace Technology
- Biological and Physical Research
- Earth Science
- Human Exploration and Development of Space
- Space Science

NASA for Kids

More About NASA:
- FY2003 NASA Budget
- Doing Business with NASA
- Educational Resources
- Freedom of Information Act
- History
- Jobs and Internships
- NASA Technology Portal
- News and Information
- Organization and Subject Index
- Project Home Pages
- Research Opportunities
- Scientific and Technical Information
- See a Launch
- Launch Schedule
- Speakers Bureau
- Spinoffs and Commercial Technology
- Visiting NASA
- Dreamtime

NASA

Students Operate Mars Odyssey Camera

A group of small, unnamed craters in the Martian southern hemisphere is the first site captured by a group of middle school students who are operating the camera system onboard NASA's Mars Odyssey spacecraft this week. The acquisition of the image marks the beginning of the Mars Student Imaging Project, a science education program funded by NASA and its Jet Propulsion Laboratory, Pasadena, Calif., and operated by the Mars Education Program at Arizona State University, Tempe. The project gives thousands of fifth to 12th grade students the opportunity to do real-life planetary exploration and to study planetary geology using Odyssey's visible-light camera. (Full Story)
(03/21/2002)

today@nasa.gov

FY2003 NASA Budget

NASA Home Page Survey

Top Search Terms

NASA TV Schedule

See the Space Station

Interested in the latest information NASA has to offer? Then take a look at today@nasa.gov. This on-line newsletter, updated daily, contains the latest news about NASA science and technology.

- Students Operate Mars Odyssey Camera
- Space Station to Receive First Space Railroad
- Experiments in Space Illustrate Effect of Gravity on the Brain

Cool NASA Websites

International Space Station | NASA Webcasts | Mars Odyssey

Other Cool NASA Websites

[Frequently Asked Questions] [Hot Topics] [Multimedia Gallery] [NASA Television]
[Text Only Version]
[NASA Privacy Statement, Disclaimer, and Accessibility Certification] [Site Maps]

FIRSTGOV
Your First Click to the U.S. Government

Author: Elvia Thompson
Responsible NASA Official: Brian Dunbar
Site Maintainer: K F Chow
Comments and Questions
Last Updated: March 21, 2002

IRAF
Image Reduction and Analysis Facility

Welcome to the IRAF Homepage! *IRAF* is the Image Reduction and Analysis Facility, a general purpose software system for the reduction and analysis of astronomical data. IRAF is written and supported by the IRAF programming group at the National Optical Astronomy Observatories (NOAO) in Tucson, Arizona. NOAO is operated by the Association of Universities for Research in Astronomy (AURA), Inc. under cooperative agreement with the National Science Foundation

News!

- GEMINI V1.3 Reduction Pkg Released *(updated 14March2002)*
- Upcoming IRAF V2.12 Highlights *(updated 01Feb2002)*
- Upcoming X11IRAF V1.3 Highlights *(updated 04Mar2002)*
- Mac OS X/LinuxPPC Port Information *(updated 05Oct2001)*

IRAF V2.11.3 Releases: *(December 1999)*

- V2.11.3b Patch *(18Sep2000)*
- V2.11.3a Patch *(11Feb2000)*
- SunOS/Solaris
- PC-IRAF (Linux/FreeBSD/Solaris)
- Digital Unix V4.0
- HP/UX 10.20
- SGI IRIX 6.5
- IBM AIX V4.1
- OpenVMS 7
- V2.11.3 Errata *(21Jan2000)*

Past Features:

- ADASS 2001 Information *(Past ADASS Conferences)*
- X11IRAF V1.2 Release
- Image Display from Host Programs
- Host CL Scripting Capability
- SYSINFO Diagnostic Tool
- GUI Applications Package
- Test Your IRAF Knowledge
- Online CD-ROM Order Form
- IRAF V2.11 Release Notes
- April 1998 IRAF Newsletter

What is it? How do I get it?

IRAF is the "Image Reduction and Analysis Facility". The main IRAF distribution includes a good selection of programs for general image processing and graphics, plus a large number of programs for the reduction and analysis of optical and IR astronomy data (the "noao" packages). Other external or layered packages are available for applications such as data acquisition or handling data from other observatories and wavelength regimes such as the Hubble Space Telescope (optical), EUVE (extreme ultra-violet), or ROSAT and AXAF (X-ray). These external packages are distributed separately from the main IRAF distribution but can be easily installed. The IRAF system also includes a complete programming environment for scientific applications, which includes a programmable Command Language scripting facility, the IMFORT Fortran/C programming interface, and the full SPP/VOS programming environment in which the portable IRAF system and all applications are written.

IRAF is freely available on all platforms via anonymous ftp to our server at iraf.noao.edu or for a small cost it may be ordered on tape or CD-ROM. If you are unsure about whether IRAF can help you, we have a FAQ (frequently-asked questions list) to answer this particular question.

How to Contact Us:

IRAF Site Support is available to help users with problems or questions installing or using the system. Electronic mail is logged to guarantee a reply and questions are usually answered within 24 hours. If you can't find the answers you need in this document or our FAQ feel free to contact us by whichever means is most convenient:

- E-mail - **iraf@noao.edu** or **noao::iraf**
- Hotline - **(520) 318-8160** FAX - **(520) 318-8360**

Users may also send questions to the ADASS newsgroups. This is encouraged especially for general interest questions and discussions, site-specific problems should probably be sent to us by email although they will still be answered if posted.

Other Projects Using IRAF

IRAF is in use by thousands of astronomers at more than 1500 sites world-wide. Some of the larger projects using IRAF include:

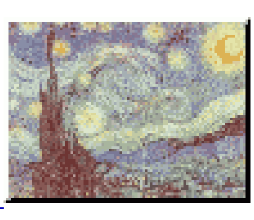
- AXAF - Advanced X-ray Astrophysics Facility
- EUVE - Extreme Ultraviolet Explorer
- FTOOLS - FITS utility package from HEASARC
- GONG - Global Oscillation Network Group
- PROS - ROSAT XRAY Data Analysis System
- STSDAS - Space Telescope Science Data Analysis System

Number of IRAF Homepage visitors (unique hosts):
If you have any comments or suggestions, let us know!

National Optical Astronomy Observatories

AURA

nsf



IRAF Project
National Optical Astronomy Observatories
950 North Cherry Avenue
Tucson, Arizona 85719
(520) 318-8000
iraf@noao.edu

Last updated: undefined

STSDAS Space Telescope Science Data Analysis System

Calibration and analysis software for Hubble Space Telescope data

Introduction to STSDAS

Versions and Packages

In addition to STSDAS, the STSDAS Group maintains additional software that is provided as external packages in the IRAF environment. The major external packages that you will find on STEIS include:

- TABLES
- HST_PIPELINE
- VDISPLAY

The current version of STSDAS is V2.3; The current version of TABLES is also V2.3. *You must install TABLES before installing STSDAS.*

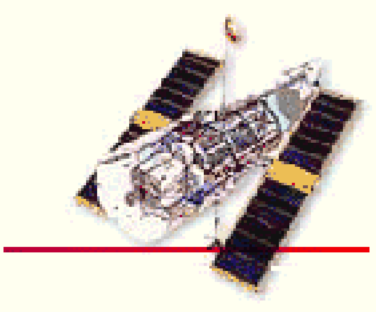
STSDAS Package Organization

Programs in STSDAS are called *tasks*. Tasks are grouped by function into *packages*. Some of the major packages in STSDAS include:

analysis
fitsio
graphics
hst_calib
toolbox

More than 400 tasks comprise STSDAS V2.0.

The STSDAS Group (stsdas@stsci.edu)
Last updated: 11 May 2000



ESS/SSG -- Space Telescope Engineering and Software Services

Science Software Group

The **SSG software development group** produces and supports software products such as:

STSDAS/TABLES	STSDAS/TABLES software homepage. HST instrument calibration pipelines.
Python programming	Python Programming exercises, links...
Pyraf	Pyraf Home page
PyFITS	PyFITS Home page
NumArray	NumArray Home page
IGI	Interactive Graphics Interpreter interactive scripting demo page.
FUSE calibration pipeline	
SSG internal page...	SSG Internal page, visible to stsci.edu domain [only]

Related Sites:

SSG Home Page
STSDAS Home Page
Pyraf Home Page
IRAF
Archive
ST-ECF
Observing with HST
Proposing
Resources for Observers
Schedule
Search · Topics · Index

Eric W. Wyckoff, - - wyckoff@stsci.edu

Last updated: *14 December 2001*

PyRAF Home Page

PyRAF is a new command language for IRAF based on the Python scripting language. It is useful both for interactive data analysis and for writing analysis scripts. PyRAF coexists with the current IRAF CL; no changes need be (or should be) made to your installed IRAF system to use it. PyRAF has been developed by the Science Software Group at the Space Telescope Science Institute.

What is PyRAF?	A detailed overview of why we developed PyRAF, what it is good for, and what our general plans are.
The PyRAF Tutorial	Currently the best (and only :-) documentation on how to use PyRAF.
Learning more about Python	
• **Quick Tour**	A mini-tutorial on the key features of Python, with pointers to sources for further information.
• **Intro to Python - viewgraphs (PDF)**	Viewgraphs from an introductory lecture on Python.
• **Documentation & Books**	This is a link to a list of available tutorials and books on Python.
• **Index of Python Modules**	This is a link to pydoc created web pages of all Python modules installed at the STScI.
Download PyRAF Beta Version	PyRAF v0.9.1 (Last updated 2001 Dec 14) NEW! Information on what was recently fixed.
Register for PyRAF Beta Version	Use this form to register to receive notification when a new version of PyRAF will be ready for downloading.
PyRAF News	News about PyRAF (last updated 2001 December 6).
Frequently Asked Questions	Follow the link at the top to search the FAQ (though currently the list is short.)
Important Information for PyRAF Beta Testers	Desired feedback, future release plans.
Known Shortcomings, Differences from IRAF, Planned Improvements, and Bugs	Summary of known bugs and limitations of current version of PyRAF, differences from the IRAF CL, and a sketch of plans for the future.
Python software at STScI	Python, PyRAF, PyFITS, NumArray, 3rd party libraries: versions and configuration at STScI.

Perry Greenfield & Rick White
Questions? Contact help@stsci.edu

Eric W. Wyckoff, - - wyckoff@stsci.edu
Last updated: *04 January 2002*

Space Telescope European Coordinating Facility

HUBBLE European Space Agency Information Centre

ASTRO VIRTEL

Servicing Mission 3B
Launched 01/03 12:22am CET
photo1 - photo2 - movies - video feeds - j-track - sm3b schedule - latest news

SM3B Objectives
ACS - NICMOS - solar panels (EVA 1: pictures) - power control unit - multi layer insulation - boost - other servicing missions

FOS BLUE data recalibrated
Final release of STPOA package from the POA FOS project

General Information	*ST-ECF Activities*	*Miscellany*
What's New	**HST Instruments** - Current and future instruments	**Observing with HST** - Proposal preparation, Exposure Time Calculators Latest RPS2 version
About ST-ECF - Staff, User Committee, Visitor Information, History.	**ST-ECF Post-Operational Archives** - Improving calibration of legacy instruments. **Latest: STPOA Package version 1.2.2**. FOS **user support**.	**Special HST Observation Programmes** STIS Parallel Programme (Cosmic Shear project), HDFs
About HST - Introduction to HST	**Software Development at ST-ECF** Drizzle, NICMOS s/w, IRAF Mirrored at ST-ECF, Tiny Tim, Tools & Utilities, ST-ECF IRAF Package, Software Links, Scisoft	**ST-ECF Conference page** - Past and future conferences
About NGST - Introduction to the Next Generation Space Telescope	**ST-ECF/ESO Archive** - Information about, and access to, HST observations and ESO observations; DSS, GSC, etc.	**HST Documentation** - Information for users
ST-ECF Newsletter - Our Newsletter is online **Latest: No 30 January 2002**	**European HST Public Outreach** - Increasing public awareness of the European part of HST	**Our Linkpage** - Related web sites (ESO, ESA Hubble, STScI, NASA) ESO ADS mirrored service
Search	***Alert Service***	***STDesk***

*The **Hubble Space Telescope** (HST) is a joint project between the US National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA).*
*The **Space Telescope European Coordinating Facility** (ST-ECF), jointly operated by ESA and the European Southern Observatory (ESO), is the European HST science facility, supporting the European astronomy community in exploiting the research opportunities provided by the Hubble Space Telescope.*

Maintained by Webmaster

HST Observer's Menu
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Defining HST Observations
Changing Programs & Resolving Problems
Scheduling Observations
Science Instruments & Calibration
RetrievingData
Data Analysis
Publishing
Documents
Getting Help

Proposing, Observing, and Handling Data from HST

Proposing to Use HST

- **The Cycle 11** Call for Proposals
- Overview of the Proposal Process.
- Director's Discretionary Time
- Approved Programs for Recent Cycles:
  - **Cycle 10** (Approved Programs, Abstract Catalog and Exposure Catalog)
  - Cycle 9 (Approved Programs, Abstract Catalog and Exposure Catalog)
  - Cycle 8, Cycle 7-NICMOS, Cycle 7 and Cycle 6
- Special Opportunities

Defining HST Observations: Guidlines, Grants and Instructions

- Policies and Guidelines and a Phase 2 Checklist
- Visit Size Recommendations
- Current Phase 2 Proposal Instructions
- Remote Proposal Submission 2 (RPS2):
  - Software Directory
  - User's Manual (also available in PDF format)
- New Astronomer's Proposal Tool (including Visual Target Tuner)
- Target Coordinate Instructions and Assistance
- HST User Information Reports: Technical reports for HST Observers.
- Activating Your Target of Opportunity
- Grant Information and Budget Forms

Changing Programs & Resolving Problems

- Policies on Duplications, Changes to Programs, and Repeats of Failed Observations (PDF version)
- Resubmitting a Phase 2 Program
- Catalogs of Completed and Scheduled HST Observations
- Reporting Problems and Major Change Requests:
  - Resolving Apparent Duplications and Conflicts of Data Rights
  - Requests for Major Changes to a Program
  - HST Observation Problem Reports (HOPRs)
  - HOPR Status Reports

Scheduling Observations

- How HST is Scheduled
- Information on the Status of an Observing Program
- Daily HST Status Reports
- The Weekly Observing Schedule

Science Instruments and their Calibration

- Current Instruments:
  Fine Guidance Sensors (FGS), Space Telescope Imaging Spectrograph (STIS), and Wide Field/Planetary Camera 2 (WFPC2)
- Future Instruments:
  Advanced Camera for Surveys (ACS), Cosmic Origins Spectrograph (COS), and Wide-Field Camera 3 (WFC3)
- Previous Instruments:
  Faint Object Camera (FOC), Faint Object Spectrograph (FOS), Goddard High Resolution Spectrograph (GHRS), High Speed Photometer (HSP), Near Infrared Camera and Multi-Object Spectrometer (NICMOS), and Wide Field/Planetary Camera (WFPC)
- General Observatory Support:
  Calibration and throughput data for HST and its SIs, focal plane calibrations, SI aperture positions, telescope pointing and jitter infromation, and any focus variations

Finding and Retrieving HST Data: The Hubble Archive

HST Data Reduction and Analysis

Publishing Your HST Data

Documents and Getting Help

- The STScI Help Desk is always available to answer your questions at (410)-338-1082 (toll free U.S. number 1-800-544-8125)

HST Data Handbook

webmaster@stsci.edu
Last update: January 05, 2001

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Proposing to Use HST

The Cycle 11 Call for Proposals

The Call for Proposals describes the policies and procedures for proposing to use HST.

The proposal process

Read a brief description of proposal preparation process -- from the initial Call for Proposals (CP) to final acceptance of a Phase II proposal.

Requests for Director's Discretionary Time

Up to 10% of the available HST observing time may be reserved for Director's Discretionary (DD) allocation. A DD proposal is appropriate when a truly unexpected transient phenomenon occurs or when developments since the last proposal cycle make a time-critical observation necessary. Check the DD proposal submission page for details.

Results from Cycle 11 proposal selection

- Approved Programs
- Abstract Catalog
- Exposure Catalog

Results from past proposal selections:

- Cycle 10 Approved Programs
- Cycle 10 Abstract Catalog
- Cycle 10 Exposure Catalog
- Cycle 9 Approved Programs
- Cycle 9 Abstract Catalog
- Cycle 9 Exposure Catalog
- Cycle 8
- Cycle 7-NICMOS
- Cycle 7
- Cycle 6

Special Opportunities

Education and Public Outreach Proposals

Brett Blacker blacker@stsci.edu
Last updated: December 10, 2001 by bsb

SPACE TELESCOPE SCIENCE INSTITUTE
Operated for NASA by AURA

HST Program Information

HUBBLE SPACE TELESCOPE

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HST Proposal Information

To obtain information about a specific proposal, enter the **Proposal ID** or the **PI's Last Name** and hit the button to the right of the entry box.

Proposal ID = [ ] [Get Proposal Information] [Clear Field]
PI's Last Name = [ ] [Find Proposals] [Clear Field]

HST Schedule Information

- Preliminary Observation Timeline Reports
- Daily Status Reports

Your comments on these pages are most welcome. Send mail to help@stsci.edu. NEW List of changes

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help@stsci.edu
Last updated: 18 February 2000

STSDAS Space Telescope Science Data Analysis System

STSDAS v2.3 Release Notes Summary - 06/12/2001

STSDAS v2.3 Release Notes - 06/12/2001

TABLES v2.3 Release Notes Summary - 06/12/2001

TABLES v2.3 Release Notes - 06/12/2001

STSDAS v2.2 Release Notes Summary - 08/18/2000

STSDAS v2.2 Release Notes - 08/18/2000

TABLES v2.2 Release Notes Summary - 08/18/2000

TABLES v2.2 Release Notes - 08/18/2000

STSDAS/TABLES v2.1.1 Release Notes Summary - 12/10/1999

Patch Release Notes STSDAS v2.1.1 - 12/10/1999

Patch Release Notes TABLES v2.1.1 - 12/10/1999

Release Notes STSDAS 2.1 - 09/22/1999

Release Notes TABLES 2.1 - 09/22/1999

Release Notes STSDAS 2.0.2 - 10/06/1998

Release Notes TABLES 2.0.2 - 10/06/1998

Release Notes STSDAS 2.0.1 - 3/24/98

Release Notes TABLES 2.0.1 - 3/24/98

Release Notes for STSDAS 2.0 - 09/11/1997

Release Notes for TABLES 2.0 - 09/11/1997

STScI Home Page · Search · Topics · Index

Eric W. Wyckoff - - *wyckoff@stsci.edu*
Last updated: *02 January 2002*

Getting STSDAS and TABLES Software

Before You Begin...

STSDAS runs in the IRAF environment. If you do not already have IRAF installed on your local system, you will need to get and install IRAF before installing STSDAS. If you do not have IRAF, you can retrieve it from The IRAF group at NOAO.

STSDAS v2.3 was tested under IRAF v2.11.3. IRAF v2.11.3 is currently available for the follow platforms:

- Solaris V5.5.1
- Solaris V5.8
- SunOS 4.1.3
- Red Hat 6.1
- Slackware 3.3
- FreeBSD 2.2.5
- DEC Alpha - Digital Unix (OSF1) V5.1
- HP-UX B.10.20
- SGI IRIX 6.5

Summary of the installation instructions:

Complete installation instructions and information for system administrators is provided in the PostScript file, *STSDAS Site Manager's Installation Guide and Reference*.

Please register your site as an STSDAS user when you install the software. This will enable us to keep you informed of software upgrades and other information. The registration form also contains check boxes that can be used to request STSDAS software on magnetic tape.

If you have any problems with the installation or software retrieval, contact the STScI Help Desk: `help@stsci.edu`

Getting STSDAS and TABLES

There are a number of ways to get the files over the network:

STSDAS

**** Current version ****

- Retrieve STSDAS V2.3 pre-compiled binaries in a series of split compressed tar file s.
- Retrieve STSDAS V2.3 source code in a series of split compressed tar files.
- Retrieve STSDAS V2.3 source code in one large compressed tar file.

**** Older versions ****

- Retrieve STSDAS V2.2 source code in a series of split compressed tar files.
- Retrieve STSDAS V2.2 source code in one large compressed tar files.
- Retrieve STSDAS V2.1.1 source code in a series of split compressed tar files.
- Retrieve STSDAS V2.1 source code in a series of split compressed tar files.
- Retrieve STSDAS V2.0.2 source code in a series of split compressed tar files.
- Retrieve STSDAS V2.0.1 source code in a series of split compressed tar files.
- Retrieve STSDAS V2.0 source code in a series of split compressed tar files.
- Retrieve STSDAS V1.3 source code in a series of split compressed tar files.

TABLES

**** Current version ****

- Retrieve TABLES V2.3 pre-compiled binaries in a series of split compressed tar files.
- Retrieve TABLES V2.3 source code in a series of split compressed tar files.
- Retrieve TABLES V2.3 source code in one large compressed tar file.

**** Older versions ****

- Retrieve TABLES V2.2 source code in a series of split compressed tar files.
- Retrieve TABLES V2.2 source code in one large compressed tar files.
- Retrieve TABLES V2.1.1 source code in a series of split compressed tar files.
- Retrieve TABLES V2.1 source code in a series of split compressed tar files.
- Retrieve TABLES V2.0.2 source code in a series of split compressed tar files.
- Retrieve TABLES V2.0.1 source code in a series of split compressed tar files.
- Retrieve TABLES V2.0 source code in a series of split compressed tar files.
- Retrieve TABLES V1.3 source code in a series of split compressed tar files.

The STSDAS Group (stsdas@stsci.edu)
Last updated: 20 June 2001

STSDAS Documentation

You can read STSDAS documentation online, download PostScript files and print documents yourself, or request printed versions of the documents.

Help System

Browse the online help system. This is the same information available to you from within STSDAS.

CVOS manual
: Documentation for the C Interface to the IRAF Virtual Operating System.

Manuals
: List of available manuals. Manuals can be viewed online or downloaded as PostScript files.

Quick Reference Cards
: Cards can be downloaded as PostScript files.

Intro CL Programming Course
: Viewgraphs and resources of a course introducing the CL as a programming language.

IGI Tutorial

Manuals

- **STSDAS User's Guide**
  Read online

  Download PostScript file
- **STSDAS Site Manager's Installation Guide and Reference**

  Download PostScript file (updated June 2001)
- **STScI User's Guide to the FITS kernel**
  Read online
  - **Download compressed file from NOAO: fits_userguide.ps.Z**
- **STScI Site Guide for IRAF and STSDAS**
  Read online

  Download PostScript file
- **IGI User's Guide**
  Read Online (old version)

  Download PostScript file

  Download PDF file
- **SPP Programmer's Reference**
  Read online

  Download PostScript file
- **Synphot User's Guide**
  Download PDF file (Dec 1998 version)

Quick Reference Cards

These are links to PostScript files.

- **CL User's Quick Reference**
- **IGI User's Quick Reference**
- **Site Manager's Quick Reference**
- **CL Programmer's Quick Reference**

Useful Documents from Other Sites

- ***Beginner's Guide to Using IRAF*, by Jeannette Barnes, August 1993**
- ***Users Manual for SAOimage*, by M. VanHilst, January 1991**

Eric W. Wyckoff, wyckoff@stsci.edu
November 19, 2001

Back to the STSDAS Page

STSDAS Space Telescope Science Data Analysis System

Calibration and analysis software for Hubble Space Telescope data

Historical progression of news in STSDAS

This page is chronologically ordered from the top down. There should be a date at the end of each item that indicates when it was added to the page.

The links in this page are NOT as new as those in the STSDAS page.

Modified 17 May 2001

The ST-ECF Post-Operational Archives group has released Version 1.1 (May 2001) of the STPOA package. STPOA is an IRAF layered package which currently offers improved calibration for FOS data. In the future, this package will contain other HST post-operational instrument calibration software. Information regarding this package can be acquired from ST-ECF.

The ST-ECF Post-Operational Archives group has released the first version of the STPOA package. STPOA is an IRAF layered package which offers improved calibration for FOS data. Information regarding this package can be acquired from ST-ECF. 21 August 2000

Announcing the RELEASE of STSDAS/TABLES v2.2 . Go to the Downloading STSDAS/TABLES software section to download the source code and/or binaries. 18 August 2000

Announcing the RELEASE of STSDAS/TABLES v2.2 . Go to the Downloading STSDAS/TABLES software section to download the source code and/or binaries. 18 August 2000

C Interface to the IRAF Virtual Operating System (CVOS). The CVOS allows one to program tasks in C which have the added advantage of being able to use IRAF functionality. 07 Janua ry 2000

STSDAS/TABLES v2.1.1 has been released. The Release notes for v2.1.1 can be read at this link. 09 December 1999

STSDAS/TABLES v2.1 was released. The Release notes for v2.1 can be read at this link. 09 October 1999

There are the draft release notes for the upcoming STSDAS/TABLES 2.1 release. We expect to be releasing STSDAS/TABLES 2.1 by the end of September. 23 September 1999 Plans for Future Support of STSDAS/TABLES on OpenVMS. 28 July 1999

Synphot Users Guide version 2.1 in PostScript form. Syntax throughout the manual reflects the most recent expression evaluator. Expanded appendixes describing instrument keywords, libraries, etc. Updated task descriptions to reflect new, obsolete, and modified tasks. 28 December 1998

Upgrades to calstis (v2.0) . 20 November 1998

Upgrade to the gcombine package in STSDAS v2.0.2

The release of **STSDAS/TABLES v2.0.2** is complete for those platforms that support IRAF v2.11.1 06 October 1998

Upgrade to SYNPHOT package , a patch that includes bug fixes for the LINUX platforms. 05 August 1998

Upgrades to calstis (v1.9) . 30 July 1998

Upgrades to the calnica(v. 3.2) and calnicb (v2.2) packages. 24 July 1998

Upgrade to the calfos(v3.0) package in STSDAS v2.0.1; includes upgrades to support spectropolarimetry. 14 July 1998

Upgrade to the calstis(v1.8) package in STSDAS v2.0.1; includes includes new task ocrreject, tastis and includes major pipeline fixes. Also minor fixes to defringe, mkfringeflat, normspflat, prepspec. 14 July 1998

Upgrade to the *dither* package in STSDAS v2.0.1 29 May 1998

Upgrade to the *calstis(v1.8)* package in STSDAS v2.0.1; includes new tasks ocrreject, tastis and includes major pipeline fixes. 22 May 1998

Upgrade to the *paperprod(v2.24)* package in STSDAS v2.0.1; includes several fixes to the STIS, NICMOS and WFPC2 Paper Products. 22 May 1998

The release of **STSDAS/TABLES v2.0.1** is complete for those platforms that support IRAF v2.11 24 March 1998

Upgrade to the *calnica(v3.1)* package in STSDAS v2.0 now recognizes the new Target Acquistion filenames. 29 December 1997

Upgrade to the *contrib* package in STSDAS v2.0 now includes the new task 'slitless' for reduction of grism observations. 29 December 1997

Upgrade to the *calstis(v1.5a)* package in STSDAS v2.0 includes the new task echplot and includes some small bugs fixes. 16 October 1997

STSDAS/TABLES 2.0 Released

A Major upgrade to STSDAS/TABLES has been released for machines running Solaris V2.4 and SunOS 4.1 (or greater). STSDAS/TABLES 2.0 requires IRAF 2.11. 12 September 1997

Update of Synphot manual Synphot Users Guide version 2.0 in PostScript form. Syntax throughout the manual reflects the most recent expression evaluator. Expanded appendixes describing instrument keywords, libraries, etc. Updated task descriptions to reflect new, obsolete, and modified tasks. 31 August 1997

User's Guide to FITS kernel STScI User's Guide to the FITS Kernel. The IRAF Fits kernel, developed at STScI and NOAO, is in use on some systems at our site. This document provides a general guide for use of this kernel. 28 March 1997

STSDAS version 1.3.5 is layered on IRAF version 2.10 and TABLES version 1.3.4. 25 July 1996

STSDAS and TABLES version 1.3.4 are layered on IRAF version 2.10. STSDAS is layered on TABLES. 05 October 1995

User Support Changes

Synphot Users Guide version 1.3.3 updated

Syntax throughout the manual reflects the most recent expression evaluator. Expanded appendixes describing instrument keywords, libraries, etc. Updated task descriptions to reflect new, obsolete, and modified tasks. 31 March 1995

STSDAS and TABLES version 1.3.3 are layered on IRAF version 2.10. STSDAS is layered on TABLES. 17 March 1995

The STSDAS Group (wyckoff@stsci.edu)
Last updated: 17 May 2001

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gethelp Search Form gethelp

Task Index

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- newimred
- noao
- stecf
- stlocal
- stpoa
- stsdas
- tables
- xray

Search Forms

Task Name [Search]

Keyword [Search]

Full text [Search] [Options]

Online documentation for this web page is available.

If you need help using STSDAS, contact the STScI Help Desk.

The Hubble Deep Field: latest news

1/2/01

The Hubble Deep Fields at the Rome Observatory.

1/2/01

European VLBI Network observations of the HDF-N.

9/1/00

Westerbork Synthesis Radio Telescope1.4 GHz observations.

4/20/00

First x-ray results from Chandra HDF Observations are now available.

10/19/98

The VLA survey of the HDF and flanking fieldsnow has its own web site.

6/29/98

Hawaii Flanking Field Catalog.Includes astrometry, photometry, redshifts, and H&K band infrared images.

6/3/98

A New Catalog of Photometric Redshifts in the HDF (Fernandez-Soto, Lanzetta, and Yahil 1998, ApJ submitted).

10/22/97

The link to the HDF South page has been added.

7/23/97

The ISO HDF web page has been updated to include copies of the accepted papers (I-V), active catalogs, tests of the reliability of sources, and other items of interest.

5/12/97

Hubble Deep Field Academy-- Educational Resource for Middle School students

12/12/96

The topic of the 1997 STScI May Symposium will be the Hubble Deep Field.

12/05/96

Data and Preprints of the ISO HDF observationsare now available.

11/26/96

A search of the STScI library STEPsheet reveals the following HDF Preprints and Publications.If yours is not listed here, please send a copy to the STScI Librarian (Librarian, Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218).

11/3/96

Infrared followup obervationsusing the KPNO IRIM camera are now available.

A new set of WFPC-2 mosaics are available courtesy of Mark Dickinson and Richard Hook. The World Coordinate System (WCS) keywords in the mosaics and in the IRIM data have been updated to match the system defined in Williams et al (1996, AJ, 112, 1335) based on radio interferometric positions for several HDF sources. An iraf script hdf_wcs_fix.cl is available to updated the header information in the version 2 drizzled images.

To make room for the mosaics, we have deleted the version-1 HST WFPC images from the archive disk. The v2 images (still available) should be better for most purposes. If (for some peculiar reason) you want the v1 images, you may request a tape from ferguson@stsci.edu.

10/14/96

The Hawaii Active Catalog provides a cursor-driven interface to information on individual HDF galaxies.

9/25/96

Plans are underway for a southern HDF. There is no specific date or field yet for the observations. Fields under consideration are being searched for a suitable QSO for absorption line studies.

The topic for the 1997 STScI May Symposium will be the Hubble Deep Field. Dates are still to be determined. Further details will be announced here, through mailings, and on the STScI meetings web page.

Preprints from the VLA survey are available: abstract; postscript ; figure 1; figure 2.

Redshiftsfrom the DEEP project survey with Keck are now available.

There is now a web page for the ISO HDF followup observations.

9/22/96

The Drizzlealgorithm used to reduce the HDF is now publicly available in a beta release version.

7/31/96

The Version 2 catalogs have finally been put on the web. Details of the STScI & ST-ECF data reduction, source detection, and photometry are described in Williams et al. (AJ, in press).

6/28/96

SUNY Stony Brook now has an HDF Web page.

6/17/96

The Berkeley HDF group now has a web page, listing, among other things redshifts for about 30 galaxies in the HDF and flanking fields.

Redshifts from the Caltech and Hawaii Keck runs have been added to the Caltech web page.

Astrometry of the HDF flanking fields has been carried out by the DEEP collaboration.

HDF version 3 has slowed considerably, mostly because it is not a high priority given the modest expected gains in resolution and S/N. The new target date is the end of the summer

A cautionary note on photometry. The zeropoints listed for the HDF do not include a correction for contamination, which progressively adds attenuation between monthly decontaminations (warmups) of WFPC-2. As the HDF was taken shortly after a DECON, this effect is less than 0.05 mag for F300W, and significantly less for the redder filters. The F300W correction will be posted here once it is computed.

A more serious concern is that the F300W exposures, which have low backgrounds and low source count rates, are in a regime where charge-transfer effects (CTE) could be significant. Measured magnitudes of faint sources in the F300W band could be up to 0.2 mag fainter than true magnitudes, with the size of the effect depending on row number. The effect is probably only a few hundredths of a mag for the optical filters because of their higher backgrounds. Laboratory tests and observations in Cycle 6 are being planned to try to arrive at a calibration of CTE as a function of row number, source count rate, background level, the number of counts in the previous image, and the time elapsed between images. Details of recent investigations of the CTE and (and a similar, probably related photometric dependence on exposure time) are posted on the WFPC-2 advisory page.

5/20/96

A TIFF format imageof the HDF + flanking fields, overlaid on a KPNO 4-m image has been added, for use a finder chart. CAUTION -- the frames in this image were aligned by eye. Has anyone in the greater HDF community yet done a precise registration of the HDF and flanking fields?

Added an update on J, H, and K band observations from the KPNO 4-m telescope.

5/3/96

New links to HDF followup at Cambridge and Lick Observatory have been added to the clearinghouse.

Our new target date for version 3 of the data reduction is now the end of May.

4/16/96

Well, the superdarks & superbiases are almost done...version 3 is probably still several weeks down the road, as there are quite a few other issues that have to be addressed in this final reduction.

Sky levels for the individual chips are now posted.

3/28/96

It is now clear that we will miss the April 1 target date for the version 3 release of the HDF data. We are in the midst of remaking superdarks and superbiases, correcting at the same time for the MgF faceplate glow. We are shooting for April 15.

3/20/96

Information on VLA observationshas been added to the HDF clearinghouse.

3/13/96

There is a problem in the World Coordinate System (WCS) in the version 2 images. The v2 image headers have had a lot of stuff stripped out of them that was in the v1 edition. 99% of that information was useless, but two keywords pertaining to the WCS were not. The parameters CTYPE1 and CTYPE2 should be set to 'RA---TAN' and 'DEC--TAN', respectively (note the number of dashes in each entry!). Currently, they are incorrectly set to 'PIXEL'.

3/7/96

The weight images in Version 2 give the inverse variance of the images in counts per second per INPUT (WF- or PC-sized) pixel. However, when you measure the noise in the drizzled images, you will be measuring it in counts per second per OUTPUT pixel. The ratio of areas (and therefore counts) between the input and output pixels is 6.25 in the WF and 1.31 in the PC. As a result the standard deviation estimated from 1./sqrt(weight) must be divided by the ratio of areas before comparison with the noise measured in the images.

3/4/96

A list of frames not used version 2 has been added.

2/29/96

Version 2 of the HDF data is now available. The additional processing has resulted in roughly a 10% improvement in S/N for the F450, F606, and F814W filters.

2/28/96

Information on image registration and combination and on the drizzle algortihm have been updated in preparation for the expected release of Version 2 on 29 Feb 1996 (what would we have done were it not a leap year?).

2/24/96

Proposals are now being solicited for ISO observations of the Hubble Deep Field. Up-to-date information about the ISO mission and instruments can be found on the ISO Homepage. Detailed information about the HDF proposal opportunity is on the same HomePage under the heading "ISO and the Hubble Deep Field".

2/21/96

Version 2 is just about ready. Really. The final scattered light subtraction is being done today.

2/20/96

Added a link to the University of Hawaii HDF web pageprovided by Len Cowie.

2/7/96

Flanking Field images. 1 & 2 orbit exposures of 8 adjacent fields have been installed on the ftp site.

1/30/96

Version 2 of the data is running a bit behind. We had hoped to have it ready Feb. 1, but it now looks like Feb. 8 is a better bet. The masking of moving targets is almost complete. Then the frames will be restacked, redrizzled, and will have scattered light subtracted.

1/25/96

The ESO/ECF HDF groupnow has a link in the HDF clearinghouse.

1/19/96

A link to the call for HDF archival proposals has been added. The deadline is March 15, 1996.

1/16/96

The catalogs released on January 15 had an error in the x,y and RA, DEC coordinates. They have been corrected and re-released January 16. The new versions will be stored as FITS tables (*.fits) rather than stsdas tables (*.tab), but may not propagate to the ftp site until mid-day on January 16.

1/14/96

HDF web pages are installed, but many are incomplete and will remain so until January 20th or so. If you have questions, contact the undersigned.

Harry Ferguson ferguson@stsci.edu
Andy Fruchter fruchter@stsci.edu

The Hubble Deep Field: Background

The Hubble Deep Field (HDF) is a Director's Discretionary program on HST in Cycle 5 to image a typical field at high galactic latitude in four wavelength passbands as deeply as reasonably possible. In order to optimize observing in the time available, a field in the northern continuous viewing zone (CVZ) was selected and images were taken for 10 consecutive days, or approximately 150 orbits. Shorter 1-orbit images were also obtained of the fields immediately adjacent to the primary HDF in order to facilitate spectroscopic follow-up by ground-based telescopes. The observations were carried out from 18-30 December 1995, and the data are available to the community for study.

- HDF paper presented at Paris HST meeting (postscript).
- Field selection.
- Filter selection.
- Flanking fields.
- Scheduling details.
- Parallel Observations.

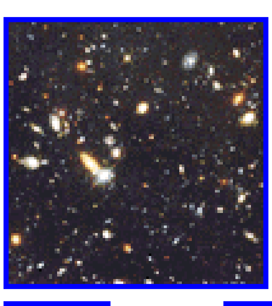
Harry Ferguson ferguson@stsci.edu 1/14/96

The Hubble Deep Field

The HDF Project including information on getting raw data.

Alternate sites for HDF information and data:

- ST-ECF (Germany)
- CADC (Canada)
- UKHST (UK)



Hubble Deep Field Wide View

JPEG 132kB GIF 420kB Caption

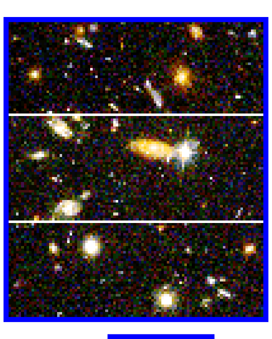
Higher resolution (300dpi):

JPEG color 1.5MB JPEG black & white 1.2MB

Hubble's Deepest-Ever View of the Universe Unveils Myriad Galaxies Back to the Beginning of Time

STScI-PRC96-01a - January 15, 1996

R. Williams and the HDF Team (ST ScI) and NASA



Hubble Deep Field Details

161kB GIF 450kB Caption

Higher resolution (300dpi):

JPEG color 1.3MB JPEG black & white 1.1MB

Sample Galaxies from the Hubble Deep Field

STScI=PRC96-01b - January 15, 1996

R. WIlliams and the HDF Team (ST ScI) and NASA

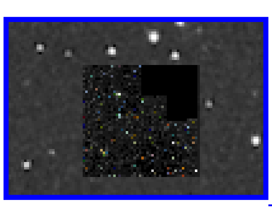
Press Release Text

Hubble's Deepest View of the Universe Unveils Bewildering Galaxies Across Billions of Years

STScI-PR96-01 January 15, 1996

R. Williams (ST ScI) and NASA

Background Information



Animation of "zoom-in" to HDF target

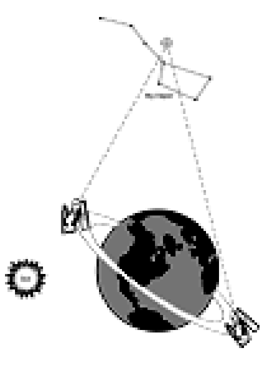


Illustration showing geometry of the HDF observations

PDF 114kB

PostScript 128kB

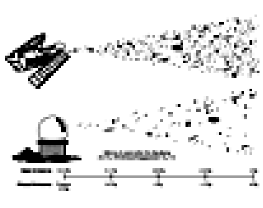
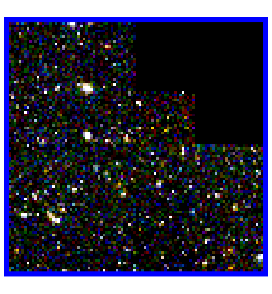


Illustration of increased sensitivity of the HDF

PDF 193kB

PostScript 208kB

Full WFPC2 Mosaic



Full resolution (3069x3100 pixels) JPEG 2.1MB GIF 5.5MB TIFF 28MB Compressed

Half resolution (1500x1575 pixels) JPEG 358kB GIF 1.5MB TIFF 7.1MB Compressed

Quarter resolution (800x840 pixels) JPEG 100kB GIF 389MB TIFF 2MB

Links to public HST pictures

Zolt Levay -- levay@stsci.edu
Office of Public Outreach -- outreach@stsci.edu

January 19, 1996

The Hubble Deep field is located at

```
12h 36m 49.4000s  +62d 12' 58.000"  J2000 Equinox
with PA_V3=112d which corresponds to U3 ORIENT=292D
```

The Hubble Deep Field Data Products:

Quick summary

Raw Data	Can be extracted from the HST archive.
Version 1	No longer available on line. We recommend using version 2.
Version 2	Final reduced images and catalogs.

The HDF data were released for general use on January 15, 1996. We have tried to anticipate the needs and desires of most astronomers, while keeping the data volume reasonable. The data products, from least processed to most processed, are listed below. The data volume, even for final images, is considerable. To reduce the load on the STScI ftp site and speed data transfer in other parts of the world, several sites have agreed to mirror the STScI data repository. Check their web pages for details on how to transfer the data.

Other HDF data sites: ST-ECF (Germany); CADC (Canada); and UKHST (UK).

- **Raw data.** Available January 15, 1996.

  This is essentially as received from the telescope, with all the cosmic rays, hot pixels, and other defects. It will probably not be useful for most people. This is best obtained on exabyte tape, as it consists of roughly 3 Gbytes of data. Request a tape by sending email to archive@stsci.edu. (The raw data can also be extracted over the internet from the HST archive, but this will be prohibitively slow for the whole data set.)

- **Version 1.** Available January 15, 1996. As of November 1, 1996, these data are no longer available on line. We recommend the use of version 2 data.

  These data reflect processing up to January 15, 1996. A number of shortcutswere taken to make these data available within three weeks of the last observation.

- **Version 2.** Available February 29, 1996.

  Essentially all of the data have been used in the final stacks, and the images have been combined with weights that are optimal for faint sources.

Harry Ferguson ferguson@stsci.edu 10/09/01

HDF Observing logs and ancillary information

- Master list of observations.
- Photometric zeropoints.
- Sky levels for each chip in version 2.
- Shifts between dither positions.
- Shifts between filters in the version 1 drizzled images.
- Unused frames in version 2
- Version 2 summed exposure times

Harry Ferguson ferguson@stsci.edu 1/14/96

The HDF Pipeline:

HDF data were reduced with the same software as the standard HST pipeline (the STSDAS task calwp2), but with different calibration files, and with a slightly different treatment of the darktime. After pipeline processing, the data were stacked and cosmic rays were identified. Hot pixels were identified from dark frames and from the images themselves. Details are listed below.

- **superbiases.**
- **superdarks.**
- **flats.**
- **cosmic ray rejection.**
- **image stacking.**
- **hot pixel rejection.**
- **scattered light subtraction.**

There is room for improvement in all these procedures. A number of shortcuts were taken in the initial processing of the data. Our plans for reprocessing the data are evolving daily, and we would appreciate any comments.

Harry Ferguson ferguson@stsci.edu 1/14/96

HDF Image Registration and Combination

The HDF observations were carried out with roughly 9 different pointing positions per filter, spaning a scale of roughly 2 arcseconds. The primary purpose of ``dithering'' in such a fashion is to smooth out flatfielding uncertainties. A secondary purpose is to try to recover some of the information lost due to the undersampling of the WF detectors.

After having been fed through the pipeline, the registration of the individual images was checked by comparing the positions of several bright sources. This revealed a couple of unexpected large (0.8 arcsec) shifts, but otherwise suggested that the images at each dither position were registered well to within the errors of such a comparison. The images with the large shifts have been treated as separate dither positions. Subsequent tests have revealed small (~0.1 pixel) shifts between some frames that were nominally at the same dither position. These positional errors have not yet been corrected; however, their influence on the final image is expected to be negligible.

The roughly 5 images per dither position were cosmic-ray rejected and stacked into a single image. Shifts and rotations between these dither stacks were measured using a specially written cross-correlation task. Estimated errors are a few hundredths of a pixel for F450W, F606W, and F814W. Only two dither positions -- those produced by the unexpected shifts -- showed any measurable rotation.

Once the shifts and rotations were measured, the images were aligned and combined using the drizzle algorithm, which corrects for geometric distortion, and produces an output image that is sampled on a smaller pixel scale than the input images. The final pixel scale is 0.04 arcsec for both the WF and the PC chips.

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HDF source detection and photometry

The catalogs released on January 15 had an error in the x,y and RA, DEC coordinates. They have been corrected and re-released January 16. The new versions will be stored as FITS tables (*.fits) rather than stsdas tables (*.tab), but may not propagate to the ftp site until mid-day on January 16.

In any event, the catalogs are released with a huge *caveat emptor*. We expect to replace these preliminary catalogs with more trustworthy ones within a few weeks. We would also be happy to archive any catalogs that others produce with different software or source detection algorithms.

The catalogs are available as FITS files of stsdas tables by anonymous ftp from stdatu.stsci.edu.

A brief description of the catalogs can be found in the README file.

The source detection and photometry were carried out with a revised version of FOCAS (Tyson and Jarvis 1979), created by Kurt Adelberger and Chuck Steidel at Caltech. This program is still in the testing phase, but has many improvements over previous versions. The program works by smoothing the data with a fixed kernel, typically the width of the PSF, and then searching for pixels more than a certain number of sigma above the local sky background.

Our source detection and photometry were carried out on the drizzled images. Source detection was done using the sum of the F606W and F814W images to provide the maximum limiting depth. The kernel was an HST psf derived from a star in the field. The minimum area required for detection was 16 continguous drizzled above (0.04 arcsec) above the detection threshold. For the catalog presented here, we have set the threshold fairly conservatively at 5-sigma.

Warnings

These catalogs were made at the very last minute before the AAS meeting. We recommend that you use them only as a comparison to your experiments with object detection. A visual inspection suggests that the catalog is not too bad -- the main problem seems to be oversplitting in general, and big clouds of spurious objects surrounding bright galaxies. It is possible that some fine tuning of the FOCAS "significance" parameter can help in avoiding these things. In isolated areas FOCAS appears to be finding most of the sources and not introducing too many spurious ones.

FOCAS detection and photometry rely heavily on detailed knowledge of the noise properties of the image. The drizzling process introduces correlated noise between pixels that is not yet fully understood. Therefore the formal significance of the detections and the uncertainties on the magnitudes must be taken with a grain of salt.

Harry Ferguson ferguson@stsci.edu 1/14/96

HDF Clearinghouse

While there is likely to be lively competition in interpreting the HDF images and carrying out follow up observations, it is our hope that there will not be much needless duplication of effort. To this end, we invite anyone contemplating followup observations or detailed analysis to share information through the HDF web page. In other words, we will provide pointers to other web locations that describe research on the HDF. The aim is to establish a forum for publicizing the status of followup work in order to avoid too much duplication, and to provide points of contact for cooperation/collaboration between various investigators. If you are interested in participating, please contact ferguson@stsci.edu.

HDF Preprints and Publications recorded by the STScI librarian (please send us your preprints if they are not listed here).

Hawaii Flanking Field Catalog.

A New Catalog of Photometric Redshifts in the HDF (Fernandez-Soto, Lanzetta, and Yahil 1998, ApJ submitted).

MERLIN Observations

KPNO IRIM Observations

Keck Caltech Consortium

ESO/ECF HDF group

Hawaii IFA HDF followup

The Hawaii Active Catalog

VLA survey of the HDF and flanking fields.

HDF followup at the Institute of Astronomy, Cambridge

HDF followup by the DEEP collaboration using Keck LRIS.

Berkeley HDF group.

HDF Followup from SUNY Stony Brook.

ISO HDF followup observations -- data and preprints available

Chandra HDF Observations.

Westerbork Synthesis Radio Telescope 1.4 GHz observations.

The Hubble Deep Fields at the Rome Observatory.

European VLBI Network observations of the HDF-N.

UK Sub-millimetre Survey Consortium web page, with HDF-N data release

Harry Ferguson ferguson@stsci.edu 02/14/02

The Hubble Deep Field Working Group

The HDF Working Group:

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Doug McElroy	mcelroy@stsci.edu
Larry Petro	petro@stsci.edu
Marc Postman	postman@stsci.edu
Bob Williams	wms@stsci.edu

ST-ECF members:

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Richard Hook	rhook@eso.org

Many others both within STScI and outside have contributed advice in selecting the fields and planning the observing strategy.

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The Hubble Deep Field: References

- Worldwide HDF Preprints and Publications
- Publications from the STScI/ST-ECF HDF working group.

Harry Ferguson ferguson@stsci.edu 11/26/96

Amazing Space
Galaxies Galore
UPDATED! Mission Mastermind
Star Light, Star Bright
Galileo to HST
Solar System Trading Cards
The Truth About Black Holes
Hubble Deep Field Academy
Comets
Galaxy Hunter NEW!

Amazing Space is a set of web-based activities primarily designed for classroom use, but made available for all to enjoy.

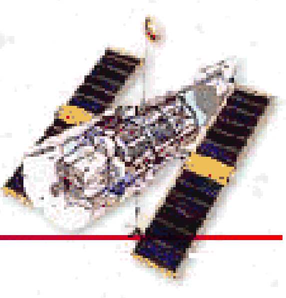
Current activities include:

- Be the Mastermind Behind the Mission! Reconstruct the order of events for Hubble Space Telescope's 2002 Servicing Mission.
  NOTE: This activity is an update of and a replacement for Astronaut Challenge.
- Explore the Hubble Deep Fields from a statistical point of view in Galaxy Hunter: A Cosmic Photo Safari.
- Whip up a batch of Comets--without trashing the kitchen!
- Fall into one of the eeriest celestial phenomena in The Truth about Black Holes
- Play with the building blocks of the universe, galaxies, in Galaxies Galore
- Find out what light and color can tell you about stars in Star Light, Star Bright
- Learn about the objects that make up the Solar System by collecting Solar System Trading Cards
- Train to be a scientist by enrolling in the Hubble Deep Field Academy.
- Brief history of telescopes from Galileo to the Hubble Space Telescope.
- Did An Activity? Tell us what you think.
- Want to preview soon-to-be-released activities? Join First Contact.

Learn more about the *Amazing Space* project.

Press Releases and other information for the general public.

Visit the Space Telescope Science Institute



What's New

After Data Release

- The Hubble Deep Fields at the Rome Observatory (January 2, 2001).
- In addition to the final combined NICMOS version 1 images that were already released on November 23, 1998, all individual calibrated (un-combined, un-mosaiced) NICMOS exposures are now also available for downloading as gzipped tar files (March 11, 1999).
- Updated the absorption line list for the QSO J2233-606 sight-line (March 5, 1999).
- Updated the list of HDF-S related references (March 5, 1999).
- Added links to the full text of some of the HDF-S related poster papers at the AAS meeting in Austin to the list of HDF-S related references (January 7, 1999).
- Added some links to technical information on the page describing the HDF-S Catalogs (December 23, 1998).
- Updated the page with file names to include the most recently added data products (December 23, 1998).
- HDF-S Catalogs are now available (December 21, 1998).
- Version 1b STIS G230L spectroscopic data are now available. This release fixes an error in the wavelength sscale of the version 1 release. Go to the Data Products page for information and data retrieval (December 21, 1998).
- Final data products for all of the WFPC-2 Flanking fields are now available, including the observations in the F606W and F814W bands taken during the 9 orbits when STIS was observing the NICMOS prime HDF-S field. Go to the Data Products page for information and data retrieval (December 21, 1998).
- Added a link to Stephen Gwyn's photometric HDF-S redshifts page on the HDF-S clearinghouse page (December 15, 1998).
- Added a link to the web site of the HDF-S group at UC Berkeley on the HDF-S clearinghouse page, and also a link to their paper Benitez et al. on the page with HDF-S related references (December 12, 1998).
- Added a link to the web site of the ESO Imaging Survey observations of the HDF-S, on the HDF-S clearinghouse page (December 7, 1998).
- Included a detailed description of the NICMOS data reduction (December 5, 1998).
- Updated the WFPC2 discussion on the Observing Strategy page (December 2, 1998).
- Added an extra column (`USED') to the NICMOS main-field observing log and the NICMOS flanking fields observing log (November 30, 1998).
- Added a link to the web site of the HDF-S group at SUNY, Stony Brook, on the HDF-S clearinghouse page (November 29, 1998).
- Added a page with links to Press Reports on the HDF_S (November 29, 1998).
- Final data products for all but one of the WFPC-2 Flanking fields are now available. Go to the Data Products page for information and data retrieval (November 25, 1998).
- Split up the NICMOS Master Observing Log into a main-field log and a flanking field log (November 24, 1998).
- Added a page with Warnings and Advisories (November 24, 1998).
- Added a section on PSF Convolution of the STIS Image to the NICMOS Data Reduction / Technical Information page, and to the README file in the nicmos/ directory on the ftp area (November 24, 1998).
- Added a page with a bare listing of all .html files on the HDF-S web site (November 23, 1998).
- Added the NICMOS Master Observing Log (November 23, 1998).
- Detailed plot added of the HST/STIS spectrum of QSO J2233-606 (November 23, 1998).

At Data Release (November 23, 1998)

- Major upgrade of the entire HDF-S web site associated with the release of the HDF-S campaign data (November 23, 1998).
  - Release of HDF-S Data Products.
  - Addition of pages on observing details, and data reduction and technical issues.
  - Addition of (links to) Public outreach materials and release pictures.
  - Addition of a page with references to HDF-S related publications.
  - Layout and content changes in most of the existing pages.

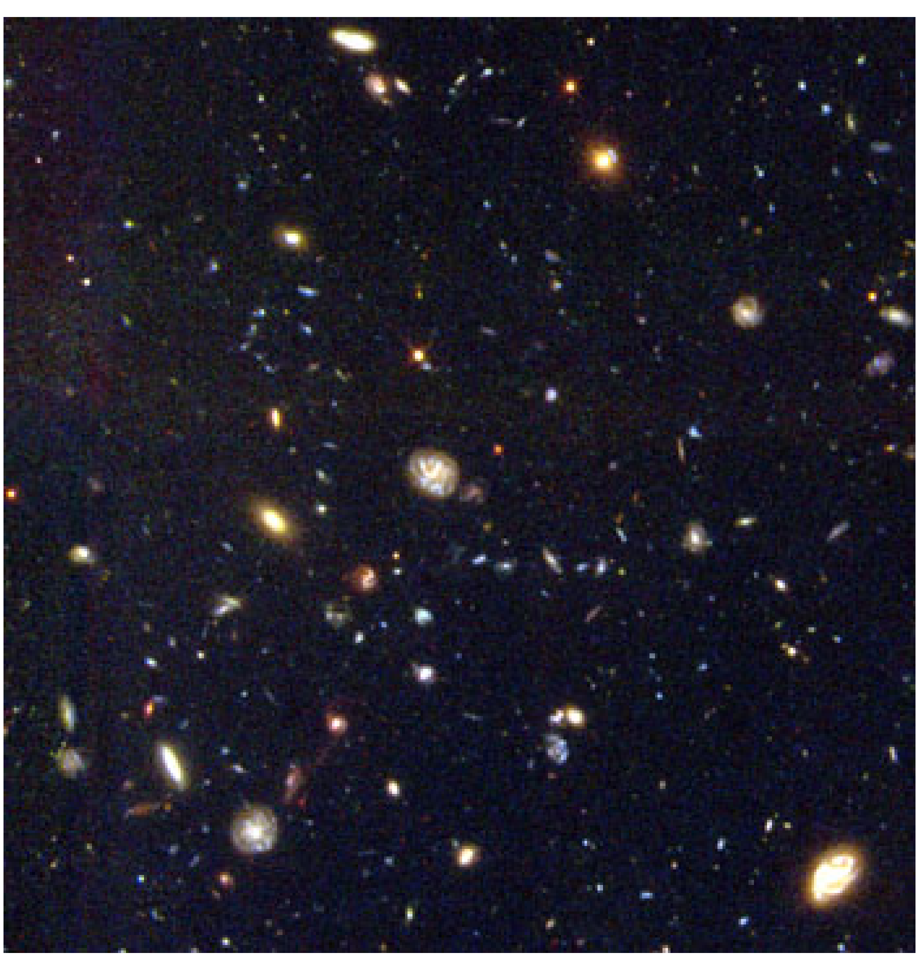
Before Data Release

- Added a link to the ESO VLT Science Verification Data of the HDF-S on the HDF-S clearinghouse page (October 7, 1998).
- Added a link to the AAO HDF-S observations page on the HDF-S clearinghouse page. Includes an AAT UCLES echelle spectrum of the quasar from 3530-4390A (October 7, 1998).
- Added a link to the ESO HDF-S project page on the HDF-S clearinghouse page (July 15, 1998).
- Updated coordinates of NIC3 field (July 2, 1998).
- Updated HDF-S working group members list (July 1, 1998).
- Updated HDF-S project description (July 1, 1998).
- Added HDF-S clearinghouse page, with addition of links to AAO, ANU, ESO NTT, ISO and AAT PF observations (February 1998 to June 1998).
- Improved NIC3 FOV overlay on CTIO image (January 7, 1998).
- Raw, pipeline calibrated and reprocessed *TEST* observations of the HDF-S (November 1997 to January 1998).

This page was last updated on March 11, 1999.

STScI-PR98-41
November 23, 1998

The Universe "Down Under" Is The Target of Hubble's Latest Deep-View



Turning its penetrating vision toward southern skies, NASA's Hubble Space Telescope has peered down a 12 billion light-year long corridor loaded with a dazzling assortment of thousands of never-before seen galaxies. The observation called the Hubble Deep Field South (HDF-S) doubles the number of far-flung galaxies available to astronomers for deciphering the history of the universe.

Office of Public Outreach -- outreach@stsci.edu

Data Products

Final Calibrated, Co-added, Reprocessed Data Products

- WFPC2
  - Images: version1, version2
  - Catalogs: Version 1 HDF-S, HDF-N
- STIS
  - Images: 50CCD, F28X50LP, MAMA
  - Spectra: E230M, G140L, G230L, G430M
  - Catalogs: v1catalog
- NICMOS
  - Images: Camera 3
  - Catalog: Version1
- Flanking Fields
  WFPC2, STIS

Check the file name legend for a listing and explanation of the adopted naming conventions.

Check the instrument specific technical pages for a description of the data products and the implemented data reduction steps: STIS , WFPC2 , NICMOS , Flanking Fields .

Check the pages on observational details for information on observing strategy and individual data sets.

Check the page with warnings and advisories before making any use of the data.

Individual Raw and Calibrated Data from the HST archive

For logistical reasons, the Hubble Deep Field South observations were split over 6 different proposals. Click below to extract a listing of the observations in the Hubble Data Archive for each of the proposals. These listings give information on individual datasets in the HDF-S campaign, and allow you to retrieve individual raw or calibrated datasets. You may also want to study the Phase 2 Proposal Information for the HDF-S proposals.

Main-field observations

- Part 1: 8058
- Part 2: 8073
- Part 3: 8074
- Part 4: 8075
- Part 5: 8076

Flanking field and PSF star observations

- 8071

Project Description

Overview

In December, 1995 the Hubble Space Telescope pointed at an undistinguished high-galactic latitude patch of sky in the northern hemisphere, and observed for 10 straight days. The result was the deepest optical image of the sky yet obtained: The Hubble Deep Field (HDF) (henceforth referred to as the Hubble Deep Field North, or HDF-N). The images allow detection of sources as faint as V = 30 in four bandpasses spanning the near-UV to the near-IR (Williams et al. 1996). The data were released to the community within one month of the observations and have been used in a wide variety of projects and publications, ranging from studies of the star-formation rate as a function of redshift, to studies of faint M dwarfs in the Galactic halo.

A second Hubble Deep Field campaign was carried out between late September and October of 1998. The raw, pipeline calibrated and reprocessed data were released to the community on November 23, 1998. The rationale for undertaking a second deep field campaign followed from the wealth of information that has come out of HDF-N, and from the desire to provide a point of focus for similar studies of the distant universe from southern-hemisphere facilities. The wide public access to the HDF-N data stimulated extensive followup observations across the electromagnetic spectrum, both from major ground-based observatories and from other satellites. A similar level of effort is anticipated for HDF-S. We are maintaining a `clearinghouse' for supporting and follow-up observations of the HDF-S.

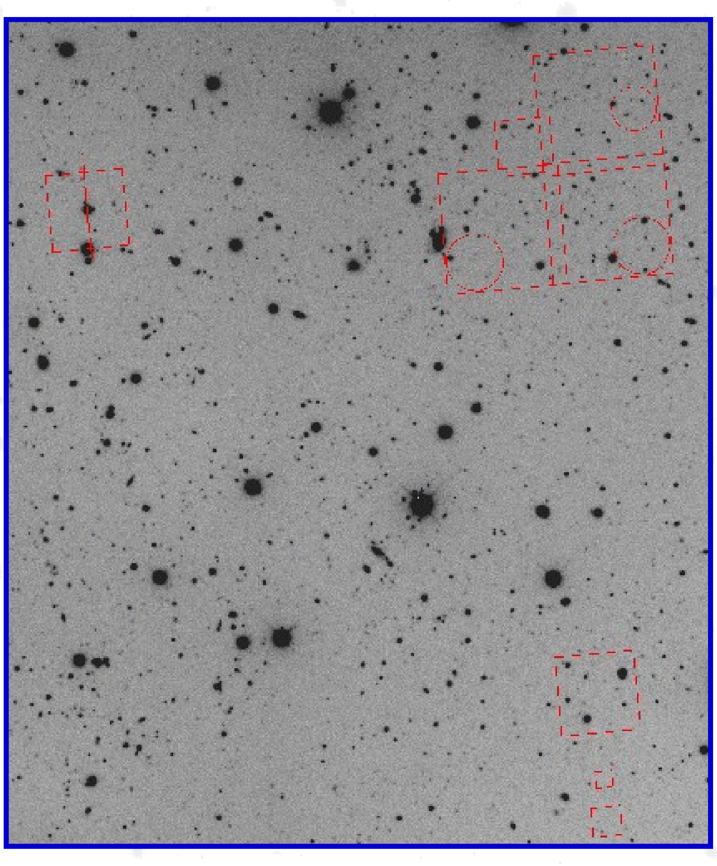
Test observations of the HDF-S field were obtained in October, 1997. The primary purpose of the test was to ensure that the guide stars to be used for the full campaign were acceptable, but an initial reconnaissance of the field was also carried out.

The HDF-S campaign differs from the HDF-N campaign in several important areas:

- The field is located in the *Southern* Continuous Viewing Zone. Choice of a field in the CVZ maximizes the observing efficiency of HST. The J2000 coordinates of the HDF-S are given here).
- A moderate redshift quasar of z ~ 2.24, identified by Boyle, Hewett, Weymann and colleagues, was placed in the STIS field for both imaging and spectroscopy so that correlations between quasar absorption redshifts and the redshifts of galaxies in the fields may be determined. Information on the QSO can be found in papers by Sealey et al. (1998) and by Savaglio (1998).
- Simultaneous, parallel observations were made with the three HST instruments STIS, WFPC2 and NICMOS of separate, neighboring fields. The STIS and NICMOS observations are significant enhancements over what was possible during the HDF-N campaign (although the HDF-N was later observed with NICMOS by GTO and GO teams).
- The early planning of the HDF-S allowed several preparatory studies to be carried out in advance, as collected on the HDF-S Clearinghouse web page.

The actual observations of the HDF-S were similar in spirit to the original HDF. As was the case for HDF-N, approximately 150 consecutive orbits were devoted to a single telescope pointing. Additional flanking field observations were made surrounding the deep STIS, WFPC2 and NICMOS fields.

Layout Main Fields

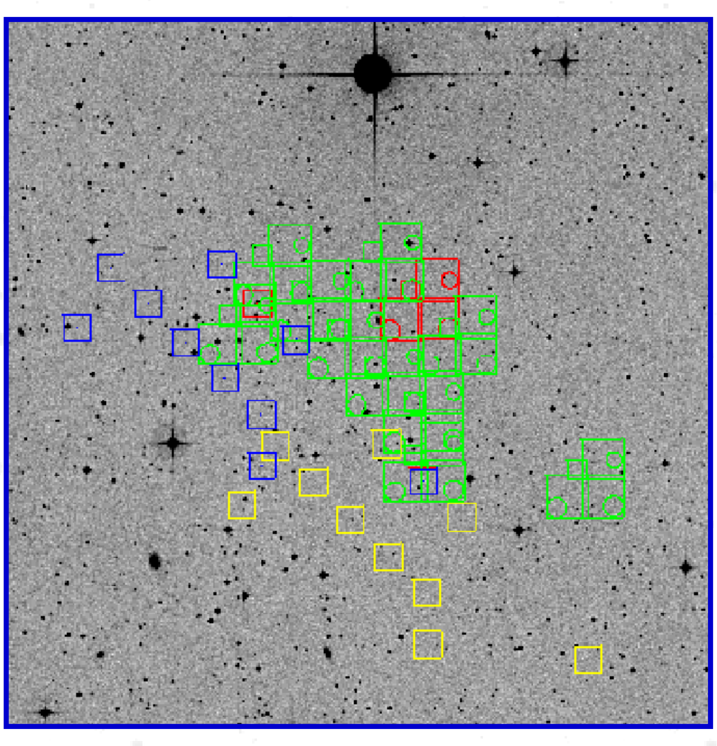


The figure shows the position of the HDF-S overlayed on a deep ground-based image. The image is a 3000s R-band exposure from the CTIO 4m telescope (courtesy of Alistair Walker). North is up and East is left. The WFPC2 region is to the West, the STIS region is to the East and NICMOS region is to the South. The STIS field is centered on the quasar at z ~ 2.24.

Note that the figure is for illustrative purposes only. The overlaid positions of the STIS and WFPC2 fields are accurate only to a few arcsec. The overlaid positions of the NICMOS fields are accurate only at the ~ 10 arcsec level. Use the calibrated J2000 coordinates of the HDF-S) when higher accuracy overlays are required.

Click on the image to get a larger scale view of the field.

Layout Flanking Fields



As with the HDF-N, some time during the HDF-S campaign was devoted to obtaining WFPC2 single-band images of a larger, contiguous area around the primary imaging field (the "flanking fields"), to a typical depth of I_AB ~ 25.5. The current plan is to observe a region about 7 arcmin in diameter, defined so as to include both the STIS and the NICMOS primary target regions. The goals of the wide-area imaging are to provide a large contiguous area for angular correlation studies, especially interesting near the QSO; to yield better statistics for less numerous, brighter galaxies; and to provide optical morphologies for galaxies in the larger fields typical of ground-based multi-object spectrographs.

The figure shows the tentative HDF-S flanking field arrangement as laid out several months before the campaign, overlaid on an image extracted from the Digitized Sky Survey. Note that the figure is for illustrative purposes only. The arrangement used for the actual campaign may have been slightly different, due to late changes in the observing strategy. Consult the actual Observing logs or the header information of the data files for more detailed information.

The red field is the main HDF-S WFPC2 field. The green fields are flanking fields for the WFPC2 with the F814W filter. The blue fields are the STIS CCD fields associated with the flanking fields, and the yellow are flanking-fields for the NIC3 parallels with the F160W filter. The main NIC3 field was observed for 9 orbits with the STIS CCD (no filter). The right-most WFPC2 flanking field is the parallel frame associated with that exposure.

Click on the image to get an overlay of the same flanking field arrangement on the deeper R-band ground-based CTIO image.

Observing strategy

Discussions about the observing strategy for the HDF-S focussed primarily on the questions:

- What filters/gratings to use for each instrument ?
- What exposure time to use for each filter/grating ?
- How to choose the detailed instrumental setup and observing parameters ?
- How to pack the observations into the individual orbits during the campaign ? In CVZ observations, scattered earth light increases the sky background in certain bandpasses on the day side of the orbit. It was therefore essential to tailor the observations for all the instruments to make optimal use of `bright' and `dark' time.

A detailed but outdated discussion of the observing strategy for each of the individual instruments is available:

- WFPC2
- NICMOS
- STIS

These discussions describe various general issues, as well as the planned observing strategy as of July 1998. The strategy used for the actual campaign was somewhat different, due to late changes in the observing strategy. Consult the actual Observing logs or the header information of the data files for more accurate and up-to-date information on the observing strategy.

The Hubble Deep Field South Working Group

Stefi Baum	Eddie Bergeron	Nicholas Bernstein	Brett Blacker
Tom Brown	Marcella Carollo	Stefano Casertano	Duilia de Mello
Mark Dickinson	Brian Espey	Harry Ferguson	Andy Fruchter
Jonathan Gardner	Anne Gonnella	Rosa Gonzalez-Lopezlira	Jeff Hayes
Inge Heyer	Richard Hook	Danny Jones	Ray Lucas
John MacKenty	Jennifer Mack	Lisa Mazzuca	Crystal Martin
MaryBeth Kaiser	Andy Lubenow	Piero Madau	Russ Makidon
Max Mutchler	Beth Periello	Marc Postman	Patricia Royle
Kailash Sahu	Alison Sherwin	Sandra Savaglio	Ed Smith
Massimo Stiavelli	Harry Teplitz	Roeland van der Marel	Gerry Williger
Mike Wiggs	Jennifer Wilson	Bob Williams	Dave Zurek

Many others both within STScI and outside have contributed advice in selecting the fields and planning the observing strategy.

HDF-S Data Reduction Teams

WFPC2

Stefano Casertano (lead)	Duilia de Mello	Mark Dickinson	Harry Ferguson
Andy Fruchter	Inge Heyer	Richard Hook	Ray Lucas
Russ Makidon	Max Mutchler	Massimo Stiavelli	Mike Wiggs

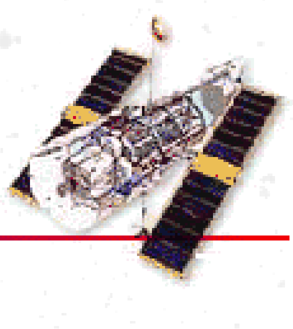
STIS

Stefi Baum	Tom Brown	Marcella Carollo	Brian Espey
Harry Ferguson (lead)	Jonathan Gardner	Anne Gonnella	Jeff Hayes
Richard Hook	Crystal Martin	MaryBeth Kaiser	Kailash Sahu
Sandra Savaglio	Ed Smith	Jennifer Wilson	Gerry Williger

NICMOS

Eddie Bergeron	Mark Dickinson	Harry Ferguson	Andy Fruchter (lead)
Richard Hook	Jennifer Mack	John MacKenty	Crystal Martin
Lisa Mazzuca	Harry Teplitz	Roeland van der Marel	Dave Zurek

The Hubble Deep Field South



References

Other listings

- xxx.lanl.gov e-Print archive
  - Search astro-ph for the string `Hubble Deep Field South'
  - Do your own search of astro-ph
- ADS (Astrophysics Data System)
  - Search the Astronomy and Astrophysics Abstract Service for the words `Hubble Deep Field South'
  - Do your own search of the Astronomy and Astrophysics Abstract Service
- AAS Meeting #193, Austin, Texas, January 1999
  - Abstracts for Session 75 on the `Hubble Deep Field South and North'.
- HDF Preprints and Publications (North and South) recorded by the STScI librarian (please send us your preprints if they are not listed here).

Data papers by the HDF-S working group

- **Comprehensive data papers** will be submitted to AJ by the HDF-S Working Group in early 1999. There will be papers on each of the topics for which an AAS abstract is listed below, and the author teams will be similar. The papers **will appear as a group in a single AJ issue in 1999**. Links to these papers will be added here as soon as they are available. **Please reference these papers in the expectation that they will appear as planned.**

- Abstracts of papers to be presented in Session 75 of the AAS Meeting #193, Austin, Texas, January 1999

75.01 The Southern Hubble Deep Field: HDF-S
R. Williams, S. A. Baum, L. E. Bergeron, B. Blacker (STScI), B. J. Boyle (AAO), T. M. Brown (GSFC), N. Bernstein (STScI), C. M. Carollo (JHU), S. Casertano, D. de Mello, M. Dickinson, B. R. Espey, H. C. Ferguson, A. S. Fruchter (STScI), J.P. Gardner (GSFC), A. Gonnella, R. Gonzalez, J. Hayes (STScI), P. Hewett (IOA-Cambridge), I. Heyer (STScI), R. N. Hook (ECF-Garching), D. Jones (STScI), M.E. Kaiser (JHU), A. Lubenow, R. A. Lucas, J. Mack, J. W. MacKenty, P. Madau, R. Makidon, C. L. Martin, L. Mazzuca, M. Mutchler (STScI), R. P. Norris (ATNF), B. Perriello, M. Postman, P. Royle, K. C. Sahu, S. Savaglio, A. Sherwin, E. Smith, M. Stiavelli (STScI), H. I. Teplitz (GSFC), R. van der Marel (STScI), R. J. Weymann (OCIW), M. S. Wiggs (STScI), G. M. Williger (GSFC), J. Wilson, D. Zurek (STScI)

75.02 The Hubble Deep Field South: UV Spectroscopy of QSO J2233-606
H. C. Ferguson, S. A. Baum, I. Busko, B. R. Espey, A. Gonnella, J. Hayes, P. Hodge, C. L. Martin, K.C. Sahu, S. Savaglio, E. Smith, R. Williams, J. Wilson (STScI), T.M. Brown, J.P. Gardner (GSFC), C. M. Carollo, M.E Kaiser (JHU)

75.03 The Hubble Deep Field -- South: STIS Imaging
J. P. Gardner, T. M. Brown, H. I. Teplitz (GSFC), S. A. Baum, B. R. Espey, H. C. Ferguson, A. S. Fruchter, A. Gonnella, J. Hayes, C. L. Martin, K. C. Sahu, S. Savaglio, E. Smith, R. Williams, J. Wilson (STScI), C. M. Carollo, M. E Kaiser (JHU), R. N. Hook (ST-ECF)

75.04 The HDF-S NICMOS Field
A. S. Fruchter, L. E. Bergeron, M. Dickinson, H. C. Ferguson (STScI), R. N. Hook (ST-ECF), J. Mack, C. L. Martin, L. Mazzuca (STScI), H. I. Teplitz (GSFC), R. van der Marel, R. Williams, D. Zurek (STScI)

75.05 HDF-S: A WFPC2 Deep Image of a Field near QSO J2233-606
S. Casertano, D. de Mello, H. C. Ferguson, A. S. Fruchter, I. Heyer (STScI), R. N. Hook (ECF-Garching), R. A. Lucas, R. Makidon, M. Mutchler, M. Stiavelli, M. S. Wiggs, R. Williams (STScI)

75.06 The Hubble Deep Field South: Flanking Fields
R.A. Lucas, S. A. Baum, S. Casertano, D. de Mello, M. Dickinson, H. C. Ferguson, A. S. Fruchter, R. Gonzalez-Lopezlira, I. Heyer, J. Mack, R. Makidon, C. L. Martin, M. Mutchler, E. Smith, M. Stiavelli, H. I. Teplitz, M. S. Wiggs, R. Williams, D. Zurek (STScI), T.M. Brown, J. P. Gardner (GSFC), M. E. Kaiser (JHU), R. N. Hook (ESO/ST-ECF)

Other HDF-S related publications

- The Hubble Deep Field - South, H.C. Ferguson, 1998, Newsletter 10, IAU Working Group on Sky Surveys, 4
  Abstract (HTML, 1 kB), Article (PostScript, gzipped, 1.2 MB), Figures (HTML, 3 kB)

- The Hubble Deep Field - South, H.C. Ferguson, 1998, Space Telescope Science Institute Newsletter, Vol. 15, No. 3 (July 1998), 6

- Observations of QSO J2233-606 in the Southern Hubble Deep Field, Sealey, K. M., Drinkwater, M. J., Webb J. K., 1998, ApJL, 499, 135

- The Metal Absorption Systems of the Hubble Deep Field South QSO, Savaglio, S., 1998, AJ, 116, 1055

- An extremely red r(1/4) galaxy in the test image of the Hubble Deep Field South, Treu T., et al., 1998, A&A, 340, L10

- AAO support observations for the Hubble Deep Field South, Boyle, B. J., 1998, To appear in "Looking Deep in the Southern Sky" eds R.Morganti & W.J.Couch, Proc. of ESO/Australia Workshop, Dec 97 Sydney

- The Evolution of Barred Spiral Galaxies in the Hubble Deep Fields North and South, Abraham, R.G., Merrifield, M.R., Ellis, R.S., Tanvir, N., Brinchmann, J., 1998, MNRAS, submitted

- VLT and HST observations of a candidate high redshift elliptical galaxy in the Hubble Deep Field South, M. Stiavelli, et al., 1999, A&A, 343, L25

- ESO Imaging Survey. Hubble Deep Field South: Optical-Infrared Observations, Data Reduction and Photometry, L. da Costa, et al., 1998, A&A, submitted

- Detection of Evolved High-Redshift Galaxies in Deep NICMOS/VLT Images, N. Benitez, T. Broadhurst, R. Bouwens, J. Silk, P. Rosati, 1998, ApJ Letters, submitted. Color image available at this http URL.

- Identification of absorbing galaxies towards the QSO J2233-606 in the Hubble Deep Field South, L. Tresse, M. Dennefeld, P.Petitjean, S. Cristiani, S. White, 1998, A&A Letters, submitted

- A possible gravitational lens in the Hubble Deep Field South, R. Barkana, R. Blandford, D. Hogg 1998, ApJ Letters, submitted.

- Investigating the Metal Line Systems at Z=1.9 toward J2233-606 in the HDF-S, J.X. Prochaska, S.M. Burles, 1998, ApJ Letters, submitted.

- Photometry and Photometric Redshifts of Galaxies in the Hubble Deep Field South Nicmos Field, H.-W. Chen et al., 1998

- The Lyman-alpha forest of the QSO in the Hubble Deep Field South, S. Savaglio et al., 1999, ApJ Letters, submitted.

- Abstracts of papers to be presented in Session 75 of the AAS Meeting #193, Austin, Texas, January 1999

  75.07 The Hubble Deep Field South: Deep uBVRI Imaging of 1/2 Square Degree
  H.I. Teplitz, J.P. Gardner, P. Palunas, M.S. Sahu, E.M. Malumuth, B.E. Woodgate, S.R. Heap, G.M. Williger, A.C. Danks, A. Smette, T.M. Brown, M.E. Kaiser, T. R. Gull (Goddard Space Flight Center)

  75.08 Wide--field search for emission--line objects around the HDF--South= Quasar
  P. Palunas, J.P. Gardner, M.S. Sahu, H.I. Teplitz, E.M. Malumuth, B.E. Woodgate, S.R. Heap, G.M. Williger (NASA--GSFC)

  75.09 High Precision Astrometry for the Hubble Deep Field - South
  N. Zacharias, T. Corbin, M. Zacharias, T. Rafferty, P.K. Seidelmann, F.S. Gauss (U.S. Naval Observatory)

  75.10 An Archival Survey Around the HDF-South Region
  R. A. White (NASA/GSFC), K. D. Borne (Raytheon STX, NASA/GSFC), C. Y. Cheung (NASA/GSFC), V. E. Kargatis (Raytheon STX, NASA/GSFC), D. T. Leisawitz (NASA/GSFC), E. J. Shaya (Raytheon STX, NASA/GSFC)

- The VLT observations of the HDF-S NICMOS field: photometric catalog and high redshift galaxy candidates, A. Fontana et al., 1999, A&A Letters, in press.

- The zabs=zem Absorption Line Systems Toward QSO J2233-606 in the Hubble Deep Field South: NeVIII770,780 absorption and partial coverage, P. Petitjean, R. Srianand, 1999, A&A, in press

This page was last updated on January 27, 1999.

Warnings and Advisories

Information is available for the following topics:

- General
- STIS Spectroscopy
- STIS Imaging
- WFPC2
- NICMOS
- Flanking Fields

General

[2] (11/29/98) When browsing through this web site, always use **RELOAD** on your browser to make sure you get the latest version of a page, rather than an older version that still exists in the cache.

[1] (11/23/98) The headers of the files may be lengthy. To avoid IRAF errors associated with the headers being too long, include the following in your login.cl: **set min_lenuserarea = 500000**

STIS Spectroscopy

[2] (11/24/98) In the Version-1 data (11/23/98) there was an error in the G230L wavelength scale, introduced in the last step of the data reduction. This was corrected in version 1b, released December 21, 1998.

[1] (11/23/98) In the Version-1 data (11/23/98) there is a mismatch between the fluxes of the G430M spectrum and the G230L and E230M spectra in the wavelength region from 3000 to 3200 Angstroms. This discrepancy is under investigation. In the meantime, caveat emptor.

STIS Imaging

[1] (11/23/98) Please read the section on the window reflection before trying to identify or analyze objects close to the quasar!

WFPC2

NICMOS

[3] (11/24/98) Photometric zeropoints : There remains some significant uncertainty in the absolute photometric calibration of the NICMOS HDF-South images, with zeropoints for some bands uncertain at roughly the 10% level. Please read the discussion of NICMOS photometric zeropoints for further information. USERS WHO REQUIRE ABSOLUTE PHOTOMETRY BETTER THAN 10% IN THE NICMOS DATA SHOULD PROCEED WITH CAUTION BECAUSE OF THESE UNCERTAINTIES. We will provide updated information on photometric zeropoints on these web pages as it becomes available.

[2] (11/24/98) PSF distortion : The tilted Field Offset Mirror (FOM) position used for the NICMOS HDF-South imaging results in some distortion of the point spread function over the field of view. Caution should be exercised in any analysis requiring precise information about the PSF.

[1] (11/24/98) Linearity corrections : During the course of HDF-South data reduction we identified problems with the standard procedures used to correct nonlinearity in NICMOS images. A new procedure was implemented for the F222M images (where the high thermal background countrate makes linearity correction necessary) but has not yet been applied to the F110W and F160W images. Moreover the new procedure is based on a preliminary revision to the linearity calibrations and has not yet been fully tested. It is unlikely that these linearity corrections affect object photometry by more than a few percent, i.e. the resulting uncertainties are probably smaller than those of the absolute photometric zeropoints of the data (see above). We will be investigating this in more detail in the near future.

Flanking Fields

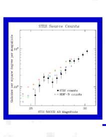
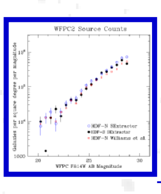
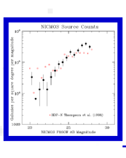
[2] (12/21/98) The final reprocessed data for all the **WFPC2 Flanking Field observations** are now available. This includes the positions 1-9, as well as the longer, 9 orbit, observations taken in parallel with STIS observations of the NICMOS deep field.

[1] (11/23/98) The **NICMOS Flanking Field data** are still being processed. The final data products will be made available as soon as they are finished. Our current target date is mid-January 1999. Raw and calibrated data for individual datasets are already available from the HST Data Archive.

This page was last updated on December 23, 1998.

Source Catalogs

Catalogs of sources found in the HDF-S images can be obtained from this page.

HDF-S STIS catalog | HDF-S WFPC2 catalog | HDF-S NICMOS catalog

HDF-N WFPC2 catalog

HDF-S WFPC2 catalog version 2

The version 1 catalogs were produced using the Source Extractor (SExtractor) package. Details of the parameters used to control the source detection and photometry are given in the README files found with the catalogs.

Detection of faint sources near brighter objects poses a difficult problem for automated photomtetry programs. SExtractor fares better than most, but nevertheless no single set of deblending thresholds, cleaning parameters, etc., was deemed acceptable. In particular, the set of parameters that did the best job for detecting the typical faint, relatively isolated galaxies, would tend to over-merge galaxies near bright stars (counting them as part of the star rather than keeping them as separate objects). While this has a negligible effect on faint-galaxy statistics, it did produce a catalog that did not have separate entries for a number of objects that might be good candidates for spectroscopy. To recover these objects, SExtractor was run multiple times with different detection thresholds. Objects that were considered to be "over merged" in the first catalog were deleted from that catalog and the entries for their various subcomponents were taken from a catalog with a higher detection threshold. A few obvious artifacts due to diffraction spikes were deleted from each catalog as well. The object numbering and the IMA_FLAGS parameter indicate which SExtractor run each catalog entry came from. The number of objects added and deleted for the different catalogs were WFPC2: 24 deleted, 31 added; STIS: 26 deleted, 8 added; and NICMOS: 14 deleted, 29 added.

The WFPC-2 catalog of HDF-N published by Williams et al. (1996) used a modified version of FOCAS for source detection and photometry. To aid in comparison to HDF-S, we have constructed a SExtractor catalog of HDF-N.

Technical information on the construction of the catalogs for the individual instruments is available:

- STIS
- WFPC2
- NICMOS
- HDF-North

This page was last updated on December 23, 1998.

SPACE TELESCOPE SCIENCE INSTITUTE
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The Hubble Deep Field South

NEW This list was updated on March 5, 1999, and replaces the list that was posted on this page from November 23, 1998 to March 4, 1999. Contact Sandra Savaglio for details about the improvements in the new list.

Absorption Line List for the QSO J2233-606 sight-line

The MIDAS package FITLYMAN (Fontana & Ballester, The ESO Messenger, 80, 37 1995) has been used to measure the parameters of absorption lines in the full range (interval 2350 A - 4330 A) of the spectra E230M, G430M of STIS/HST and of the spectrum UCLES/AAT (Outram et al., 1998, MNRAS submitted, astro-ph/9809404). Line fitting through chi^2 minimization of Voigt profiles provides the redshift, the Doppler parameter b, the column density and the Equivalent Width. Multiple lines of a single ion have been fitted simultaneously. The line identification should be considered preliminary and line parameters taken with caution due to the considerable uncertainties. About 257 Lyman-alpha clouds have been identified in the redshift range 1.201 - 2.247, though a small fraction of them might be misinterpreted unidentified metal lines.

Sequence	Ion	lambda	D_lambda	redshift	log(N)	D_log(N)	b(km/s)	D_b	EW
1	HI_1025	2290.90	0.07	1.2334466	14.79	0.17	73.60	16.50	0.33
2	HI_1025	2291.88	0.03	1.2344102	14.08	0.25	17.65	8.01	0.07
3	AlII_1670	2362.90	0.08	0.4142433	12.26	0.59	8.29	13.61	0.06
4	HI_1025	2366.82	0.01	1.3074663	14.19	0.37	9.83	2.12	0.06
5	HI_1025	2426.01	0.02	1.3651736	15.25	0.24	67.32	7.44	0.56
6	HI_1025	2547.06	0.06	1.4831835	15.47	0.26	49.20	7.54	0.52
7	HI_926	2607.77	0.01	1.8154792	16.69	0.22	33.21	1.68	0.31
8	HI_937	2612.64	0.10	1.7859124	16.62	0.71	11.62	2.36	0.15
9	HI_937	2613.20	0.05	1.7865127	15.46	0.24	17.54	6.07	0.10
10	HI_937	2613.75	0.04	1.7871023	14.87	0.07	25.37	3.62	0.04
11	HI_930	2620.50	0.01	1.8154786	16.69	0.22	33.21	1.68	0.34
12	HI_972	2621.50	0.04	1.6955318	14.69	0.06	34.28	3.22	0.10
13	HI_1025	2622.29	0.05	1.5565341	13.99	0.08	44.55	6.80	0.07
14	HI_1025	2623.91	0.05	1.5581067	13.86	0.09	33.24	7.75	0.05
15	HI_1025	2640.24	0.07	1.5740329	13.78	0.07	44.51	11.23	0.04
16	HI_937	2640.36	0.01	1.8154794	16.69	0.22	33.21	1.68	0.37
17	HI_920	2640.93	0.02	1.8675712	15.41	0.09	24.33	2.11	0.03
18	HI_920	2641.92	0.02	1.8686528	15.59	0.07	36.20	3.67	0.04
19	HI_920	2643.16	0.02	1.8699915	16.10	0.27	37.00	2.35	0.12
20	HI_972	2643.25	0.02	1.7178880	14.53	0.04	30.83	2.06	0.07
21	HI_920	2644.19	0.35	1.8711120	15.20	2.96	25.00	2.12	0.02
22	HI_920	2645.27	0.05	1.8722837	16.50	0.17	40.00	2.59	0.23
23	HI_1025	2645.31	0.04	1.5789710	13.99	0.14	27.99	8.51	0.06
24	HI_949	2645.90	0.10	1.7859122	16.62	0.71	11.62	2.36	0.16
25	HI_949	2646.48	0.05	1.7865179	15.46	0.24	17.54	6.07	0.14
26	HI_949	2647.03	0.04	1.7871021	14.87	0.07	25.37	3.62	0.07
27	HI_923	2647.20	0.02	1.8675708	15.41	0.09	24.33	2.11	0.04
28	HI_923	2648.20	0.02	1.8686519	15.59	0.07	36.20	3.67	0.06
29	HI_923	2649.43	0.02	1.8699919	16.10	0.27	37.00	2.35	0.15
30	HI_923	2650.47	0.35	1.8711119	15.20	2.96	25.00	2.12	0.02
31	HI_923	2651.55	0.05	1.8722841	16.50	0.17	40.00	2.59	0.27
32	HI_926	2656.02	0.02	1.8675702	15.41	0.09	24.33	2.11	0.05
33	HI_972	2656.54	0.02	1.7315613	14.43	0.11	26.59	3.24	0.05
34	HI_926	2657.02	0.02	1.8686529	15.59	0.07	36.20	3.67	0.08
35	HI_1025	2657.25	0.06	1.5906183	15.35	2.63	30.17	20.74	0.34
36	HI_926	2658.26	0.02	1.8699917	16.10	0.27	37.00	2.35	0.19
37	HI_926	2659.30	0.35	1.8711125	15.20	2.96	25.00	2.12	0.03
38	HI_926	2660.38	0.05	1.8722838	16.50	0.17	40.00	2.59	0.31
39	HI_930	2668.99	0.02	1.8675711	15.41	0.09	24.33	2.11	0.08
40	HI_930	2669.99	0.02	1.8686519	15.59	0.07	36.20	3.67	0.11
41	HI_930	2671.24	0.02	1.8699918	16.10	0.27	37.00	2.35	0.24
42	HI_930	2672.28	0.35	1.8711123	15.20	2.96	25.00	2.12	0.05
43	HI_949	2673.98	0.01	1.8154789	16.69	0.22	33.21	1.68	0.41
44	HI_972	2674.05	0.02	1.7495629	14.34	0.02	75.50	3.12	0.05
45	HI_1215	2675.72	0.09	1.2010243	13.50	0.18	30.74	15.06	0.13
46	HI_1025	2676.55	0.09	1.6094303	14.00	0.09	52.99	13.65	0.07
47	HI_1215	2676.67	0.05	1.2018055	13.71	0.17	22.84	7.54	0.17
48	HI_1215	2677.64	0.03	1.2026060	16.39	4.02	15.31	11.51	0.35
49	HI_1025	2677.76	0.05	1.6106073	14.79	0.10	55.24	6.72	0.30
50	HI_1215	2679.18	0.18	1.2038686	13.67	0.21	53.52	31.86	0.20
51	HI_1215	2681.23	0.03	1.2055544	13.99	0.18	25.24	5.10	0.24
52	HI_1215	2682.57	0.03	1.2066567	15.37	0.85	32.55	9.35	0.56
53	HI_1215	2683.64	0.02	1.2075428	16.47	1.07	17.81	3.57	0.41
54	HI_1215	2685.36	0.04	1.2089573	13.77	0.08	28.83	5.03	0.20
55	HI_1215	2686.07	0.03	1.2095407	13.96	0.12	24.71	4.57	0.23
56	HI_1215	2688.14	0.02	1.2112402	14.18	0.18	27.44	4.10	0.30
57	HI_937	2689.22	0.01	1.8675709	15.41	0.09	24.33	2.11	0.11
58	HI_1025	2689.55	0.08	1.6221036	13.62	0.07	53.06	16.01	0.03
59	HI_1215	2689.64	0.03	1.2124730	15.08	2.09	14.04	8.54	0.25
60	HI_937	2690.23	0.02	1.8686523	15.59	0.07	36.20	3.67	0.16
61	HI_937	2691.49	0.02	1.8699923	16.10	0.27	37.00	2.35	0.30
62	HI_937	2692.54	0.35	1.8711131	15.20	2.96	25.00	2.12	0.08
63	HI_937	2693.64	0.05	1.8722843	16.50	0.17	40.00	2.59	0.40
64	HI_920	2694.37	0.01	1.9255977	17.00	0.08	31.18	0.87	0.30
65	HI_920	2695.70	0.01	1.9270476	15.42	0.05	13.49	1.86	0.03
66	HI_920	2696.49	0.01	1.9279013	16.71	0.06	35.25	1.53	0.26
67	HI_920	2697.33	0.02	1.9288129	15.40	0.04	25.00	1.65	0.03
68	HI_1215	2698.90	0.04	1.2200891	13.36	0.13	20.18	6.28	0.09
69	HI_923	2700.77	0.01	1.9255978	17.00	0.08	31.18	0.87	0.32
70	HI_1215	2701.62	0.04	1.2223322	13.71	0.09	23.55	8.81	0.17
71	HI_923	2702.10	0.01	1.9270478	15.42	0.05	13.49	1.86	0.04
72	HI_923	2702.89	0.01	1.9279015	16.71	0.06	35.25	1.53	0.30
73	HI_923	2703.73	0.02	1.9288129	15.40	0.04	25.00	1.65	0.04
74	HI_1215	2705.20	0.03	1.2252753	13.56	0.08	24.65	4.25	0.14
75	HI_1215	2707.07	0.05	1.2268168	12.99	0.18	16.81	9.36	0.05
76	HI_923	2707.67	0.01	1.9330717	15.75	0.03	26.51	0.74	0.08
77	HI_1215	2708.90	0.02	1.2283200	17.36	0.12	7.39	0.86	0.37
78	HI_1215	2708.94	0.06	1.2283547	14.05	0.11	32.34	6.14	0.29
79	HI_972	2709.40	0.08	1.7859124	16.62	0.71	11.62	2.36	0.18
80	HI_926	2709.76	0.01	1.9255977	17.00	0.08	31.18	0.87	0.34
81	HI_972	2709.99	0.05	1.7865174	15.46	0.24	17.54	6.07	0.17
82	HI_972	2710.56	0.03	1.7871028	14.87	0.07	25.37	3.62	0.12
83	HI_926	2711.11	0.01	1.9270478	15.42	0.05	13.49	1.86	0.05
84	HI_926	2711.90	0.01	1.9279014	16.71	0.06	35.25	1.53	0.33
85	HI_926	2712.74	0.02	1.9288129	15.40	0.04	25.00	1.65	0.05
86	HI_1215	2715.13	0.08	1.2334465	14.79	0.17	73.60	16.50	0.89
87	HI_923	2715.83	0.05	1.9419194	15.42	0.09	20.82	2.22	0.04
88	HI_1215	2716.31	0.03	1.2344100	14.08	0.25	17.65	8.01	0.20
89	HI_923	2716.36	0.02	1.9424870	16.06	0.06	28.83	1.64	0.13
90	HI_926	2716.69	0.01	1.9330719	15.75	0.03	26.51	0.74	0.10
91	HI_1215	2718.71	0.02	1.2363899	13.22	0.09	14.35	3.92	0.07
92	HI_1215	2720.10	0.04	1.2375306	13.68	0.06	38.01	5.69	0.19
93	HI_1215	2721.01	0.04	1.2382810	13.43	0.08	26.81	6.94	0.11
94	HI_972	2721.11	0.26	1.7979558	13.99	0.06	30.35	19.06	0.02
95	HI_1215	2722.15	0.02	1.2392161	15.45	1.69	15.87	6.62	0.30
96	HI_930	2722.99	0.01	1.9255977	17.00	0.08	31.18	0.87	0.36
97	HI_949	2723.46	0.01	1.8675708	15.41	0.09	24.33	2.11	0.16
98	HI_930	2723.71	0.05	1.9263697	14.87	0.17	15.61	8.98	0.26
99	HI_930	2724.03	0.05	1.9267107	14.68	0.18	11.92	3.77	0.19
100	HI_930	2724.34	0.03	1.9270480	15.42	0.05	13.49	1.86	0.06
101	HI_949	2724.48	0.02	1.8686522	15.59	0.07	36.20	3.67	0.23
102	HI_926	2724.88	0.05	1.9419194	15.42	0.09	20.82	2.22	0.05
103	HI_930	2725.13	0.02	1.9279014	16.71	0.27	35.25	2.79	0.44
104	HI_926	2725.41	0.02	1.9424872	16.06	0.06	28.83	1.64	0.16
105	HI_949	2725.76	0.02	1.8699923	16.10	0.27	37.00	2.35	0.36

106	HI_930	2725.99	0.02	1.9288133	15.40	0.04	25.00	1.65	0.07
107	HI_972	2726.74	0.00	1.8037347	14.47	0.00	53.51	0.00	0.07
108	HI_949	2726.82	0.35	1.8711128	15.20	2.96	25.00	2.12	0.12
109	HI_949	2727.93	0.05	1.8722842	16.50	0.17	40.00	2.59	0.45
110	HI_930	2729.95	0.01	1.9330719	15.75	0.03	26.51	0.74	0.13
111	HI_949	2733.73	0.02	1.8783878	14.00	0.05	25.07	2.55	0.01
112	HI_923	2736.54	0.01	1.9643493	15.10	0.04	28.64	1.06	0.02
113	HI_1215	2736.82	0.03	1.2512825	13.69	0.13	18.96	4.91	0.15
114	HI_972	2738.16	0.01	1.8154790	16.69	0.22	33.21	1.68	0.46
115	HI_930	2738.19	0.05	1.9419199	15.42	0.09	20.82	2.22	0.07
116	HI_930	2738.71	0.02	1.9424872	16.06	0.06	28.83	1.64	0.20
117	HI_937	2743.63	0.01	1.9255978	17.00	0.08	31.18	0.87	0.39
118	HI_937	2744.36	0.04	1.9263697	14.87	0.17	15.61	8.98	0.04
119	HI_937	2744.68	0.04	1.9267106	14.68	0.18	11.92	3.77	0.02
120	HI_1025	2744.91	0.05	1.6760744	13.68	0.06	40.58	9.59	0.03
121	HI_937	2744.99	0.01	1.9270478	15.42	0.05	13.49	1.86	0.09
122	HI_926	2745.66	0.01	1.9643494	15.10	0.04	28.64	1.06	0.03
123	HI_937	2745.79	0.01	1.9279014	16.71	0.06	35.25	1.53	0.40
124	HI_937	2746.65	0.02	1.9288129	15.40	0.04	25.00	1.65	0.11
125	HI_1025	2746.80	0.16	1.6779209	13.86	0.17	52.83	15.56	0.05
126	HI_1025	2747.92	0.15	1.6790059	14.00	0.12	62.34	22.92	0.07
127	HI_926	2748.20	0.02	1.9670956	14.70	0.05	39.81	2.16	0.01
128	HI_937	2750.64	0.01	1.9330719	15.75	0.03	26.51	0.74	0.18
129	HI_1025	2753.47	0.60	1.6844206	13.39	2.97	11.34	65.46	0.02
130	HI_1215	2754.56	0.06	1.2658799	12.93	0.17	22.15	12.96	0.04
131	HI_1025	2757.85	0.12	1.6886867	13.45	0.09	57.81	13.36	0.02
132	HI_937	2758.94	0.03	1.9419198	15.42	0.09	20.82	2.22	0.10
133	HI_930	2759.06	0.01	1.9643492	15.10	0.04	28.64	1.06	0.04
134	HI_937	2759.47	0.02	1.9424874	16.06	0.06	28.83	1.64	0.24
135	HI_930	2761.62	0.02	1.9670957	14.70	0.05	39.81	2.16	0.02
136	HI_1025	2764.87	0.03	1.6955329	14.69	0.06	34.28	3.22	0.21
137	HI_1025	2765.72	0.13	1.6963629	13.77	0.14	41.07	18.85	0.04
138	HI_972	2768.70	0.06	1.8468875	13.84	0.17	30.89	12.96	0.02
139	HI_972	2770.01	0.04	1.8482327	13.50	0.14	21.28	1.04	0.01
140	HI_972	2770.83	0.12	1.8490700	14.11	0.09	102.24	1.06	0.03
141	HI_972	2773.78	0.00	1.8521130	14.13	0.00	32.49	0.00	0.03
142	HI_1025	2774.82	0.04	1.7052352	13.65	0.04	50.56	7.24	0.03
143	HI_1215	2777.55	0.12	1.2847909	13.86	0.11	61.06	19.84	0.30
144	HI_949	2778.57	0.01	1.9255977	17.00	0.08	31.18	0.87	0.43
145	HI_949	2779.30	0.04	1.9263695	14.87	0.17	15.61	8.98	0.06
146	HI_949	2779.62	0.04	1.9267107	14.68	0.18	11.92	3.77	0.04
147	HI_949	2779.94	0.01	1.9270477	15.42	0.05	13.49	1.86	0.11
148	HI_937	2779.98	0.01	1.9643493	15.10	0.04	28.64	1.06	0.07
149	HI_949	2780.75	0.02	1.9279014	16.71	0.27	35.25	2.79	0.44
150	HI_949	2781.62	0.02	1.9288126	15.40	0.04	25.00	1.65	0.16
151	HI_937	2782.55	0.02	1.9670957	14.70	0.05	39.81	2.16	0.03
152	HI_972	2782.84	0.00	1.8614249	13.85	0.00	44.99	0.00	0.02
153	HI_949	2785.66	0.01	1.9330719	15.75	0.03	26.51	0.74	0.22
154	HI_1025	2786.93	0.06	1.7170442	13.45	0.08	29.88	10.45	0.02
155	HI_972	2787.59	0.02	1.8663048	14.28	0.06	21.81	2.17	0.04
156	HI_1025	2787.80	0.02	1.7178878	14.53	0.04	30.83	2.06	0.17
157	HI_972	2788.82	0.02	1.8675710	15.41	0.09	24.33	2.11	0.22
158	HI_972	2789.87	0.02	1.8686525	15.59	0.07	36.20	3.67	0.32
159	HI_972	2791.17	0.02	1.8699923	16.10	0.27	37.00	2.35	0.42
160	HI_972	2792.26	0.36	1.8711128	15.20	2.96	25.00	2.12	0.18
161	HI_972	2793.40	0.05	1.8722842	16.50	0.17	40.00	2.59	0.52
162	HI_949	2794.07	0.03	1.9419196	15.42	0.09	20.82	2.22	0.15
163	HI_949	2794.61	0.02	1.9424875	16.06	0.06	28.83	1.64	0.29
164	MgII_2796	2796.39	0.06	0.0000124	15.46	1.10	13.08	3.65	0.65
165	MgII_2796	2797.11	0.08	0.0002711	14.70	0.44	28.53	6.15	1.10
166	HI_972	2799.34	0.02	1.8783882	14.00	0.05	25.07	2.55	0.02
167	HI_1215	2801.01	0.04	1.3040910	13.96	0.06	42.60	6.73	0.30
168	HI_1215	2801.70	0.03	1.3046509	14.23	0.34	13.79	2.72	0.18
169	HI_1025	2801.82	0.02	1.7315621	14.43	0.11	26.59	3.24	0.13
170	HI_1025	2802.53	0.02	1.7322472	13.92	0.10	16.46	2.92	0.05
171	HI_937	2802.86	0.01	1.9887526	14.50	0.05	22.88	1.32	0.02
172	MgII_2803	2803.57	0.06	0.0000125	15.46	1.10	13.08	3.65	0.61
173	MgII_2803	2804.29	0.08	0.0002711	14.70	0.44	28.53	6.15	1.01
174	HI_1215	2805.12	0.01	1.3074661	14.19	0.37	9.83	2.12	0.14
175	HI_1215	2805.86	0.08	1.3080769	13.44	0.17	35.86	22.76	0.12
176	HI_1215	2806.68	0.08	1.3087482	13.64	0.10	45.03	12.46	0.19
177	HI_1215	2809.45	0.04	1.3110318	13.61	0.10	20.76	5.40	0.14
178	HI_949	2812.71	0.02	1.9615525	14.38	0.06	26.33	2.04	0.03
179	HI_972	2814.68	0.03	1.8941619	13.76	0.10	19.25	4.21	0.01
180	HI_949	2815.37	0.01	1.9643492	15.10	0.04	28.64	1.06	0.11
181	HI_949	2817.98	0.02	1.9670957	14.70	0.05	39.81	2.16	0.05
182	HI_1215	2819.11	0.16	1.3189753	13.64	0.18	71.26	40.32	0.20
183	HI_1025	2820.29	0.02	1.7495637	14.34	0.02	75.50	3.12	0.14
184	HI_1215	2821.32	0.14	1.3207957	14.46	0.16	52.38	14.00	0.57
185	HI_972	2821.79	0.10	1.9014788	13.47	0.08	48.84	11.49	0.01
186	HI_1215	2822.30	0.07	1.3216034	15.39	0.90	26.77	8.49	0.47
187	HI_1215	2823.12	0.04	1.3222731	13.08	0.15	15.39	8.46	0.05
188	HI_1025	2824.10	0.11	1.7532809	13.38	0.07	76.34	15.62	0.02
189	HI_1215	2825.92	0.03	1.3245754	14.04	0.05	43.87	4.23	0.34
190	HI_1215	2828.88	0.03	1.3270152	13.68	0.06	28.19	3.78	0.17
191	HI_1025	2828.97	0.06	1.7580253	13.22	0.07	35.79	11.16	0.01
192	HI_920	2833.96	0.01	2.0771701	15.78	0.03	32.19	0.55	0.06
193	HI_1025	2835.40	0.03	1.7642947	13.77	0.04	32.84	4.76	0.04
194	HI_920	2836.16	0.01	2.0795624	14.58	0.06	19.25	0.88	0.00
195	HI_1025	2836.31	0.04	1.7651880	13.43	0.08	17.28	4.05	0.02
196	HI_937	2836.35	0.03	2.0244679	14.07	0.14	21.40	3.94	0.01
197	HI_949	2838.55	0.01	1.9887526	14.50	0.05	22.88	1.32	0.03
198	HI_923	2840.69	0.01	2.0771704	15.78	0.03	32.19	0.55	0.08
199	HI_1215	2840.70	0.01	1.3367326	15.70	0.31	49.34	4.30	0.88
200	HI_1215	2842.33	0.04	1.3380740	13.16	0.11	19.46	4.45	0.07
201	HI_1215	2843.88	0.00	1.3393494	13.39	0.30	62.90	55.38	0.12
202	HI_972	2845.25	0.01	1.9255978	17.00	0.08	31.18	0.87	0.47
203	HI_972	2846.00	0.04	1.9263697	14.87	0.17	15.61	8.98	0.10
204	HI_972	2846.33	0.04	1.9267106	14.68	0.18	11.92	3.77	0.07
205	HI_972	2846.66	0.00	1.9270442	15.42	0.05	13.49	1.86	0.14
206	HI_972	2847.49	0.02	1.9279015	16.71	0.27	35.25	2.79	0.49
207	HI_972	2848.38	0.02	1.9288127	15.40	0.04	25.00	1.65	0.22
208	CIV_1548	2848.73	0.06	0.8400342	13.85	6.68	0.72	3.18	0.02
209	CIV_1548	2849.08	0.04	0.8402573	13.55	0.24	3.10	1.20	0.04
210	HI_926	2850.16	0.01	2.0771704	15.78	0.03	32.19	0.55	0.11
211	HI_1215	2851.78	0.06	1.3458503	13.95	0.10	31.10	7.72	0.26
212	HI_972	2852.52	0.01	1.9330717	15.75	0.03	26.51	0.74	0.28
213	CIV_1550	2853.47	0.06	0.8400342	13.85	6.68	0.72	3.18	0.02
214	CIV_1550	2853.82	0.04	0.8402573	13.55	1.56	3.10	1.20	0.04
215	HI_1025	2857.57	0.09	1.7859125	16.62	0.71	11.62	2.36	0.21
216	HI_1025	2858.19	0.06	1.7865175	15.46	0.24	17.54	6.07	0.22
217	HI_1025	2858.79	0.03	1.7871028	14.87	0.07	25.37	3.62	0.22
218	HI_1025	2859.69	0.05	1.7879722	13.60	0.07	30.57	9.66	0.03
219	HI_949	2859.95	0.03	2.0112879	13.87	0.06	31.33	3.76	0.01
220	HI_972	2859.95	0.08	1.9407142	13.78	0.08	45.17	9.89	0.01
221	HI_1215	2860.43	0.04	1.3529651	13.41	0.10	19.93	5.41	0.10
222	HI_972	2861.13	0.03	1.9419198	15.42	0.09	20.82	2.22	0.19
223	HI_972	2861.68	0.02	1.9424874	16.06	0.06	28.83	1.64	0.34
224	HI_930	2864.07	0.01	2.0771706	15.78	0.03	32.19	0.55	0.15
225	HI_1025	2864.54	0.05	1.7927020	13.53	0.11	18.63	9.02	0.02
226	HI_1025	2865.43	0.03	1.7935754	14.28	0.06	40.57	4.65	0.12
227	HI_930	2866.30	0.01	2.0795619	14.58	0.06	19.25	0.88	0.01

228	HI_1025	2869.93	0.22	1.7979555	13.99	0.06	30.35	19.06	0.06
229	HI_949	2872.47	0.03	2.0244684	14.07	0.14	21.40	3.94	0.01
230	HI_1215	2875.27	0.03	1.3651737	15.25	0.24	67.32	7.44	1.02
231	HI_1025	2875.85	0.02	1.8037341	14.47	0.07	53.51	4.07	0.17
232	HI_972	2878.36	0.06	1.9596463	13.88	0.06	54.68	8.38	0.02
233	HI_937	2878.42	0.02	2.0693250	14.48	0.08	22.56	1.99	0.02
234	HI_972	2880.22	0.02	1.9615532	14.38	0.05	26.33	2.04	0.05
235	HI_1025	2880.43	0.07	1.8081957	13.68	0.05	87.30	12.89	0.03
236	HI_972	2882.94	0.01	1.9643493	15.10	0.04	28.64	1.06	0.18
237	HI_972	2885.61	0.02	1.9670959	14.70	0.05	39.81	2.16	0.10
238	HI_937	2885.78	0.01	2.0771706	15.78	0.03	32.19	0.55	0.20
239	HI_1025	2886.28	0.04	1.8138973	13.36	3.77	14.20	10.01	0.02
240	HI_949	2886.35	0.02	2.0390861	13.84	0.05	24.69	2.08	0.01
241	HI_1025	2887.90	0.01	1.8154788	16.69	0.22	33.21	1.68	0.54
242	HI_937	2888.02	0.01	2.0795619	14.58	0.06	19.25	0.88	0.02
243	HI_1025	2891.27	0.04	1.8187611	13.50	3.77	35.31	10.01	0.02
244	HI_1215	2892.04	0.10	1.3789669	13.48	0.13	40.59	12.11	0.13
245	HI_1215	2893.25	0.06	1.3799607	13.33	0.15	20.36	6.71	0.09
246	HI_1215	2894.70	0.05	1.3811539	14.24	0.13	39.48	5.96	0.40
247	NV_1238	2895.24	0.04	1.3370960	14.13	0.08	26.05	5.44	0.18
248	HI_1025	2896.08	0.02	1.8234589	13.93	0.10	11.90	1.41	0.05
249	HI_930	2897.35	0.01	2.1129255	14.66	0.04	45.60	1.30	0.02
250	NV_1242	2904.55	0.04	1.3370959	14.13	0.08	26.05	5.44	0.11
251	HI_1215	2905.51	0.09	1.3900470	13.23	0.18	33.18	18.94	0.08
252	HI_972	2906.67	0.02	1.9887526	14.50	0.05	22.88	1.32	0.06
253	HI_1025	2910.20	0.04	1.8372202	13.71	0.05	38.71	7.22	0.04
254	HI_1215	2912.52	0.04	1.3958112	13.40	0.08	27.37	6.72	0.11
255	HI_949	2915.07	0.02	2.0693245	14.48	0.08	22.56	1.99	0.03
256	HI_1025	2917.26	0.04	1.8441054	13.33	0.18	12.16	6.96	0.01
257	HI_1025	2919.09	0.04	1.8458830	13.63	0.07	22.26	5.24	0.03
258	HI_937	2919.31	0.01	2.1129258	14.66	0.04	45.60	1.30	0.06
259	HI_1025	2920.12	0.03	1.8468884	13.84	0.05	30.89	4.35	0.05
260	HI_1025	2921.50	0.04	1.8482327	13.50	0.14	21.28	1.04	0.02
261	HI_1025	2922.35	0.13	1.8490701	14.11	0.09	102.24	1.06	0.09
262	HI_949	2922.52	0.01	2.0771706	15.78	0.03	32.19	0.55	0.26
263	HI_949	2924.79	0.01	2.0795619	14.58	0.06	19.25	0.88	0.04
264	HI_1025	2925.48	0.02	1.8521132	14.13	0.05	32.49	3.17	0.08
265	HI_1215	2926.27	0.04	1.4071279	12.94	0.18	10.53	4.94	0.04
266	HI_1025	2929.29	0.04	1.8558298	13.52	0.06	24.57	6.64	0.02
267	HI_1215	2933.40	0.05	1.4129918	13.16	0.18	14.87	5.84	0.06
268	HI_1025	2935.03	0.09	1.8614249	13.85	0.10	44.99	10.05	0.05
269	HI_1025	2935.97	0.36	1.8623446	13.33	0.32	52.29	34.57	0.02
270	HI_1025	2939.22	0.03	1.8655080	13.50	0.10	13.81	4.58	0.02
271	HI_1025	2940.03	0.02	1.8663048	14.28	0.06	21.81	2.17	0.10
272	HI_1025	2941.33	0.02	1.8675708	15.41	0.09	24.33	2.11	0.29
273	HI_972	2941.41	0.03	2.0244675	14.07	0.14	21.40	3.94	0.03
274	HI_1025	2942.44	0.02	1.8686523	15.59	0.07	36.20	3.67	0.43
275	HI_1025	2943.81	0.02	1.8699921	16.10	0.27	37.00	2.35	0.52
276	HI_1025	2944.96	0.38	1.8711129	15.20	2.96	25.00	2.12	0.27
277	HI_1025	2946.17	0.06	1.8722843	16.50	0.17	40.00	2.59	0.62
278	HI_1215	2947.16	0.06	1.4243090	13.95	0.11	30.70	9.02	0.26
279	HI_972	2949.21	0.05	2.0324938	13.76	0.05	42.20	5.32	0.01
280	HI_1025	2952.43	0.02	1.8783880	14.00	0.05	25.07	2.55	0.06
281	HI_972	2955.62	0.02	2.0390830	13.84	0.05	24.69	2.08	0.02
282	HI_1215	2956.21	0.15	1.4317535	13.60	0.10	85.07	27.14	0.19
283	HI_949	2956.48	0.01	2.1129258	14.66	0.04	45.60	1.30	0.09
284	HI_1025	2957.24	0.05	1.8830799	13.60	0.05	44.31	9.11	0.03
285	HI_1025	2958.90	0.08	1.8846977	13.29	0.09	32.76	12.69	0.01
286	OVI_1031	2959.07	0.06	1.8675252	14.35	0.06	55.54	9.57	0.21
287	OVI_1031	2960.43	0.04	1.8688391	14.04	0.23	26.06	10.35	0.10
288	HI_1025	2960.80	0.06	1.8865538	13.39	0.08	27.80	10.84	0.02
289	OVI_1031	2961.23	0.05	1.8696162	14.24	0.19	29.09	7.28	0.15
290	OVI_1031	2962.07	0.38	1.8704290	14.52	0.28	119.01	83.36	0.34
291	HI_1025	2967.25	0.03	1.8928381	13.66	0.06	24.59	5.62	0.03
292	HI_1025	2968.61	0.02	1.8941622	13.76	0.10	19.25	4.21	0.04
293	HI_1025	2972.54	0.12	1.8979938	13.30	0.12	13.05	13.14	0.01
294	OVI_1037	2975.39	0.06	1.8675252	14.35	0.06	55.54	9.57	0.12
295	HI_1025	2976.11	0.10	1.9014794	13.47	0.08	48.84	11.49	0.02
296	OVI_1037	2976.76	0.04	1.8688394	14.04	0.23	26.06	10.35	0.06
297	OVI_1037	2977.56	0.05	1.8696163	14.24	0.19	29.09	7.28	0.09
298	OVI_1037	2978.41	0.38	1.8704292	14.52	0.28	119.01	83.36	0.19
299	HI_1215	2984.69	0.07	1.4551810	13.38	0.16	19.70	10.31	0.10
300	HI_972	2985.03	0.02	2.0693245	14.48	0.08	22.56	1.99	0.06
301	HI_972	2989.15	0.02	2.0735636	14.14	0.05	34.66	2.58	0.03
302	HI_972	2990.14	0.03	2.0745747	13.89	0.04	40.61	4.48	0.02
303	HI_972	2992.66	0.01	2.0771706	15.78	0.03	32.19	0.55	0.33
304	HI_1215	2994.00	0.10	1.4628433	13.16	0.28	22.69	34.99	0.07
305	HI_972	2994.99	0.01	2.0795619	14.58	0.06	19.25	0.88	0.07
306	SiIII_1206	2996.24	0.09	1.4834181	12.52	0.12	38.43	11.86	0.06
307	HI_1215	2998.77	0.03	1.4667635	13.76	0.09	22.29	3.91	0.18
308	HI_1025	3000.85	0.01	1.9255978	17.00	0.08	31.18	0.87	0.54
309	HI_1025	3001.64	0.04	1.9263697	14.87	0.17	15.61	8.98	0.16
310	HI_1025	3001.99	0.05	1.9267107	14.68	0.18	11.92	3.77	0.11
311	HI_972	3002.24	0.01	2.0870144	13.89	0.03	30.16	1.76	0.02
312	HI_1025	3002.33	0.00	1.9270442	15.42	0.05	13.49	1.86	0.18
313	HI_1025	3003.21	0.02	1.9279013	16.71	0.27	35.25	2.79	0.58
314	HI_1025	3004.15	0.02	1.9288129	15.40	0.04	25.00	1.65	0.29
315	HI_1215	3007.03	0.03	1.4735581	14.24	0.09	42.36	4.31	0.41
316	HI_1025	3007.41	0.08	1.9319881	13.41	0.14	31.39	12.58	0.02
317	HI_1025	3008.52	0.01	1.9330717	15.75	0.03	26.51	0.74	0.35
318	HI_1215	3010.29	0.10	1.4762360	13.29	0.14	32.95	11.64	0.09
319	HI_972	3010.62	0.02	2.0956318	13.63	0.03	30.26	2.54	0.01
320	HI_1215	3015.60	0.13	1.4806077	13.47	0.20	31.03	16.37	0.13
321	HI_1025	3016.36	0.07	1.9407154	13.78	0.08	45.17	9.89	0.04
322	HI_1215	3016.55	0.10	1.4813858	13.34	0.19	28.73	17.65	0.10
323	HI_1025	3017.59	0.03	1.9419198	15.42	0.09	20.82	2.22	0.25
324	HI_1025	3018.17	0.02	1.9424872	16.06	0.06	28.83	1.64	0.41
325	HI_1215	3018.73	0.07	1.4831834	15.47	0.26	49.20	7.54	0.83
326	HI_1215	3025.03	0.03	1.4883628	14.23	0.21	24.50	4.61	0.28
327	HI_972	3027.43	0.01	2.1129258	14.66	0.04	45.60	1.30	0.17
328	HI_1215	3030.60	0.07	1.4929478	13.15	0.19	19.30	7.84	0.06
329	HI_1025	3032.39	0.05	1.9563440	13.93	0.07	41.71	5.40	0.06
330	HI_1215	3034.68	0.11	1.4963043	13.76	0.10	55.84	12.01	0.24
331	HI_1025	3035.77	0.07	1.9596460	13.88	0.06	54.68	8.38	0.05
332	HI_1215	3036.28	0.07	1.4976225	14.25	0.07	65.49	10.78	0.53
333	HI_1025	3037.73	0.02	1.9615530	14.38	0.05	26.33	2.04	0.12
334	HI_1025	3040.60	0.01	1.9643493	15.10	0.04	28.64	1.06	0.28
335	HI_1025	3043.42	0.02	1.9670957	14.70	0.05	39.81	2.16	0.23
336	HI_1215	3045.10	0.06	1.5048759	13.76	0.08	44.45	8.20	0.23
337	CII_1036	3048.87	0.03	1.9419715	13.42	0.05	32.22	5.37	0.03
338	CII_1036	3049.43	0.01	1.9425048	13.66	0.04	16.43	1.22	0.04
339	CII_1036	3049.54	0.00	1.9426138	13.51	0.05	4.76	0.98	0.03
340	HI_1215	3051.49	0.08	1.5101329	13.38	0.13	31.58	8.99	0.11
341	HI_1215	3053.73	0.07	1.5119731	14.11	0.07	62.87	11.20	0.44
342	HI_1215	3062.72	0.01	1.5193698	14.54	4.74	7.04	11.54	0.12
343	HI_972	3062.86	0.02	2.1493564	13.97	0.02	41.31	2.13	0.02
344	HI_1025	3065.63	0.02	1.9887528	14.50	0.05	22.88	1.32	0.14
345	HI_1025	3066.98	0.03	1.9900686	13.52	0.08	17.91	3.18	0.02
346	HI_1215	3067.12	0.06	1.5229912	13.65	0.28	20.19	13.26	0.15
347	HI_1215	3068.52	0.09	1.5241358	13.60	0.09	40.22	21.57	0.17
348	HI_1025	3068.79	0.05	1.9918380	13.52	0.07	27.55	4.91	0.02
349	HI_972	3083.70	0.01	2.1707807	13.87	0.02	22.12	0.67	0.02

350	HI_1025	3088.75	0.03	2.0112889	13.87	0.06	31.33	3.76	0.05
351	HI_1025	3102.26	0.03	2.0244620	14.07	0.14	21.40	3.94	0.07
352	HI_1025	3102.77	0.21	2.0249591	13.79	0.18	48.49	13.64	0.04
353	HI_1215	3103.18	0.17	1.5526499	13.78	0.08	103.28	28.20	0.28
354	HI_1025	3104.23	0.08	2.0263834	13.43	0.08	43.38	11.33	0.02
355	HI_1215	3107.90	0.05	1.5565344	13.99	0.08	44.55	6.80	0.32
356	HI_1215	3109.81	0.05	1.5581071	13.86	0.09	33.24	7.75	0.24
357	HI_1025	3110.50	0.05	2.0324934	13.76	0.05	42.20	5.32	0.04
358	HI_972	3114.81	0.00	2.2027674	14.09	0.00	42.88	0.00	0.03
359	HI_1025	3117.26	0.02	2.0390868	13.84	0.05	24.69	2.08	0.05
360	HI_1215	3129.17	0.07	1.5740330	13.78	0.07	44.51	11.23	0.24
361	HI_972	3133.14	0.01	2.2216148	14.12	0.01	65.13	1.15	0.03
362	HI_1215	3135.18	0.04	1.5789708	13.99	0.14	27.99	8.51	0.26
363	HI_1025	3138.11	0.04	2.0594137	13.60	0.05	42.35	4.93	0.03
364	HI_1215	3141.10	0.09	1.5838443	13.30	0.13	22.40	14.11	0.09
365	HI_1025	3141.17	0.15	2.0623970	13.53	0.14	59.66	29.54	0.02
366	HI_1025	3148.27	0.00	2.0693247	14.48	0.00	22.56	0.00	0.14
367	HI_1215	3149.34	0.06	1.5906184	15.35	2.63	30.17	20.74	0.52
368	HI_1025	3152.62	0.02	2.0735638	14.14	0.05	34.66	2.58	0.09
369	HI_1025	3153.66	0.03	2.0745745	13.89	0.04	40.61	4.48	0.05
370	HI_1025	3156.32	0.01	2.0771706	15.78	0.03	32.19	0.55	0.42
371	HI_1025	3158.78	0.01	2.0795619	14.58	0.06	19.25	0.88	0.14
372	HI_1215	3161.36	0.48	1.6005104	13.60	2.01	11.49	44.97	0.10
373	HI_1025	3166.42	0.01	2.0870144	13.89	0.03	30.16	1.76	0.05
374	HI_1215	3172.21	0.11	1.6094302	14.00	0.09	52.99	13.65	0.35
375	HI_1215	3173.64	0.06	1.6106071	14.79	0.10	55.24	6.72	0.72
376	HI_1025	3175.26	0.02	2.0956318	13.63	0.03	30.26	2.54	0.03
377	HI_1025	3181.74	0.03	2.1019506	13.58	0.04	33.41	3.24	0.03
378	HI_1025	3186.04	0.01	2.1061392	13.68	0.03	25.16	1.67	0.03
379	HI_1215	3187.61	0.08	1.6221032	13.62	0.07	53.06	16.01	0.18
380	HI_1025	3193.00	0.01	2.1129258	14.66	0.04	45.60	1.30	0.32
381	HI_1025	3199.19	0.01	2.1189632	13.46	0.03	21.56	1.80	0.02
382	HI_1215	3201.71	0.09	1.6336992	13.36	0.10	30.97	13.77	0.10
383	HI_1215	3212.56	0.06	1.6426243	13.56	1.92	7.92	17.39	0.08
384	HI_1025	3215.85	0.01	2.1352038	13.53	0.02	29.14	1.89	0.02
385	HI_1025	3227.63	0.02	2.1466930	13.52	0.02	30.17	2.12	0.02
386	HI_1025	3230.37	0.02	2.1493568	13.97	0.02	41.31	2.13	0.06
387	HI_1025	3231.18	0.02	2.1501544	13.67	0.05	22.21	2.51	0.03
388	HI_1025	3231.82	0.06	2.1507733	13.50	0.07	43.89	8.00	0.02
389	HI_1025	3252.34	0.01	2.1707807	13.87	0.02	22.12	0.67	0.05
390	HI_1215	3253.22	0.06	1.6760745	13.68	0.06	40.58	9.59	0.19
391	HI_1215	3255.47	0.20	1.6779212	13.86	0.17	52.83	15.56	0.28
392	HI_1215	3256.79	0.18	1.6790060	14.00	0.12	62.34	22.92	0.37
393	HI_1215	3263.37	0.60	1.6844213	13.39	2.97	11.34	65.46	0.08
394	HI_1215	3268.56	0.12	1.6886871	13.45	0.09	57.81	13.36	0.14
395	HI_1215	3276.88	0.04	1.6955329	14.69	0.06	34.28	3.22	0.47
396	HI_1215	3277.89	0.15	1.6963627	13.77	0.14	41.07	18.85	0.23
397	HI_1025	3280.42	0.01	2.1981571	13.75	0.01	45.27	1.03	0.04
398	HI_1025	3285.15	0.01	2.2027674	14.09	0.01	42.88	0.69	0.08
399	HI_1025	3286.20	0.01	2.2037952	13.41	0.02	24.31	1.10	0.02
400	HI_1025	3287.55	0.08	2.2051051	13.70	0.04	78.92	6.20	0.04
401	HI_1215	3288.67	0.04	1.7052354	13.65	0.04	50.56	7.24	0.19
402	HI_1215	3289.83	0.51	1.7061881	12.60	1.49	7.09	40.00	0.02
403	HI_1025	3298.95	0.00	2.2162175	13.92	0.01	25.75	0.45	0.05
404	OVI_1031	3300.26	0.02	2.1981578	14.97	0.03	58.96	2.62	0.50
405	HI_1215	3303.03	0.07	1.7170445	13.45	0.08	29.88	10.45	0.12
406	HI_1025	3303.84	0.01	2.2209861	13.40	0.04	19.51	1.52	0.02
407	HI_1215	3304.05	0.02	1.7178879	14.53	0.04	30.83	2.06	0.40
408	HI_1025	3304.48	0.01	2.2216151	14.12	0.01	65.13	1.15	0.09
409	HI_1215	3305.59	0.05	1.7191499	13.44	0.04	30.00	0.00	0.12
410	OVI_1031	3307.58	0.08	2.2052464	14.99	0.05	82.19	6.76	0.61
411	OVI_1031	3309.60	0.20	2.2072077	14.72	0.08	110.31	18.25	0.48
412	OVI_1031	3312.56	0.04	2.2100756	14.11	0.05	30.73	8.63	0.12
413	OVI_1037	3318.46	0.02	2.1981580	14.97	0.03	58.96	2.62	0.36
414	HI_1215	3320.68	0.03	1.7315623	14.43	0.11	26.59	3.24	0.34
415	HI_1215	3321.51	0.03	1.7322471	13.92	0.10	16.46	2.92	0.17
416	HI_1215	3323.54	0.04	1.7339154	13.14	2.54	9.87	26.23	0.05
417	OVI_1037	3325.82	0.08	2.2052464	14.99	0.05	82.19	6.76	0.42
418	OVI_1037	3327.85	0.20	2.2072077	14.72	0.08	110.31	18.25	0.28
419	OVI_1037	3330.83	0.04	2.2100756	14.11	0.05	30.73	8.63	0.07
420	HI_1215	3342.56	0.02	1.7495637	14.34	0.02	75.50	3.12	0.63
421	HI_1215	3347.08	0.13	1.7532809	13.38	0.07	76.34	15.62	0.12
422	HI_1215	3352.85	0.07	1.7580252	13.22	0.07	35.79	11.16	0.08
423	HI_1215	3360.47	0.04	1.7642946	13.77	0.04	32.84	4.76	0.21
424	HI_1215	3361.56	0.04	1.7651880	13.43	0.08	17.28	4.05	0.01
425	HI_1215	3374.81	0.07	1.7760870	12.47	1.64	3.14	13.44	0.10
426	HI_1215	3377.88	0.09	1.7786123	13.03	0.28	3.11	27.85	0.03
427	HI_1215	3386.75	0.10	1.7859124	16.62	0.71	11.62	2.36	0.30
428	HI_1215	3387.49	0.07	1.7865175	15.46	0.24	17.54	6.07	0.33
429	HI_1215	3388.20	0.04	1.7871027	14.87	0.07	25.37	3.62	0.39
430	HI_1215	3389.25	0.06	1.7879721	13.60	0.07	30.57	9.66	0.16
431	HI_1215	3395.00	0.06	1.7927018	13.53	0.11	18.63	9.02	0.12
432	HI_1215	3396.07	0.03	1.7935756	14.28	0.06	40.57	4.65	0.42
433	HI_1215	3401.39	0.26	1.7979556	13.99	0.06	30.35	19.06	0.27
434	HI_1215	3402.05	1.64	1.7985017	13.18	0.61	65.83	475.12	0.08
435	HI_1215	3408.42	0.03	1.8037341	14.47	0.07	53.51	4.07	0.58
436	HI_1215	3410.90	1.14	1.8057809	12.16	1.19	1.97	4.90	0.01
437	HI_1215	3413.84	0.09	1.8081957	13.68	0.05	87.30	12.89	0.23
438	HI_1215	3420.77	0.10	1.8138968	13.36	0.12	14.20	10.75	0.08
439	HI_1215	3422.69	0.01	1.8154789	16.69	0.22	33.21	1.68	0.75
440	HI_1215	3426.68	0.06	1.8187606	13.50	0.06	35.31	9.43	0.14
441	HI_1215	3430.65	0.13	1.8220224	13.10	0.13	32.13	17.51	0.06
442	HI_1215	3432.39	0.02	1.8234590	13.93	0.10	11.90	1.41	0.14
443	HI_1215	3449.12	0.05	1.8372203	13.71	0.05	38.71	7.22	0.20
444	HI_1215	3457.49	0.04	1.8441051	13.33	0.18	12.16	6.96	0.08
445	HI_1215	3459.65	0.05	1.8458830	13.63	0.07	22.26	5.24	0.15
446	HI_1215	3460.88	0.03	1.8468884	13.84	0.05	30.89	4.35	0.23
447	HI_1215	3462.51	0.05	1.8482327	13.50	0.14	21.28	1.04	0.12
448	HI_1215	3463.53	0.15	1.8490702	14.11	0.09	102.24	1.06	0.51
449	HI_1215	3467.23	0.02	1.8521131	14.13	0.05	32.49	3.17	0.32
450	HI_1215	3471.75	0.04	1.8558298	13.52	0.06	24.57	6.64	0.13
451	HI_1215	3478.55	0.11	1.8614249	13.85	0.10	44.99	10.05	0.27
452	HI_1215	3479.67	0.43	1.8623447	13.33	0.32	52.29	34.57	0.10
453	HI_1215	3483.51	0.04	1.8655080	13.50	0.10	13.81	4.58	0.10
454	HI_1215	3484.48	0.02	1.8663049	14.28	0.06	21.81	2.17	0.27
455	HI_1215	3486.02	0.02	1.8675709	15.41	0.09	24.33	2.11	0.44
456	HI_1215	3487.33	0.02	1.8686523	15.59	0.07	36.20	3.67	0.65
457	HI_1215	3488.96	0.02	1.8699920	16.10	0.27	37.00	2.35	0.74
458	HI_1215	3490.33	0.45	1.8711129	15.20	2.96	25.00	2.12	0.42
459	HI_1215	3491.75	0.07	1.8722843	16.50	0.17	40.00	2.59	0.86
460	HI_1215	3499.17	0.02	1.8783880	14.00	0.05	25.07	2.55	0.24
461	HI_1215	3504.87	0.06	1.8830798	13.60	0.05	44.31	9.11	0.17
462	HI_1215	3506.84	0.09	1.8846977	13.29	0.09	32.76	12.69	0.09
463	HI_1215	3509.10	0.07	1.8865538	13.39	0.08	27.80	10.84	0.11
464	HI_1215	3516.74	0.03	1.8928380	13.66	0.06	24.59	5.62	0.16
465	HI_1215	3518.35	0.03	1.8941622	13.76	0.10	19.25	4.21	0.16
466	HI_1215	3523.00	0.14	1.8979937	13.30	0.12	13.05	13.14	0.08
467	HI_1215	3525.94	0.24	1.9004086	13.11	0.58	5.36	55.76	0.04
468	HI_1215	3527.24	0.10	1.9014789	13.47	0.08	48.84	11.49	0.14
469	SiIII_1206	3530.11	0.05	1.9259080	13.11	0.05	43.99	6.24	0.21
470	SiIII_1206	3532.50	0.14	1.9278885	12.02	0.32	3.30	29.68	0.17
471	SiIII_1206	3549.41	0.18	1.9419042	12.40	0.69	10.27	27.30	0.04

472	SiIII_1206	3550.19	0.03	1.9425505	14.72	1.20	10.21	3.28	0.20
473	HI_1215	3556.56	0.01	1.9255978	17.00	0.08	31.18	0.87	0.75
474	HI_1215	3557.50	0.05	1.9263697	14.87	0.17	15.61	8.98	0.26
475	HI_1215	3557.91	0.05	1.9267107	14.68	0.18	11.92	3.77	0.19
476	HI_1215	3558.32	0.00	1.9270475	15.42	0.05	13.49	1.86	0.26
477	HI_1215	3559.36	0.02	1.9279014	16.71	0.27	35.25	2.79	0.79
478	HI_1215	3560.47	0.02	1.9288127	15.40	0.04	25.00	1.65	0.45
479	HI_1215	3564.33	0.09	1.9319881	13.41	0.14	31.39	12.58	0.11
480	HI_1215	3565.65	0.01	1.9330717	15.75	0.03	26.51	0.74	0.51
481	HI_1215	3570.20	0.08	1.9368156	13.26	0.16	21.70	8.83	0.08
482	HI_1215	3574.94	0.08	1.9407154	13.78	0.08	45.17	9.89	0.24
483	HI_1215	3576.40	0.04	1.9419198	15.42	0.09	20.82	2.22	0.38
484	HI_1215	3577.09	0.03	1.9424874	16.06	0.06	28.83	1.64	0.59
485	HI_1215	3578.39	0.08	1.9435506	13.56	0.12	24.68	6.78	0.14
486	HI_1215	3580.79	0.07	1.9455261	12.82	0.26	10.91	7.58	0.03
487	HI_1215	3593.00	0.05	1.9555713	12.88	0.26	6.71	6.17	0.03
488	HI_1215	3593.94	0.05	1.9563441	13.93	0.07	41.71	5.40	0.29
489	HI_1215	3597.95	0.07	1.9596465	13.88	0.06	54.68	8.38	0.30
490	MgII_2796	3599.53	0.02	0.2872221	12.69	0.12	6.55	2.27	0.12
491	HI_1215	3600.27	0.02	1.9615532	14.38	0.05	26.33	2.04	0.33
492	HI_1215	3603.67	0.01	1.9643493	15.10	0.04	28.64	1.06	0.46
493	HI_1215	3607.01	0.03	1.9670956	14.70	0.05	39.81	2.16	0.53
494	MgII_2803	3608.77	0.02	0.2872221	12.69	0.12	6.55	2.27	0.08
495	CIV_1548	3616.95	0.03	1.3362365	13.39	0.10	13.71	3.63	0.08
496	CIV_1548	3617.45	0.03	1.3365589	13.16	0.13	8.54	3.27	0.05
497	CIV_1550	3622.97	0.03	1.3362364	13.39	0.10	13.71	3.63	0.04
498	CIV_1550	3623.47	0.03	1.3365589	13.16	0.13	8.54	3.27	0.03
499	NV_1238	3624.69	0.03	1.9259186	13.03	0.22	2.96	4.54	0.02
500	HI_1215	3627.84	0.06	1.9842323	13.07	0.15	17.49	10.80	0.05
501	HI_1215	3633.34	0.02	1.9887527	14.50	0.05	22.88	1.32	0.31
502	HI_1215	3634.94	0.03	1.9900686	13.52	0.08	17.91	3.18	0.12
503	NV_1242	3636.34	0.03	1.9259187	13.03	0.22	2.96	4.54	0.01
504	HI_1215	3637.09	0.05	1.9918387	13.52	0.07	27.55	4.91	0.13
505	HI_1215	3638.88	0.05	1.9933144	12.77	0.19	8.25	6.31	0.03
506	HI_1215	3639.79	0.07	1.9940639	12.87	0.18	12.10	6.67	0.03
507	HI_1215	3641.82	0.03	1.9957283	13.33	0.08	18.06	4.09	0.09
508	HI_1215	3654.37	0.03	2.0060575	12.70	0.19	4.98	3.95	0.02
509	HI_1215	3654.93	0.04	2.0065160	13.43	0.07	22.48	4.25	0.11
510	FeII_2586	3658.25	0.03	0.4142794	13.15	0.27	3.24	4.95	0.04
511	HI_1215	3659.70	0.16	2.0104396	13.11	0.27	30.55	24.74	0.06
512	HI_1215	3660.73	0.03	2.0112884	13.87	0.06	31.33	3.76	0.24
513	HI_1215	3662.36	0.14	2.0126293	12.91	0.17	23.87	12.10	0.04
514	HI_1215	3670.79	0.04	2.0195651	12.76	0.15	8.55	3.39	0.03
515	HI_1215	3676.76	0.03	2.0244682	14.07	0.14	21.40	3.94	0.23
516	HI_1215	3677.35	0.21	2.0249598	13.79	0.18	48.49	13.64	0.25
517	FeII_2600	3677.37	0.03	0.4142794	13.15	0.27	3.24	4.95	0.07
518	HI_1215	3679.08	0.08	2.0263834	13.43	0.08	43.38	11.33	0.13
519	HI_1215	3686.51	0.05	2.0324936	13.76	0.05	42.20	5.32	0.22
520	SiII_1260	3687.47	0.04	1.9255871	12.58	0.11	16.41	5.66	0.05
521	SiII_1260	3687.87	0.13	1.9259045	12.41	4.61	1.58	10.44	0.02
522	HI_1215	3694.53	0.02	2.0390863	13.84	0.05	24.69	2.08	0.20
523	HI_1215	3702.84	0.18	2.0459275	13.03	0.14	50.25	18.04	0.06
524	SiII_1260	3708.28	0.18	1.9420931	12.40	0.72	20.55	42.82	0.03
525	SiII_1260	3708.84	0.07	1.9425408	12.96	0.15	19.76	7.60	0.10
526	HI_1215	3710.89	0.09	2.0525479	12.64	0.22	14.78	11.23	0.02
527	SiII_1260	3712.93	0.03	1.9457808	12.32	0.14	8.53	2.69	0.03
528	HI_1215	3719.24	0.04	2.0594137	13.60	0.05	42.35	4.93	0.17
529	HI_1215	3722.86	0.15	2.0623975	13.53	0.14	59.66	29.54	0.16
530	HI_1215	3723.74	0.04	2.0631168	12.92	0.33	14.05	7.12	0.04
531	HI_1215	3724.98	0.05	2.0641336	12.99	0.10	18.75	4.21	0.05
532	HI_1215	3725.88	0.04	2.0648737	12.70	0.14	9.93	4.53	0.02
533	HI_1215	3731.29	0.02	2.0693245	14.48	0.08	22.56	1.99	0.30
534	HI_1215	3731.48	0.10	2.0694811	13.77	0.10	71.23	11.32	0.26
535	HI_1215	3736.44	0.03	2.0735638	14.14	0.05	34.66	2.58	0.33
536	HI_1215	3737.67	0.04	2.0745745	13.89	0.04	40.61	4.48	0.27
537	HI_1215	3739.62	0.05	2.0761824	12.75	0.15	11.45	5.42	0.03
538	HI_1215	3740.82	0.01	2.0771704	15.78	0.03	32.19	0.55	0.61
539	HI_1215	3743.73	0.01	2.0795619	14.58	0.06	19.25	0.88	0.28
540	HI_1215	3748.53	0.03	2.0835123	12.49	0.16	6.26	3.74	0.01
541	HI_1215	3752.79	0.02	2.0870144	13.89	0.03	30.16	1.76	0.24
542	HI_1215	3755.40	0.08	2.0891616	12.63	0.16	18.09	7.02	0.02
543	HI_1215	3758.73	0.15	2.0918958	13.26	0.08	77.24	14.82	0.09
544	HI_1215	3763.27	0.02	2.0956316	13.63	0.03	30.26	2.54	0.16
545	HI_1215	3765.49	0.04	2.0974643	13.22	0.06	30.87	5.13	0.08
546	HI_1215	3769.99	0.04	2.1011598	13.25	0.06	24.83	4.81	0.08
547	HI_1215	3770.95	0.03	2.1019509	13.58	0.04	33.41	3.24	0.16
548	HI_1215	3773.12	0.03	2.1037331	13.02	0.07	18.40	3.33	0.05
549	HI_1215	3776.04	0.02	2.1061392	13.68	0.03	25.16	1.67	0.17
550	HI_1215	3777.56	0.06	2.1073928	12.74	0.12	20.32	5.98	0.03
551	HI_1215	3784.29	0.01	2.1129260	14.66	0.04	45.60	1.30	0.58
552	HI_1215	3788.59	0.02	2.1164632	13.15	0.05	15.12	2.22	0.06
553	HI_1215	3791.63	0.02	2.1189632	13.46	0.03	21.56	1.80	0.11
554	HI_1215	3793.49	0.06	2.1204946	13.19	0.06	35.18	7.33	0.07
555	HI_1215	3811.37	0.02	2.1352038	13.53	0.02	29.14	1.89	0.14
556	HI_1215	3824.09	0.02	2.1456616	13.21	0.03	20.53	1.77	0.07
557	HI_1215	3825.34	0.02	2.1466937	13.52	0.02	30.17	2.12	0.14
558	HI_1215	3826.11	0.02	2.1473222	13.00	0.06	16.71	2.53	0.05
559	HI_1215	3826.93	0.07	2.1480021	12.89	0.10	33.83	10.52	0.04
560	HI_1215	3828.58	0.02	2.1493566	13.97	0.02	41.31	2.13	0.30
561	HI_1215	3829.55	0.02	2.1501544	13.67	0.05	22.21	2.51	0.16
562	HI_1215	3830.30	0.07	2.1507730	13.50	0.07	43.89	8.00	0.14
563	HI_1215	3835.14	0.09	2.1547549	12.82	0.13	31.50	12.71	0.03
564	HI_1215	3836.66	0.08	2.1560037	12.85	0.08	37.60	7.55	0.04
565	SiII_1304	3838.16	0.08	1.9425410	12.96	0.15	19.76	7.60	0.01
566	HI_1215	3838.20	0.10	2.1572738	12.97	0.08	58.82	12.87	0.05
567	HI_1215	3843.06	0.03	2.1612659	13.10	0.04	28.35	3.43	0.06
568	CIV_1548	3843.81	0.01	1.4827675	13.24	0.14	2.30	0.50	0.03
569	CIV_1548	3844.05	0.04	1.4829206	13.26	0.06	22.57	3.93	0.07
570	CIV_1548	3844.75	0.01	1.4833764	13.82	0.02	21.25	1.04	0.17
571	CIV_1550	3850.20	0.01	1.4827675	13.24	0.14	2.30	0.50	0.02
572	CIV_1550	3850.44	0.04	1.4829206	13.26	0.06	22.57	3.93	0.03
573	CIV_1550	3851.15	0.01	1.4833765	13.82	0.02	21.25	1.04	0.11
574	HI_1215	3854.62	0.01	2.1707807	13.87	0.02	22.12	0.67	0.20
575	HI_1215	3862.51	0.05	2.1772685	13.10	0.04	48.02	5.21	0.06
576	HI_1215	3869.86	0.02	2.1833179	13.10	0.03	28.34	2.11	0.06
577	HI_1215	3871.32	0.05	2.1845162	12.45	0.10	20.75	5.34	0.01
578	HI_1215	3872.93	0.11	2.1858361	12.61	0.19	23.30	9.53	0.02
579	HI_1215	3873.54	0.04	2.1863427	12.99	0.08	22.92	4.51	0.05
580	HI_1215	3874.89	0.03	2.1874492	12.87	0.04	23.48	3.21	0.04
581	HI_1215	3878.93	0.02	2.1907778	13.00	0.03	25.84	2.41	0.05
582	HI_1215	3881.20	0.01	2.1926453	13.46	0.01	24.77	0.92	0.12
583	HI_1215	3883.18	0.01	2.1942701	13.35	0.02	22.20	0.86	0.10
584	HI_1215	3887.90	0.01	2.1981568	13.75	0.01	45.27	1.03	0.23
585	HI_1215	3889.27	0.17	2.1992815	12.97	0.28	64.42	32.27	0.05
586	HI_1215	3891.71	0.19	2.2012882	13.31	0.15	130.92	52.57	0.11
587	HI_1215	3893.51	0.01	2.2027678	14.09	0.01	42.88	0.69	0.36
588	HI_1215	3894.76	0.01	2.2037952	13.41	0.02	24.31	1.10	0.11
589	HI_1215	3896.35	0.08	2.2051051	13.70	0.04	78.92	6.20	0.23
590	HI_1215	3897.53	0.07	2.2060788	13.06	0.16	42.95	7.56	0.06
591	HI_1215	3898.85	0.00	2.2071607	13.26	0.09	63.54	10.33	0.09
592	HI_1215	3899.77	0.00	2.2079182	13.44	0.03	101.19	10.39	0.14
593	CII_1334	3904.41	0.09	1.9256754	12.88	0.19	20.15	10.53	0.01

594	CII_1334	3904.80	0.02	1.9259697	13.16	0.08	9.36	1.64	0.03
595	HI_1215	3907.26	0.06	2.2140775	12.56	0.09	30.58	8.33	0.02
596	HI_1215	3908.29	0.04	2.2149296	12.75	0.05	30.56	3.50	0.03
597	HI_1215	3909.86	0.00	2.2162175	13.92	0.01	25.75	0.45	0.23
598	HI_1215	3912.29	0.06	2.2182209	12.26	0.12	19.70	6.52	0.01
599	HI_1215	3915.66	0.01	2.2209861	13.40	0.04	19.51	1.52	0.10
600	HI_1215	3916.42	0.02	2.2216151	14.12	0.01	65.13	1.15	0.45
601	HI_1215	3918.11	0.03	2.2230027	12.69	0.09	21.30	5.64	0.03
602	HI_1215	3918.81	0.02	2.2235837	13.11	0.04	22.39	2.68	0.06
603	HI_1215	3919.42	0.02	2.2240860	12.92	0.04	17.07	2.03	0.04
604	CII_1334	3926.16	0.04	1.9419715	13.42	0.05	32.22	5.37	0.05
605	CII_1334	3926.87	0.02	1.9425046	13.66	0.04	16.43	1.22	0.07
606	CII_1334	3927.01	0.01	1.9426138	13.51	0.05	4.76	0.98	0.04
607	CII_1335	3930.13	0.05	1.9423599	12.91	0.08	20.43	5.09	0.01
608	CII_1335	3930.57	0.09	1.9426873	12.42	1.62	1.70	7.52	0.00
609	CaII_3934	3934.76	0.00	-0.000003	12.25	0.02	8.13	0.58	0.12
610	HI_1215	3935.92	0.01	2.2376585	13.18	0.02	33.44	1.73	0.07
611	HI_1215	3947.53	0.04	2.2472079	12.87	0.04	41.27	4.97	0.04
612	MgII_2796	3954.77	0.00	0.4142604	12.87	0.01	7.04	0.23	0.15
613	NV_1238	3960.66	0.03	2.1971202	13.02	0.05	23.90	3.07	0.02
614	NV_1238	3961.94	0.01	2.1981535	14.22	0.01	38.10	0.62	0.24
615	MgII_2803	3964.92	0.00	0.4142605	12.87	0.01	7.04	0.23	0.10
616	NV_1238	3965.70	0.07	2.2011869	13.50	0.05	68.85	9.96	0.06
617	CaII_3969	3969.58	0.00	-0.000003	12.25	0.02	8.13	0.58	0.07
618	NV_1238	3969.70	0.04	2.2044139	13.85	0.05	38.65	2.85	0.13
619	NV_1238	3970.73	0.03	2.2052453	13.45	0.04	30.34	2.99	0.05
620	NV_1238	3971.38	0.18	2.2057712	14.14	0.12	67.18	13.63	0.24
621	NV_1238	3972.97	0.02	2.2070572	13.80	0.02	42.25	2.21	0.12
622	NV_1242	3973.39	0.03	2.1971204	13.02	0.05	23.90	3.07	0.01
623	NV_1238	3973.65	0.05	2.2076058	13.24	0.20	19.23	7.97	0.03
624	NV_1242	3974.68	0.01	2.1981537	14.22	0.01	38.10	0.62	0.14
625	NV_1238	3974.70	0.03	2.2084517	13.90	0.02	59.15	3.04	0.15
626	NV_1238	3976.33	0.05	2.2097721	13.27	0.10	25.52	5.37	0.04
627	NV_1242	3978.45	0.07	2.2011871	13.50	0.05	68.85	9.96	0.03
628	NV_1242	3982.46	0.04	2.2044139	13.85	0.05	38.65	2.85	0.07
629	NV_1242	3983.49	0.03	2.2052455	13.45	0.04	30.34	2.99	0.03
630	NV_1242	3984.15	0.18	2.2057712	14.14	0.12	67.18	13.63	0.13
631	NV_1242	3985.74	0.02	2.2070575	13.80	0.02	42.25	2.21	0.06
632	NV_1242	3986.43	0.05	2.2076058	13.24	0.20	19.23	7.97	0.02
633	NV_1242	3987.48	0.03	2.2084517	13.90	0.02	59.15	3.04	0.08
634	NV_1242	3989.12	0.05	2.2097723	13.27	0.10	25.52	5.37	0.02
635	SiIV_1393	3996.34	0.00	1.8673159	11.96	0.09	4.89	2.21	0.01
636	SiIV_1393	3996.57	0.00	1.8674856	12.97	0.02	4.97	0.38	0.05
637	SiIV_1393	3996.93	0.01	1.8677454	14.46	0.15	0.61	0.43	0.02
638	SiIV_1393	3999.48	0.03	1.8695726	12.05	0.13	5.19	3.22	0.01
639	SiIV_1393	3999.74	0.00	1.8697600	13.18	0.02	6.90	0.68	0.07
640	SiIV_1393	4000.15	0.02	1.8700498	12.49	0.36	7.25	4.01	0.02
641	SiIV_1393	4000.30	0.13	1.8701597	12.65	0.30	19.24	7.31	0.04
642	SiIV_1393	4000.87	0.01	1.8705724	12.19	0.07	4.74	1.83	0.01
643	SiIV_1393	4001.58	0.01	1.8710754	12.84	0.02	9.44	0.66	0.05
644	SiIV_1393	4002.60	0.02	1.8718106	12.11	0.09	7.92	2.88	0.01
645	CIV_1548	4009.24	0.02	1.5896229	12.32	0.12	4.53	2.89	0.01
646	CIV_1548	4010.67	0.02	1.5905458	13.37	0.11	8.13	1.46	0.06
647	CIV_1548	4010.91	0.06	1.5906986	13.15	0.18	12.66	3.99	0.05
648	CIV_1550	4015.91	0.02	1.5896229	12.32	0.12	4.53	2.89	0.00
649	CIV_1550	4017.34	0.02	1.5905459	13.37	0.11	8.13	1.46	0.04
650	CIV_1550	4017.58	0.06	1.5906986	13.15	0.18	12.66	3.99	0.03
651	SiIV_1402	4022.18	0.00	1.8673159	11.96	0.09	4.89	2.21	0.00
652	SiIV_1402	4022.42	0.00	1.8674854	12.97	0.02	4.97	0.38	0.03
653	SiIV_1402	4022.79	0.01	1.8677453	14.46	0.15	0.61	0.43	0.02
654	SiIV_1402	4025.35	0.03	1.8695724	12.05	0.13	5.19	3.22	0.00
655	SiIV_1402	4025.61	0.00	1.8697600	13.18	0.02	6.90	0.68	0.05
656	SiIV_1402	4026.02	0.02	1.8700496	12.49	0.36	7.25	4.01	0.01
657	SiIV_1402	4026.17	0.13	1.8701596	12.65	0.30	19.24	7.31	0.02
658	SiIV_1402	4026.75	0.01	1.8705722	12.19	0.07	4.74	1.83	0.01
659	SiIV_1402	4027.46	0.01	1.8710753	12.84	0.02	9.44	0.66	0.03
660	SiIV_1402	4028.49	0.02	1.8718106	12.11	0.09	7.92	2.88	0.01
661	SiIV_1393	4077.72	0.02	1.9257108	12.03	0.11	4.30	3.56	0.01
662	SiIV_1393	4078.08	0.01	1.9259690	12.79	0.03	6.74	0.82	0.04
663	SiIV_1393	4100.39	0.01	1.9419765	13.06	0.02	11.21	0.79	0.07
664	SiIV_1393	4100.98	0.03	1.9423976	13.22	0.15	9.19	1.70	0.08
665	SiIV_1393	4101.24	0.03	1.9425802	13.46	0.09	12.60	1.64	0.13
666	SiIV_1402	4104.10	0.02	1.9257109	12.03	0.11	4.30	3.56	0.00
667	SiIV_1402	4104.46	0.01	1.9259689	12.79	0.03	6.74	0.82	0.02
668	SiIV_1402	4126.92	0.01	1.9419762	13.06	0.02	11.21	0.79	0.04
669	SiIV_1402	4127.51	0.03	1.9423977	13.22	0.15	9.19	1.70	0.05
670	SiIV_1402	4127.76	0.03	1.9425801	13.46	0.09	12.60	1.64	0.09
671	CIV_1548	4309.51	0.06	1.7835705	13.03	0.07	28.16	5.74	0.04
672	CIV_1548	4313.52	0.01	1.7861595	13.93	0.01	23.88	0.78	0.21
673	CIV_1548	4314.58	0.02	1.7868426	12.61	0.09	4.99	2.00	0.01
674	CIV_1548	4315.13	0.01	1.7872013	13.19	0.04	7.83	1.26	0.05
675	CIV_1550	4316.68	0.06	1.7835705	13.03	0.07	28.16	5.74	0.02
676	CIV_1550	4320.69	0.01	1.7861596	13.93	0.01	23.88	0.78	0.13
677	CIV_1550	4321.75	0.02	1.7868426	12.61	0.09	4.99	2.00	0.01
678	CIV_1550	4322.31	0.01	1.7872015	13.19	0.04	7.83	1.26	0.03
679	CIV_1548	4529.94	0.02	1.9259518	13.78	1.21	2.47	2.56	0.04
680	CIV_1550	4537.48	0.02	1.9259520	13.78	1.21	2.47	2.56	0.04

Coordinates

For accurate information on coordinates and astrometry of the HDF-S check the header information in the final data products. Consult the technical information on the data reduction to assess the accuracy of the header coordinates systems.

The following coordinates may be useful, but please contact us for up-to-date details if you plan supporting observations of this field.

WFPC2 (apex) pointing

```
22h 32m 56.22s      -60d 33' 02.69"    J2000 Equinox
```

Note: PA_V3 = 230.5D, which corresponds to U3 ORIENT=50.5D.

STIS pointing

```
22h 33m 37.67s      -60d 33' 28.95"    J2000 Equinox
```

The position of the QSO has been determined with estimated errors less than 40 milli-arcseconds to be:

```
22h 33m 37.5883s    -60d 33' 29.128"   J2000 Equinox
```

NICMOS (NIC3) pointing

```
22h 32m 51.75s      -60d 38' 48.20"    J2000 Equinox
```

Note: NIC3 coordinates are uncertain by about 5 arcsec.

This page was last updated on November 23, 1998.

The Hubble Deep Field South

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Observing Strategy

Discussions about the observing strategy for the HDF-S focussed primarily on the questions:

- What filters/gratings to use for each instrument ?
- What exposure time to use for each filter/grating ?
- How to choose the detailed instrumental setup and observing parameters ?
- How to pack the observations into the individual orbits during the campaign ? In CVZ observations, scattered earth light increases the sky background in certain bandpasses on the day side of the orbit. It was therefore essential to tailor the observations for all the instruments to make optimal use of `bright' and `dark' time.

Below please find discussions of the observing strategy for each of the individual instruments. For more detailed information, check the instrument specific technical pages for a description of the data products and the implemented data reduction steps for STIS , WFPC2 , NICMOS and the Flanking Fields . Consult the observing logs or the header information of the data files for additional information. Check the page with warnings and advisories before making any use of the data.

WFPC2

The WFPC2 observing strategy was similar to that for HDF-N. We used the same filters, F300W, F450W, F606W, and F814W, and very similar total observing times. During each orbit, the part with elevated background (because of scattered Earth light) was used for F300W, where the background accounts for a relatively small fraction of the total noise. The remaining time was split evenly between F450W, F606W and F814W, with F606W receiving somewhat less observing time than the others.

Different areas of the Version 1 output image correspond to variable amounts of exposure time, due to the relatively large pointing shifts necessitated by the multi-instrument observing strategy. The weight images delivered with each image can be used to estimate the noise per unit area in the output images. About 7% of the individual exposures were excluded from the Version 1 images, generally because more processing was necessary either to determine an accurate pointing or to correct some minor image blemishes.

For quick estimates of the image depth, these are the average exposure times used in the Version 1 images and an approximate limiting magnitude for each filter (defined as 10-sigma within a 0.2 square arcsec area, or 125 pixels in the processed image):

Table 1. WFPC-2 Filters, exposure times and limiting AB magnitudes for Version 1 images

Filter	Exposure time (ks)	AB mag. limit S/N=10 in 0.2 sq. arcsec
F300W	140	26.8
F450W	101	27.7
F606W	81	28.2
F814W	100	27.7

NICMOS

The discussion of the observing strategy for NICMOS given here is **somewhat outdated**. It describes general issues, as well as the planned strategy as of **July 1998**. The strategy used for the actual campaign was somewhat different, due to late changes in the observing strategy. Consult the observing logs or the header information of the data files for more accurate information.

NICMOS will observe in parallel with WFPC2 and STIS, with the Pupil Alignment Mechanism (PAM) set to optimize focus for Camera 3, providing the widest available field of view. At present and in the foreseeable future, Camera 3 remains somewhat out of focus even with the PAM set to the end of its travel range. Nevertheless, the image quality is sharp enough to be undersampled by the NIC3 pixels, and there is little doubt that interesting science on faint galaxy images can be achieved. The images will be dithered using the NICMOS Field Offset Mirror (FOM) in order to improve flat fielding, sky subtraction, and detector artifact removal.

Nearly all of the dark-time orbits will be used for broad band imaging with the F110W and F160W filters (J and H--bands, approximately), giving approximately 48 hours of observing in each band. Limiting magnitudes are given in Table 2. It appears that scattered earthlight during the ``bright'' portions of CVZ orbits affects NICMOS imaging, and various options (including K or narrow band imaging) are being considered to take advantage of these periods. Slitless grism spectroscopy is another option during dark time, but its utility may be compromised by the fact that we cannot easily obtain data at multiple position angles during the HDF-S campaign.

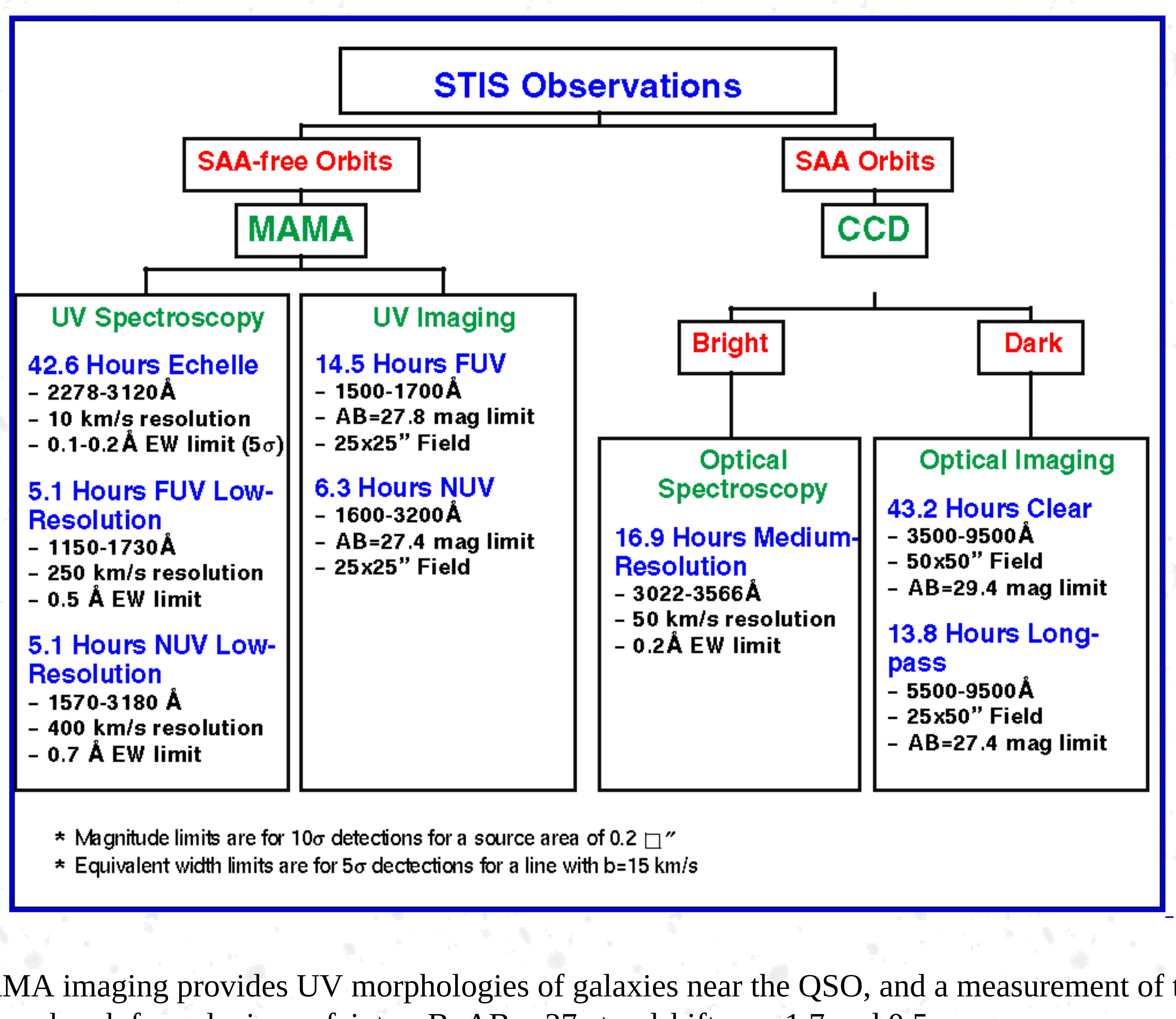
Table 2. NICMOS Filters, exposure times and limiting AB magnitudes

Filter	Exposure time (ks)	Surface Brightness limit (1 sigma over 1 sq. arcsec)	Limiting Magnitude S/N=10 in 0.8 sq. arcsec
F110W	176	6.4 x 10^-8 Jy/arcsec-2	J_AB = 27.0
F160W	174	7.6 x 10^-8 Jy/arcsec-2	H_AB = 26.8
F220M	111	1.0 x 10^-6 Jy/arcsec-2	K_AB = 24.0

STIS

Observations with the MAMA (UV) detectors on STIS are limited to about 60 orbits due to the restriction that they only operate during during SAA-free orbits.

The flowchart shows the STIS observing plan schematically. Most of the MAMA observing time is put into high-resolution spectroscopy. This provides high resolution (10 km/s) QSO absorption-line data in the region from 2650-3200 Angstroms, and low resolution (250 km/s) spectra from 1600 to 1200 Angstroms. The region from 1600-2650 is suppressed by a Lyman continuum absorption-line system at z ~ 1.9.



MAMA imaging provides UV morphologies of galaxies near the QSO, and a measurement of the Lyman break for galaxies as faint as B_AB = 27 at redshifts z ~ 1.7 and 0.5.

The STIS CCD images provide a deep view of galaxies immediately surrounding the QSO. The images are significantly deeper than those with the WFPC-2, and have a higher spatial resolution. Color information is a bit cruder than for the WFPC-2 images, but in the portion of the field with MAMA UV imaging and long-pass filter imaging, there are four bandpasses available for photometric redshifts, and the inclusion of the UV provides greater accuracy for galaxies in the redshift range 0.5-2.5.

Bright time for the CCD was used to obtain a QSO spectrum at a resolution of 30 km/s and with S/N ~50 per resolution element.

Table 3. STIS Modes and exposure times

Detector	Filter or Grating	Exposure time (s)
CCD	50CCD	155590
CCD	F28X50LP	49768
CCD	G430M (cenwave=3165)	31492
CCD	G430M (cenwave=3423)	25600
FUV-MAMA	G140L	18480
FUV-MAMA	MIRROR	52124
NUV-MAMA	E230M	151074
NUV-MAMA	G230L	18424
NUV-MAMA	MIRROR	22616

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Visit the Space Telescope Science Institute *home page*.

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Phase 2 Proposal Information

For logistical reasons, the Hubble Deep Field South observations were split over 6 different proposals. Click below for the Phase 2 proposal information.

Main-field observations

- Part 1: 8058
- Part 2: 8073
- Part 3: 8074
- Part 4: 8075
- Part 5: 8076

Flanking field and PSF star observations

- 8071

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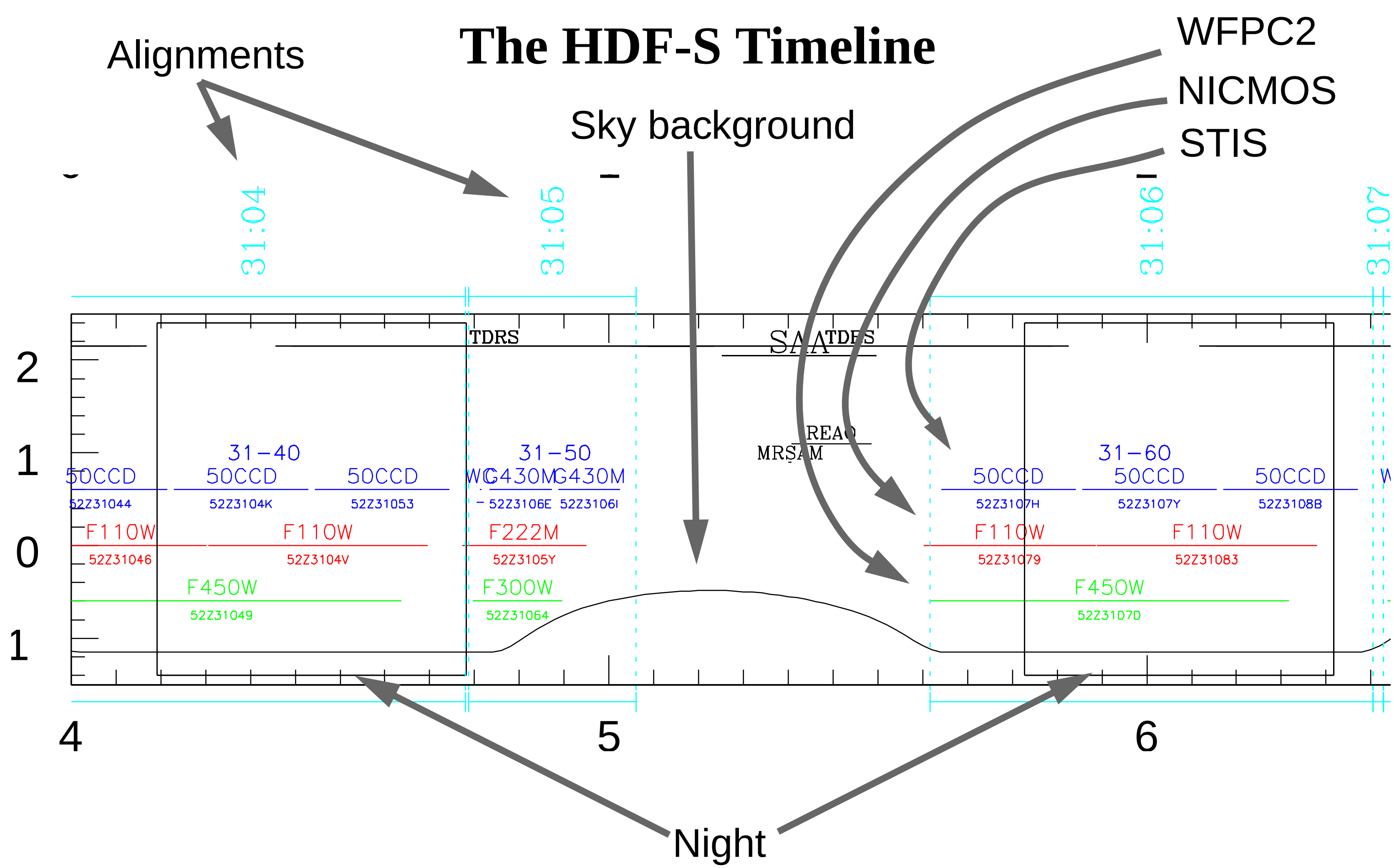
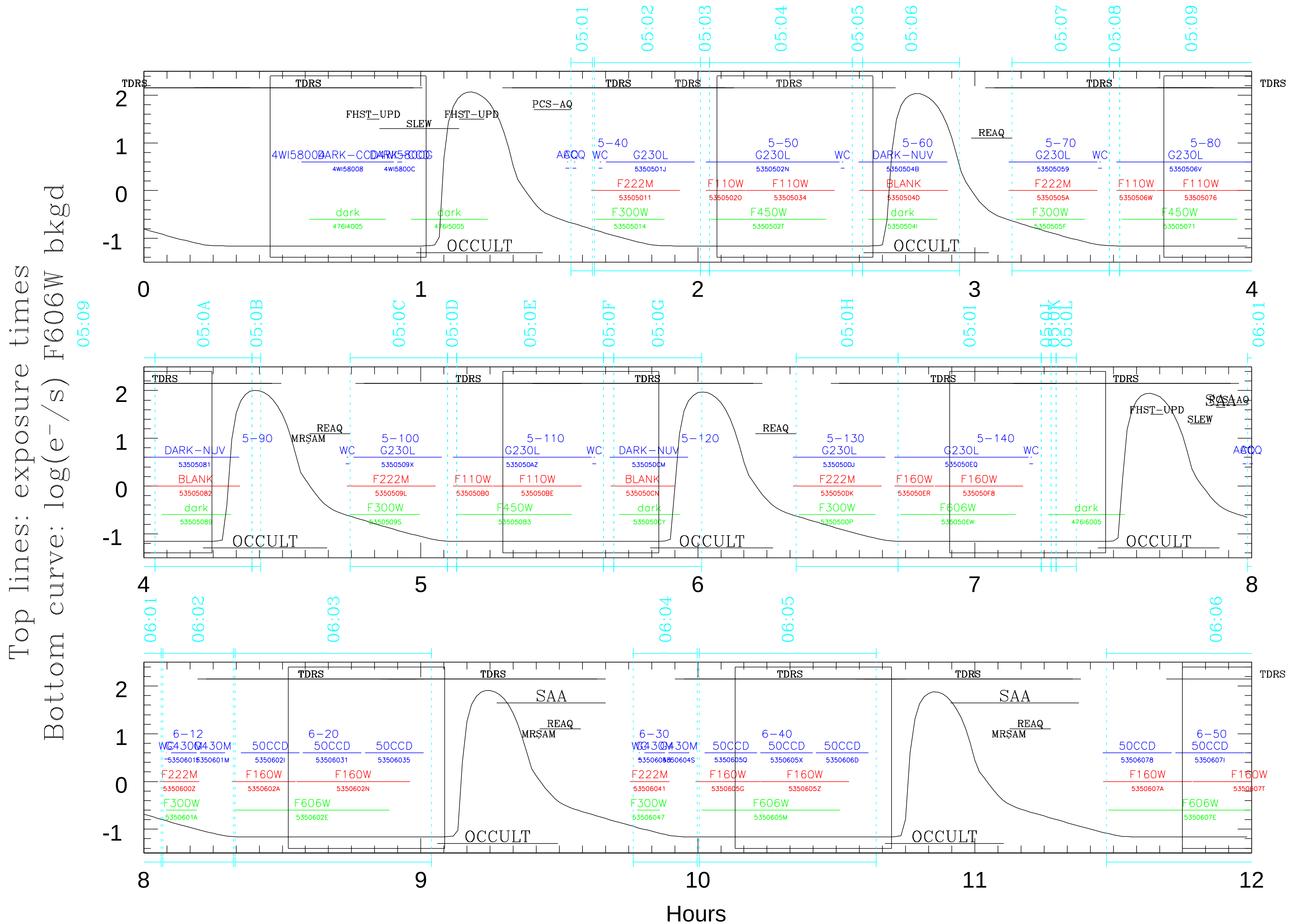
The HDF-S Timeline



Day 271 = September 28



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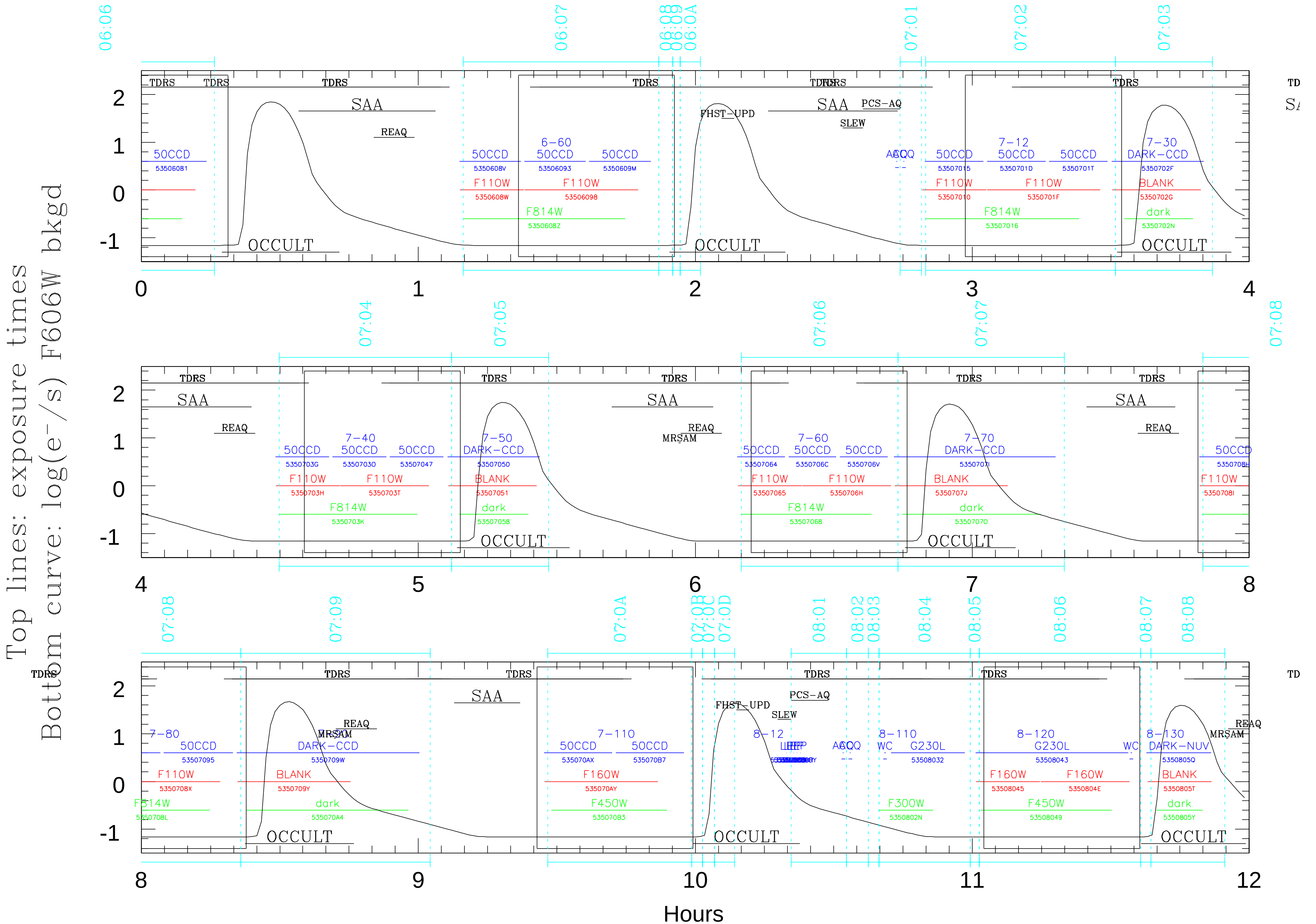

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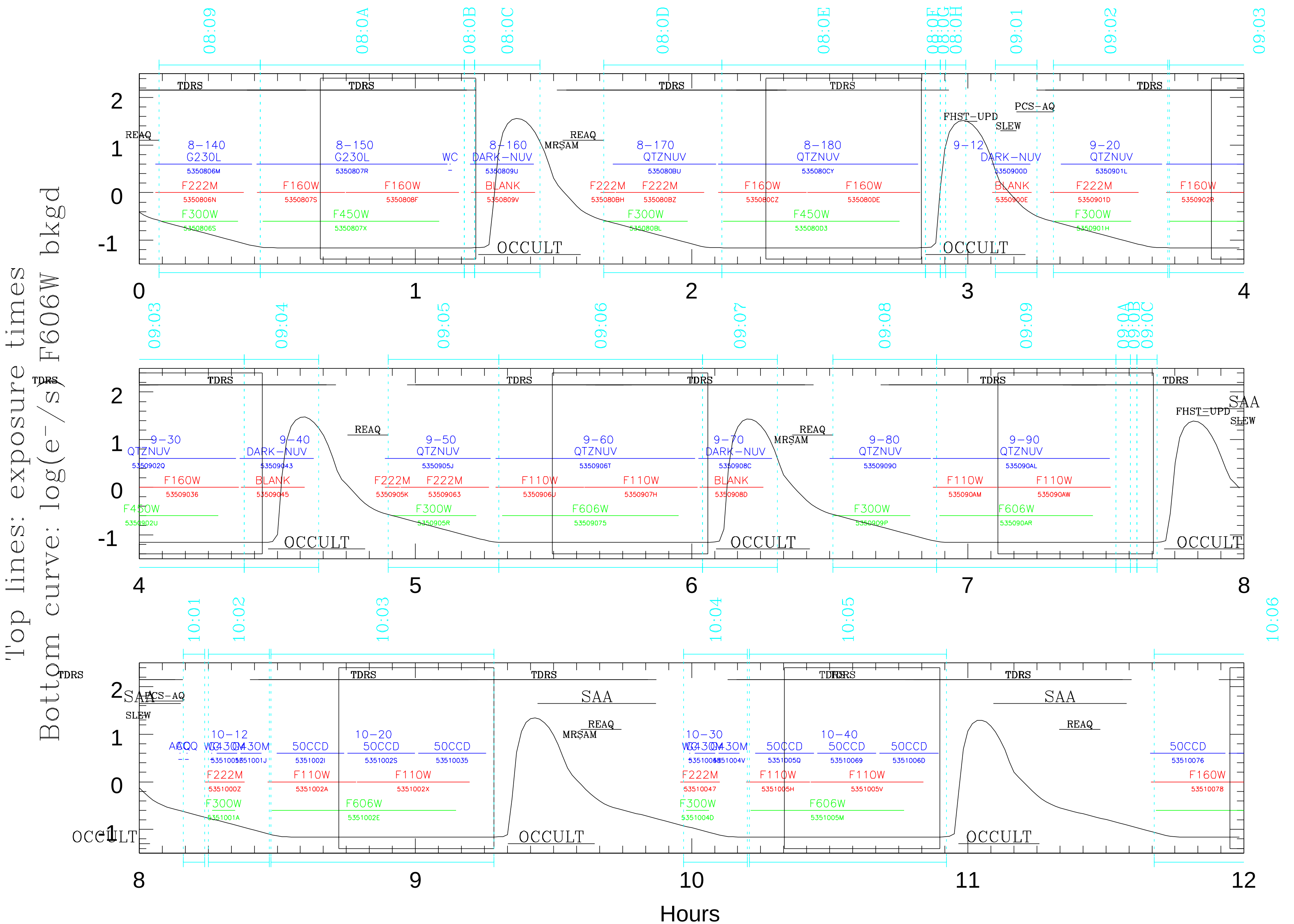

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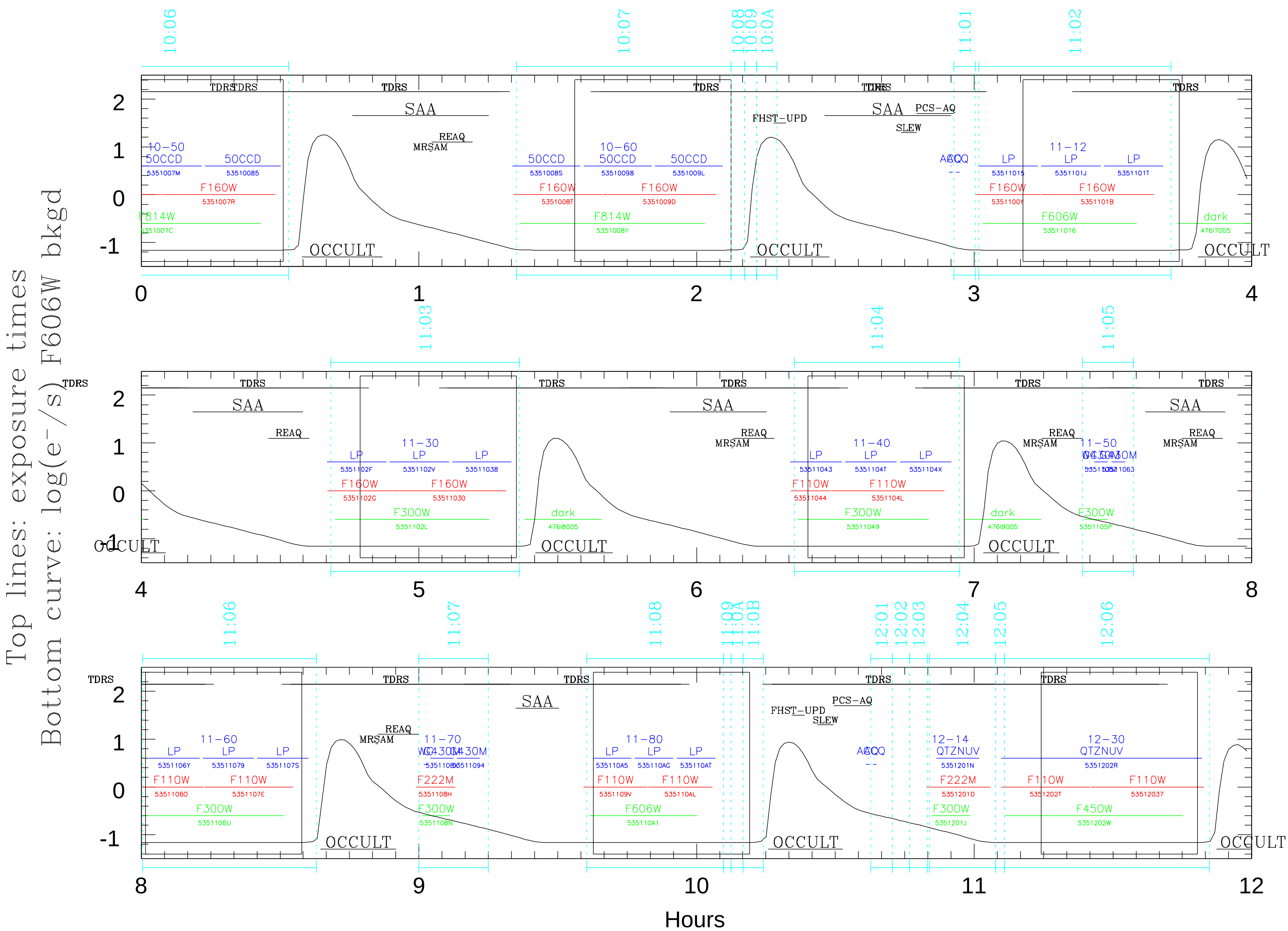

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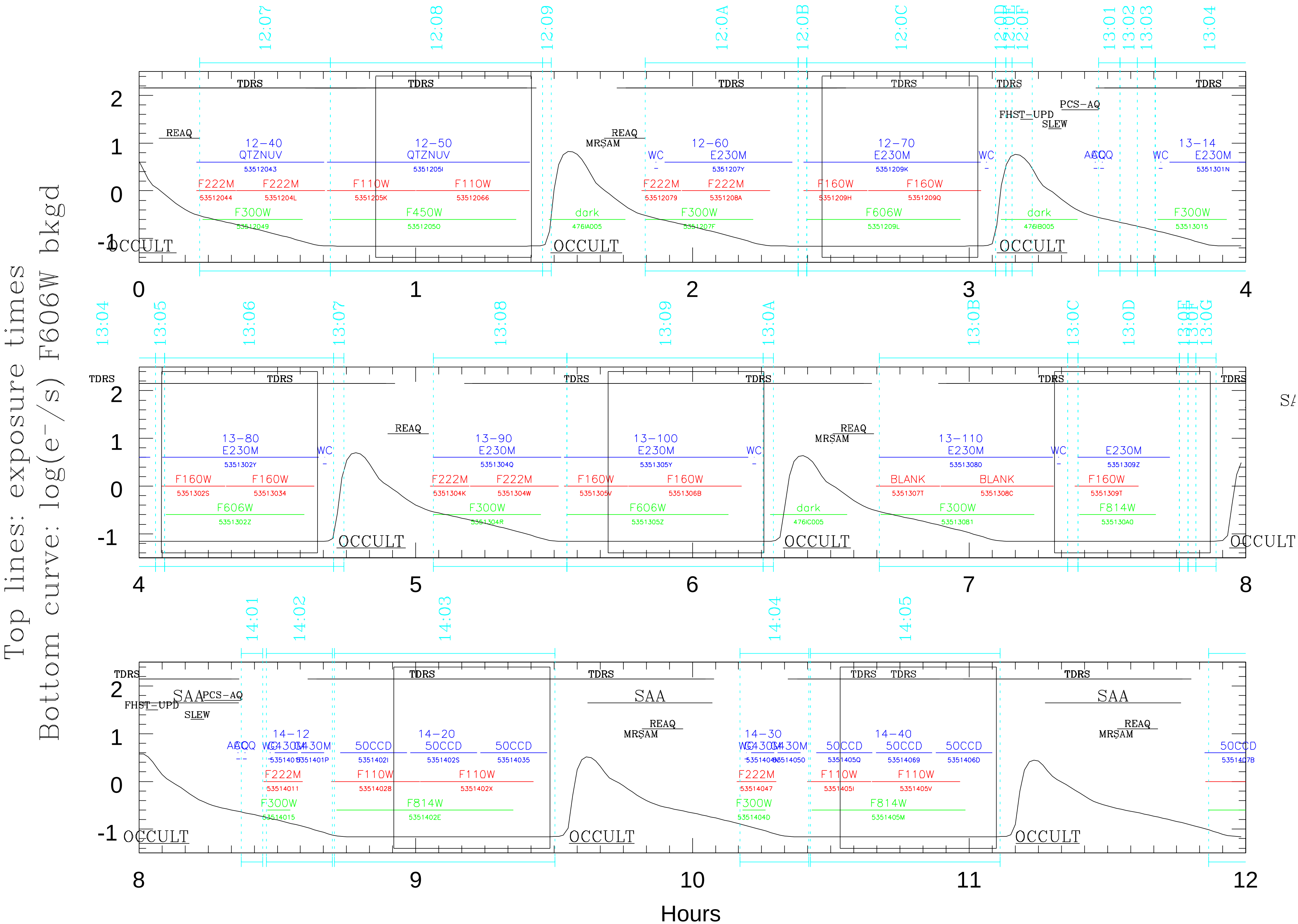

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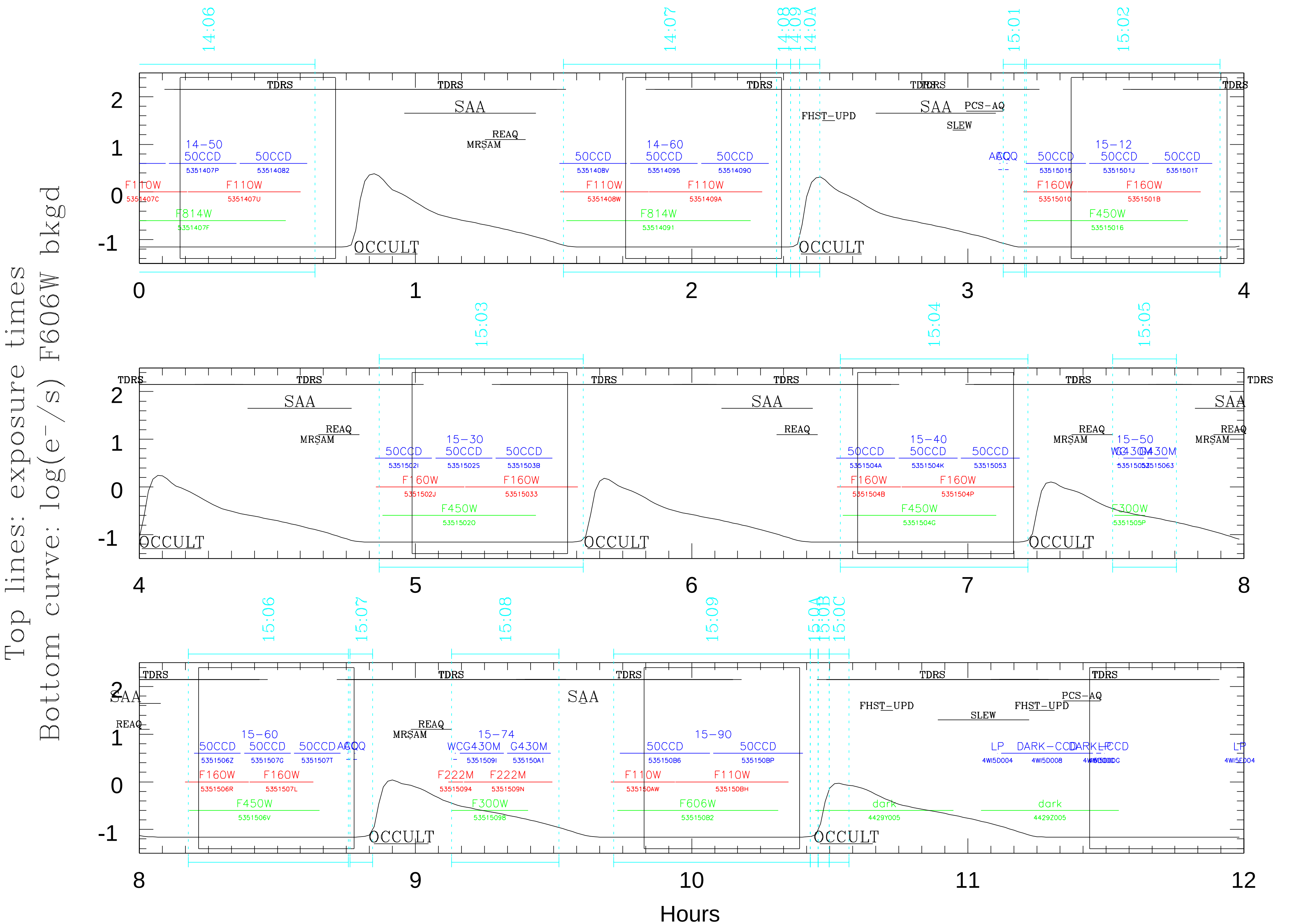

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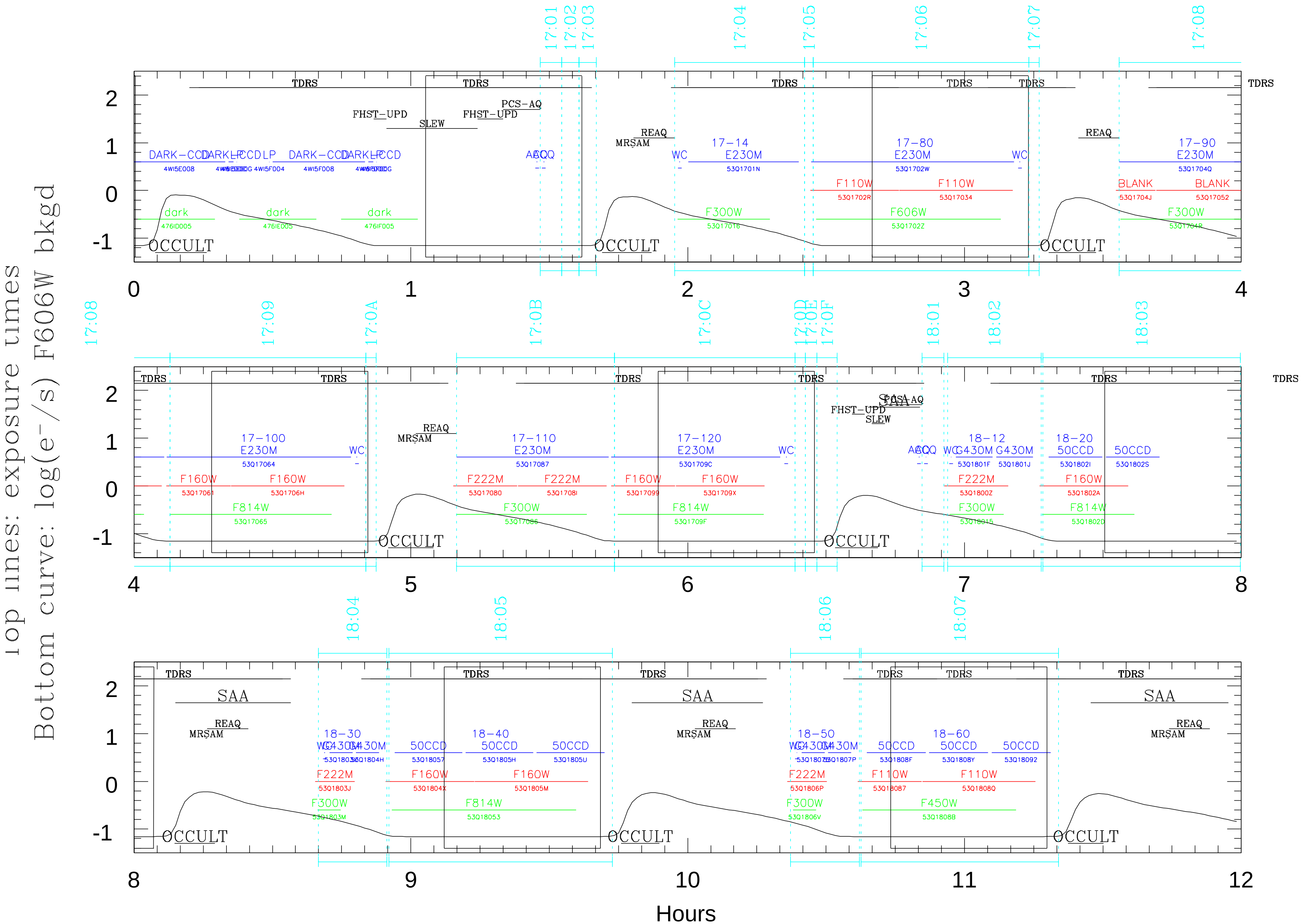

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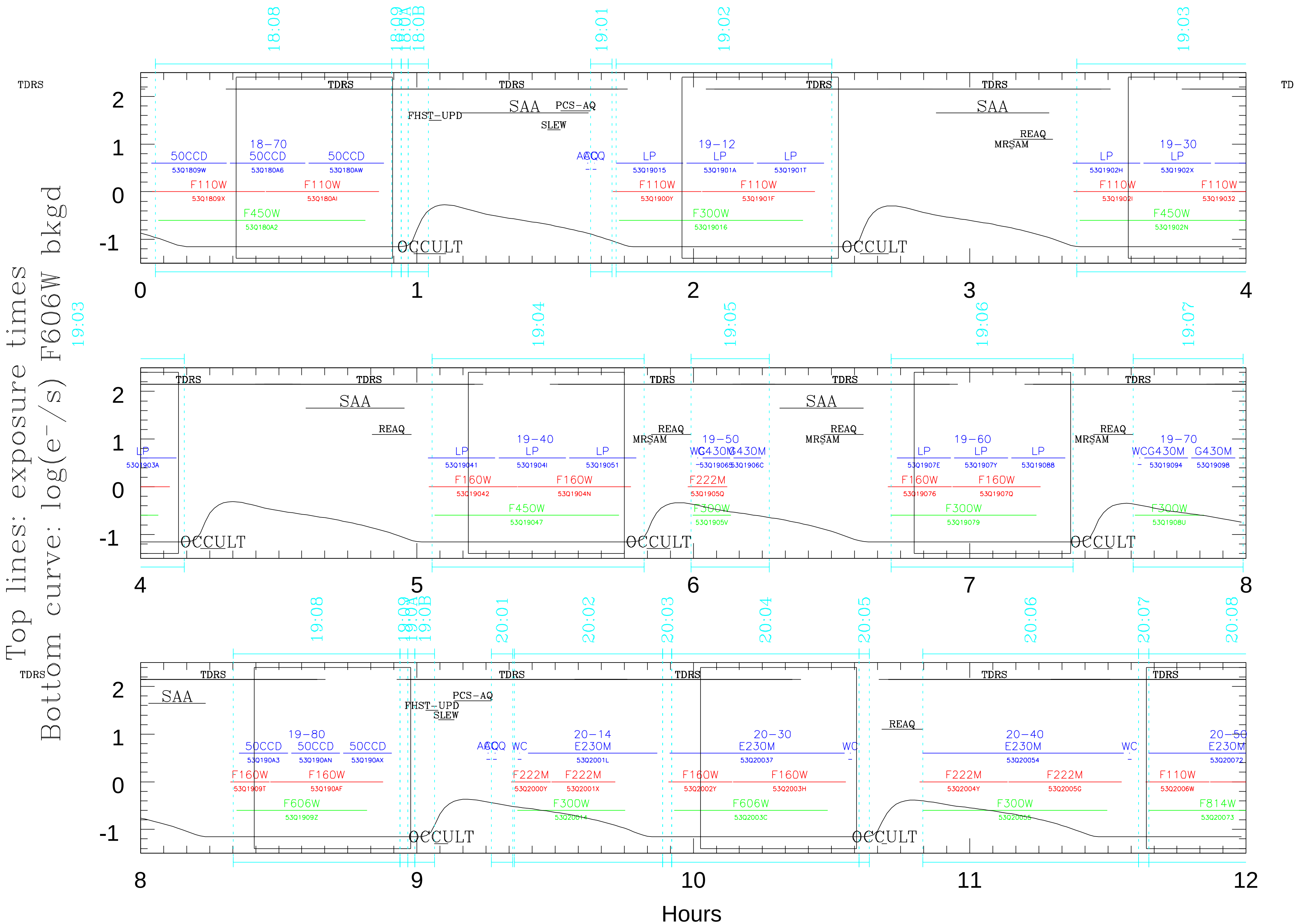

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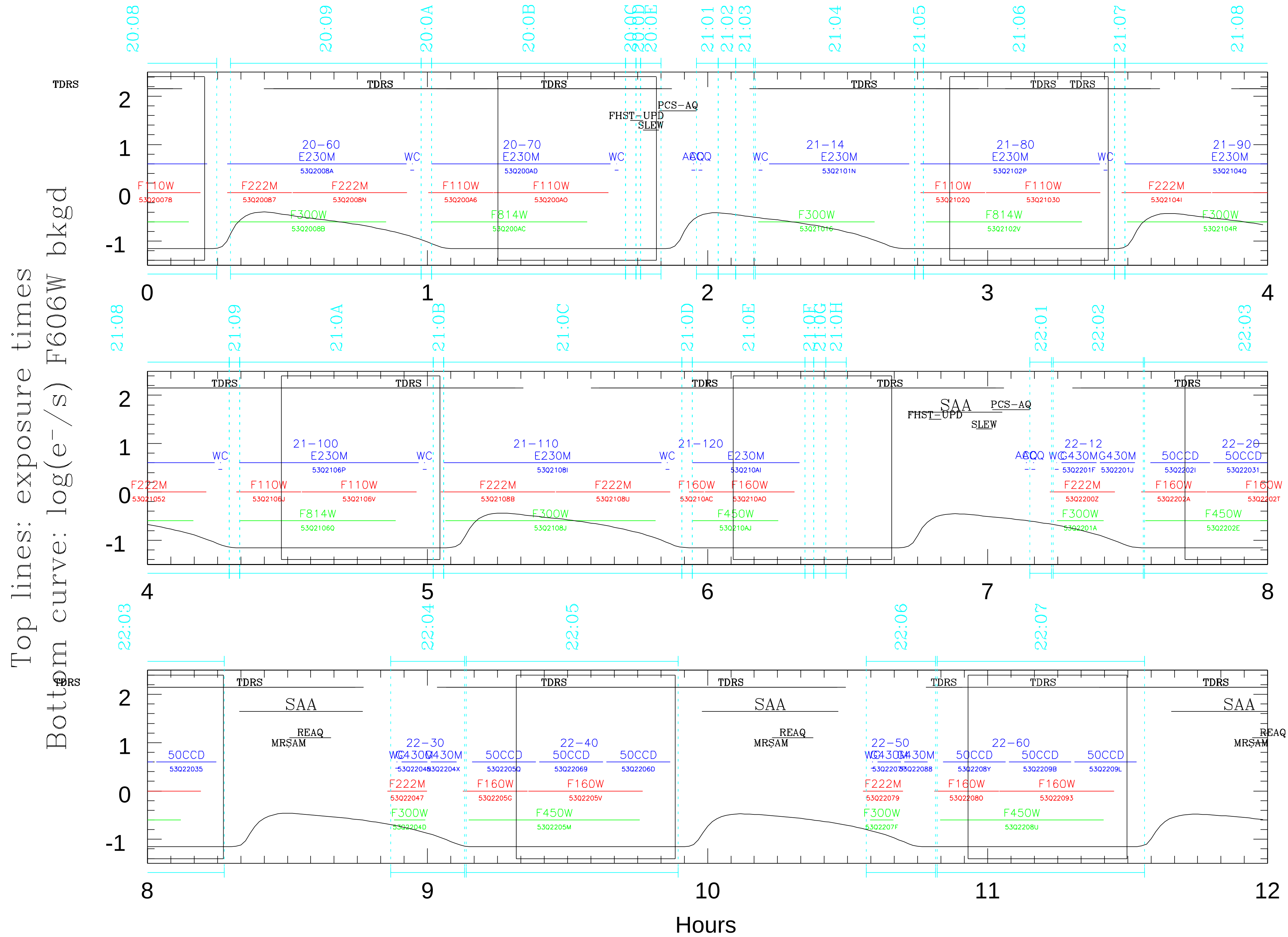

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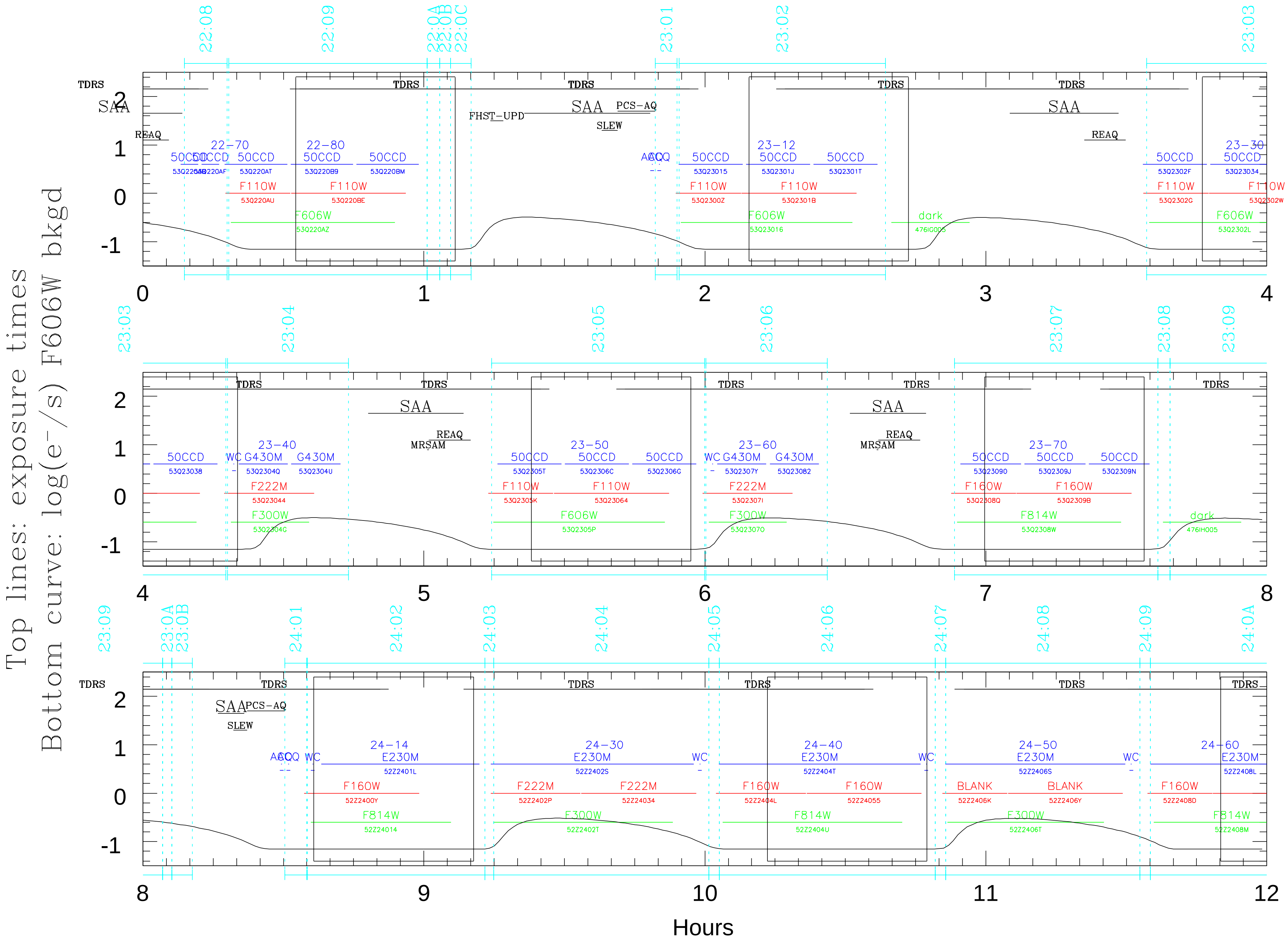

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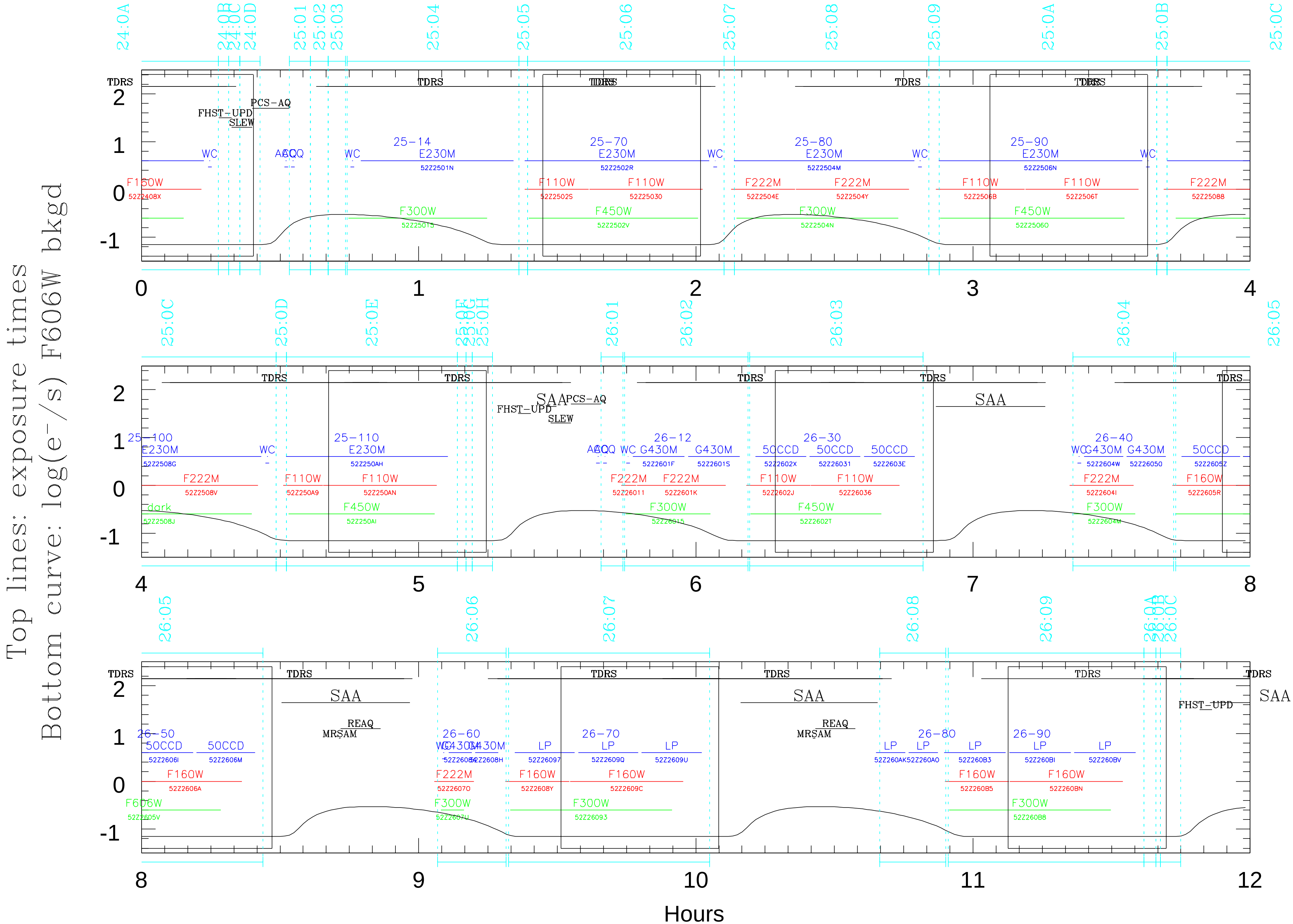

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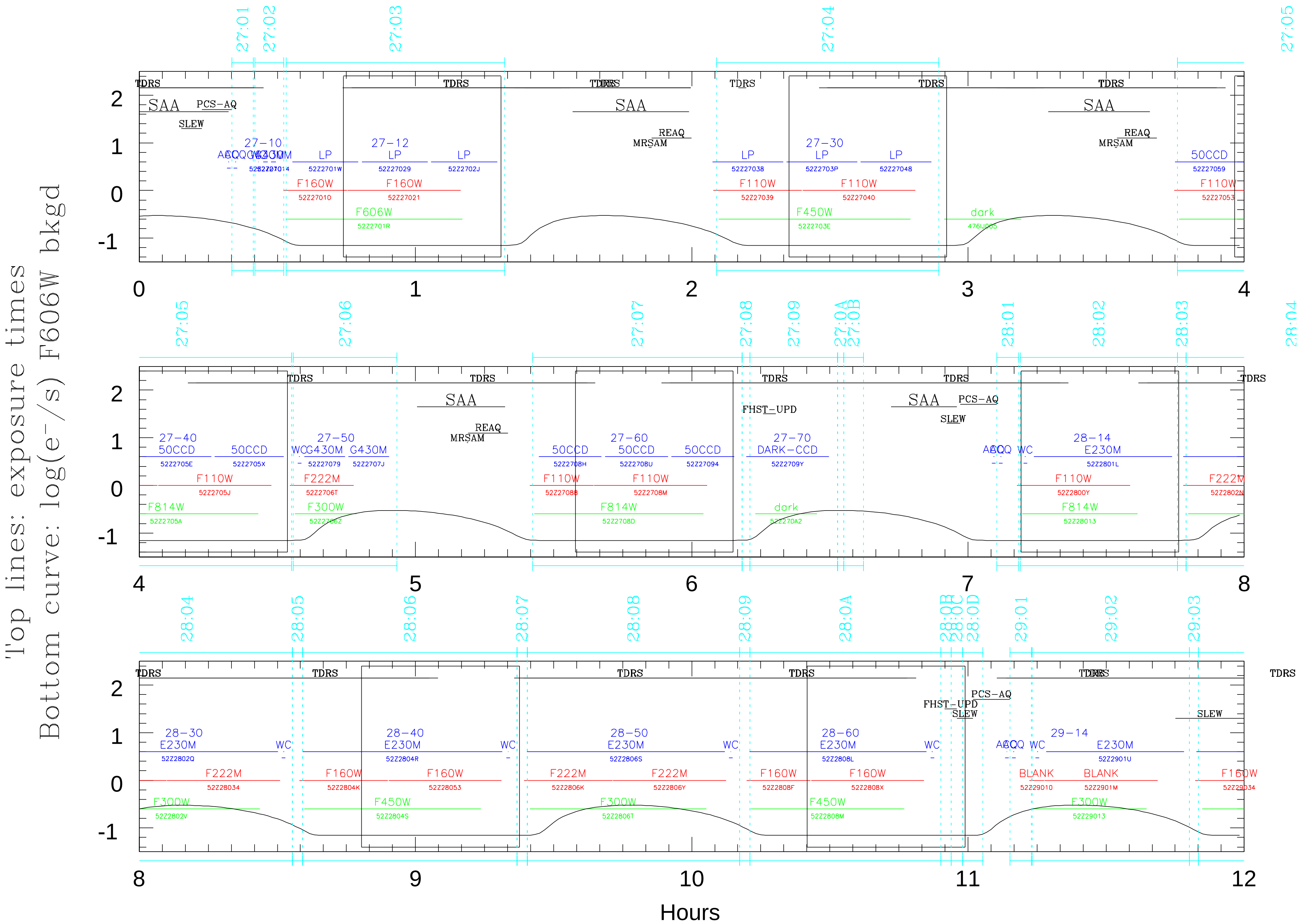

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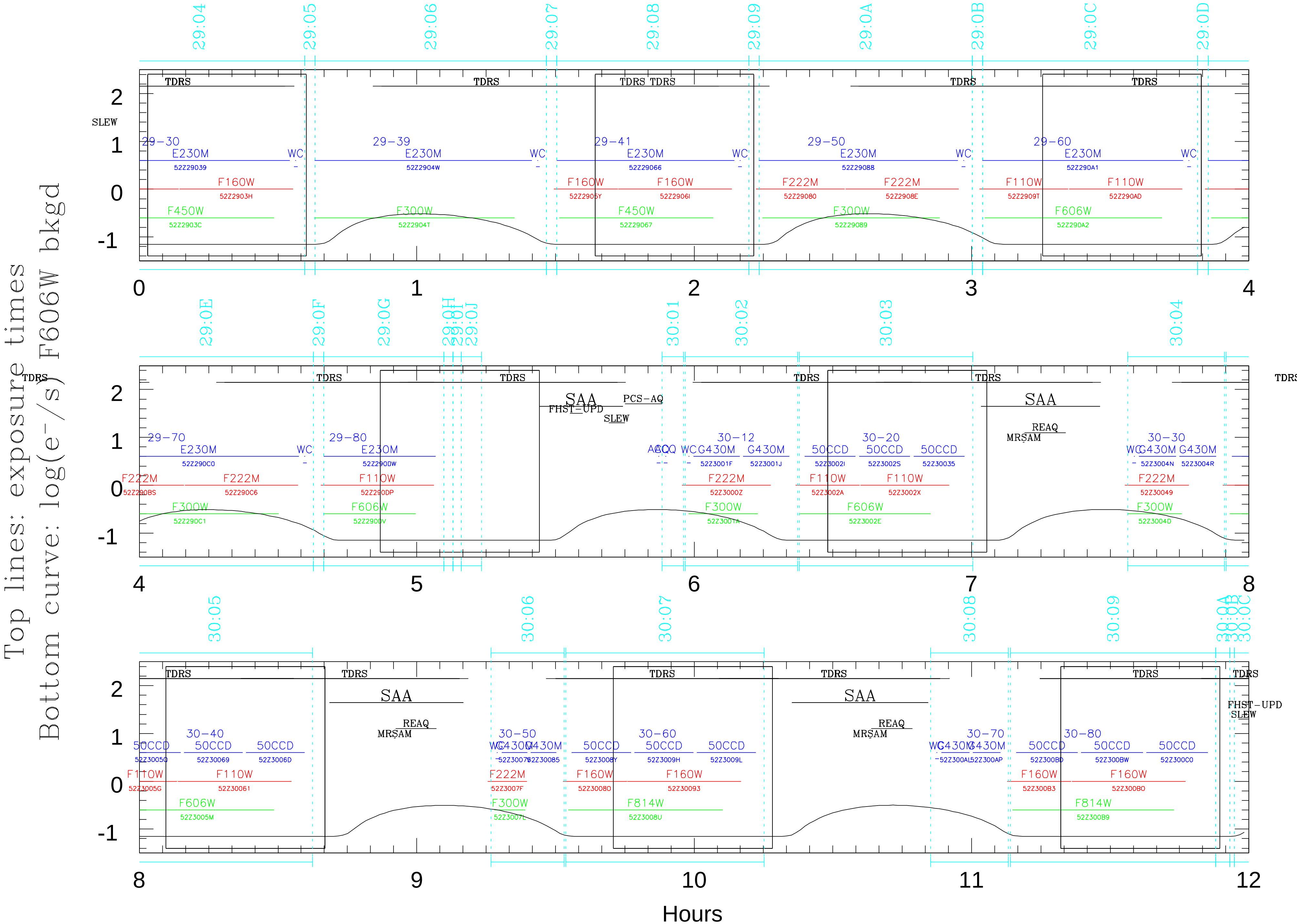

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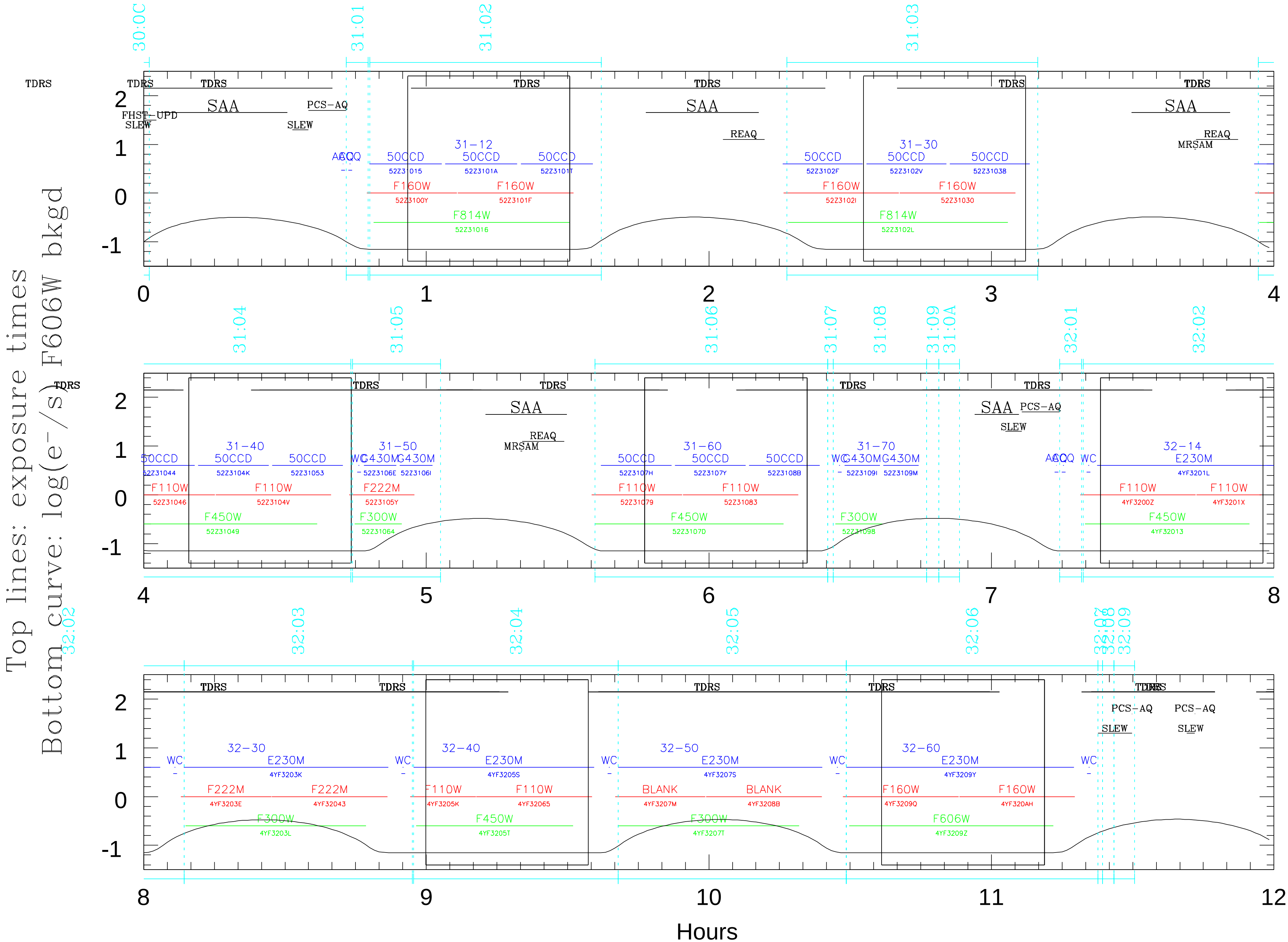

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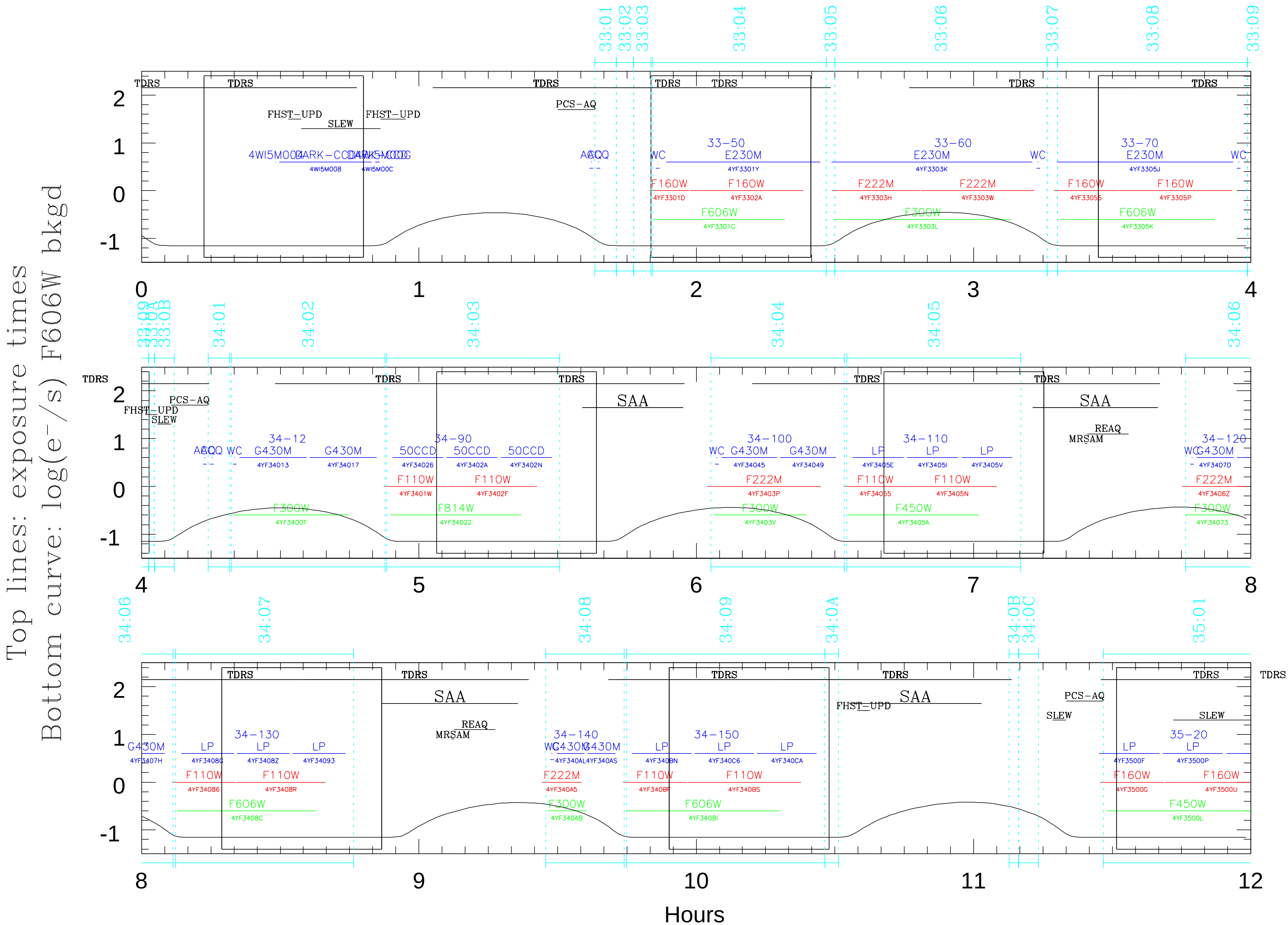

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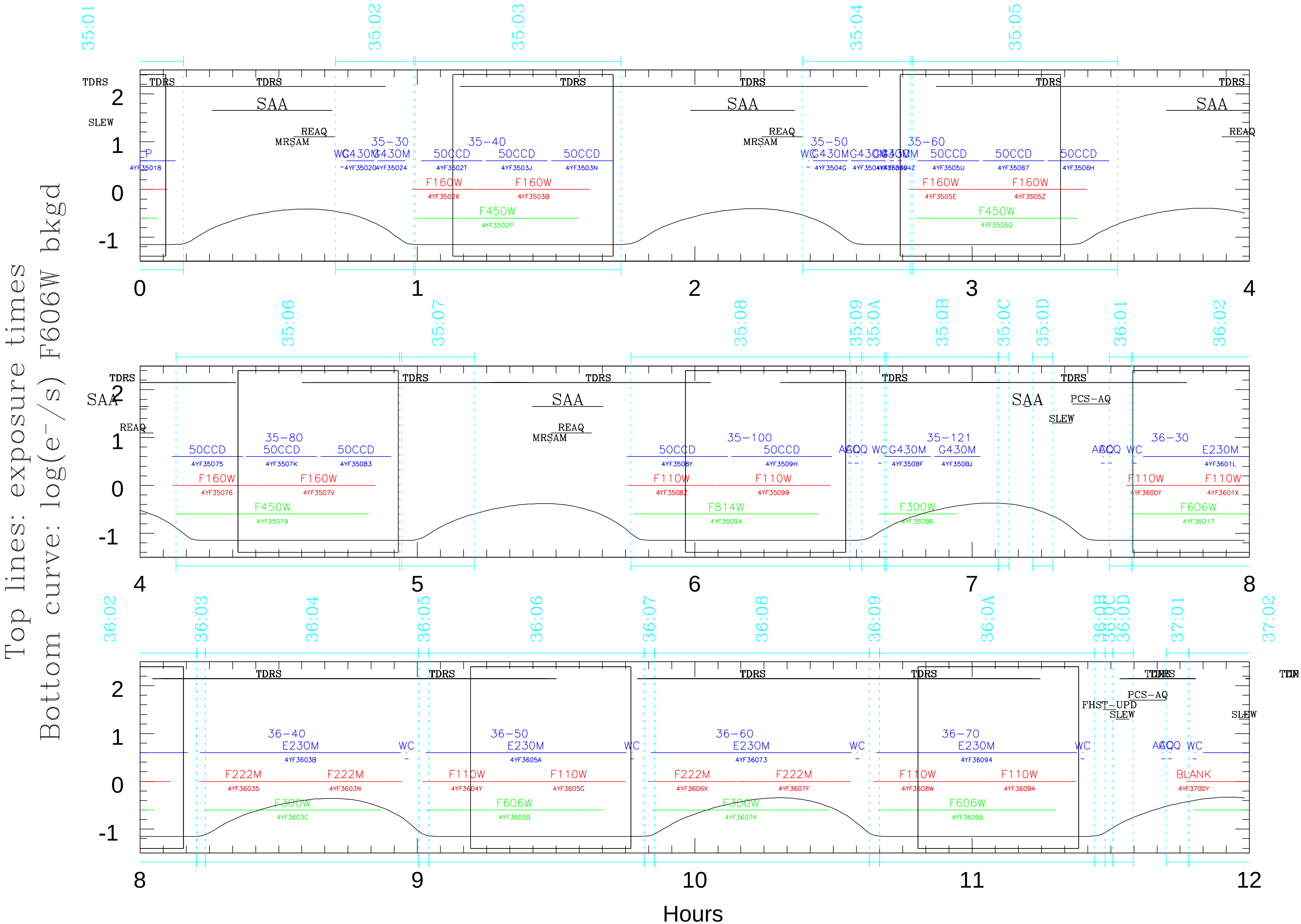

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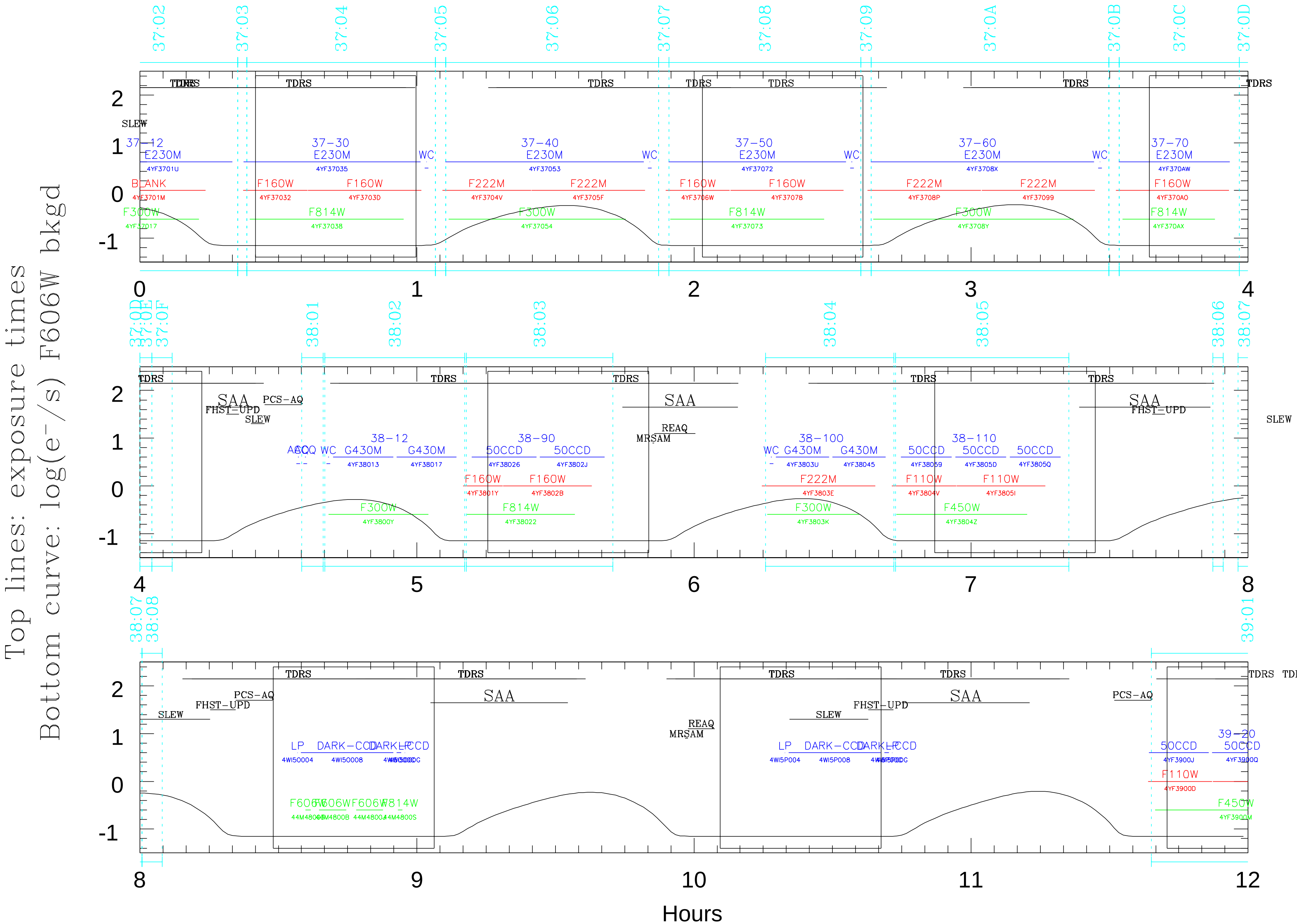

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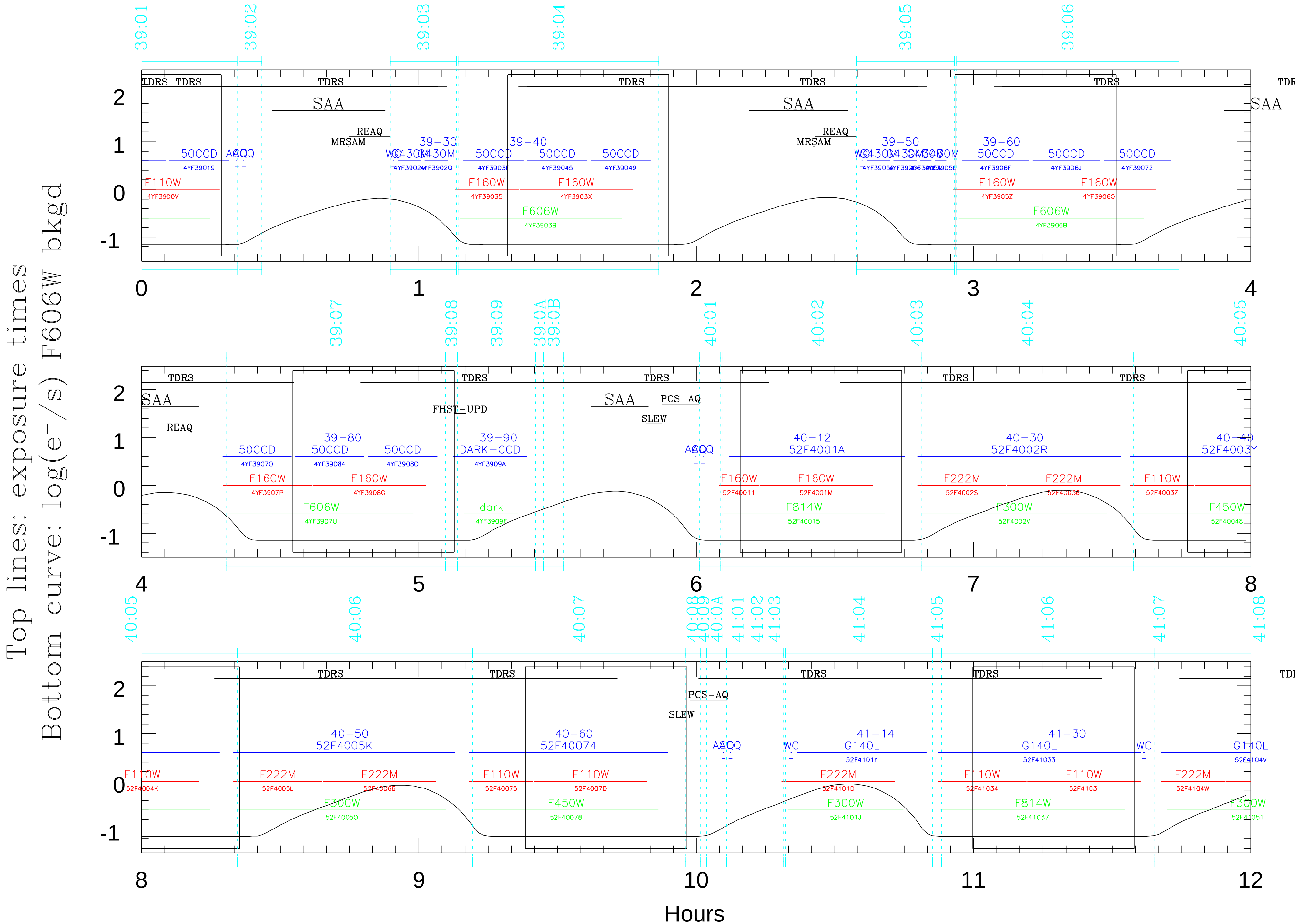

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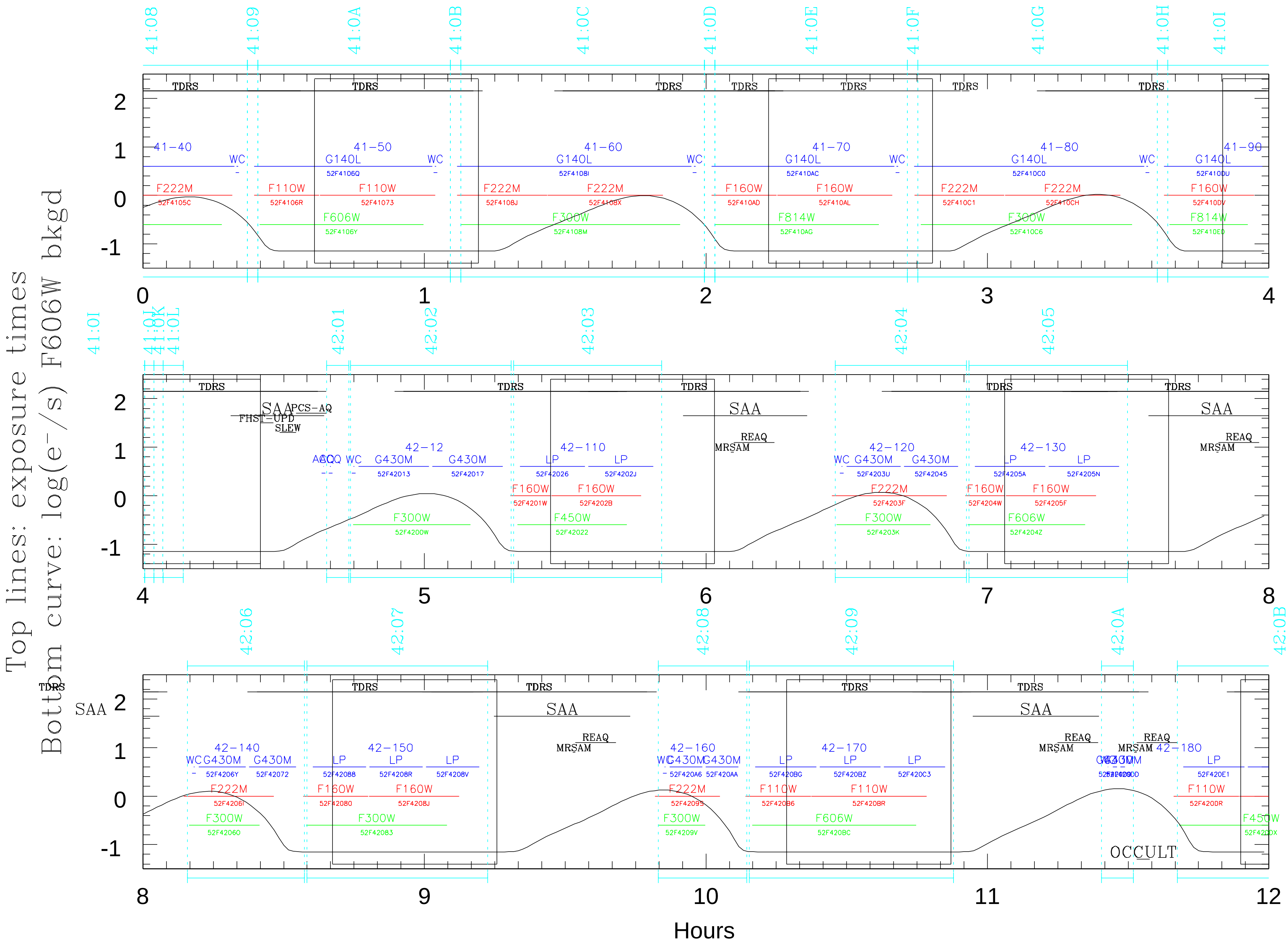

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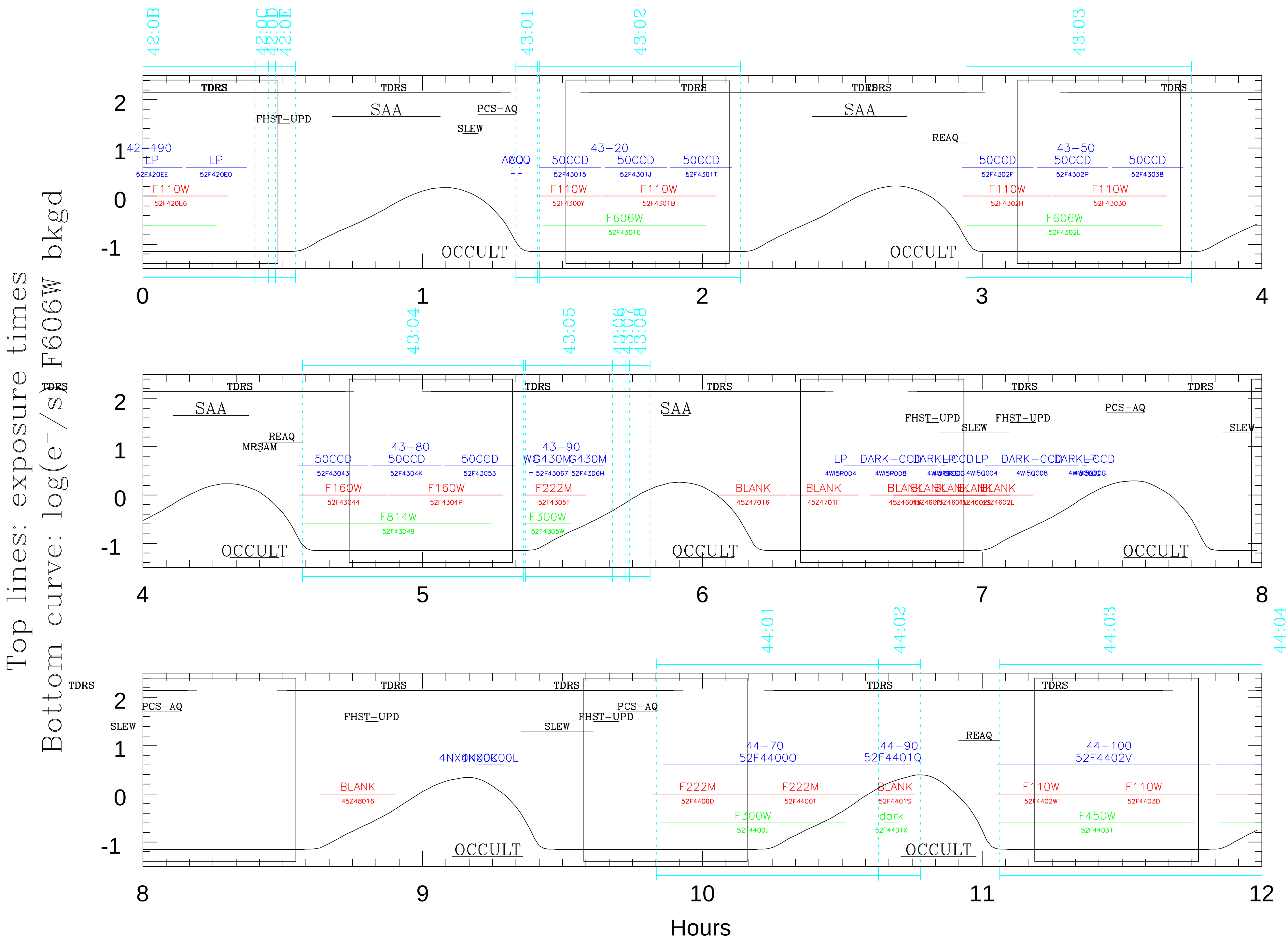

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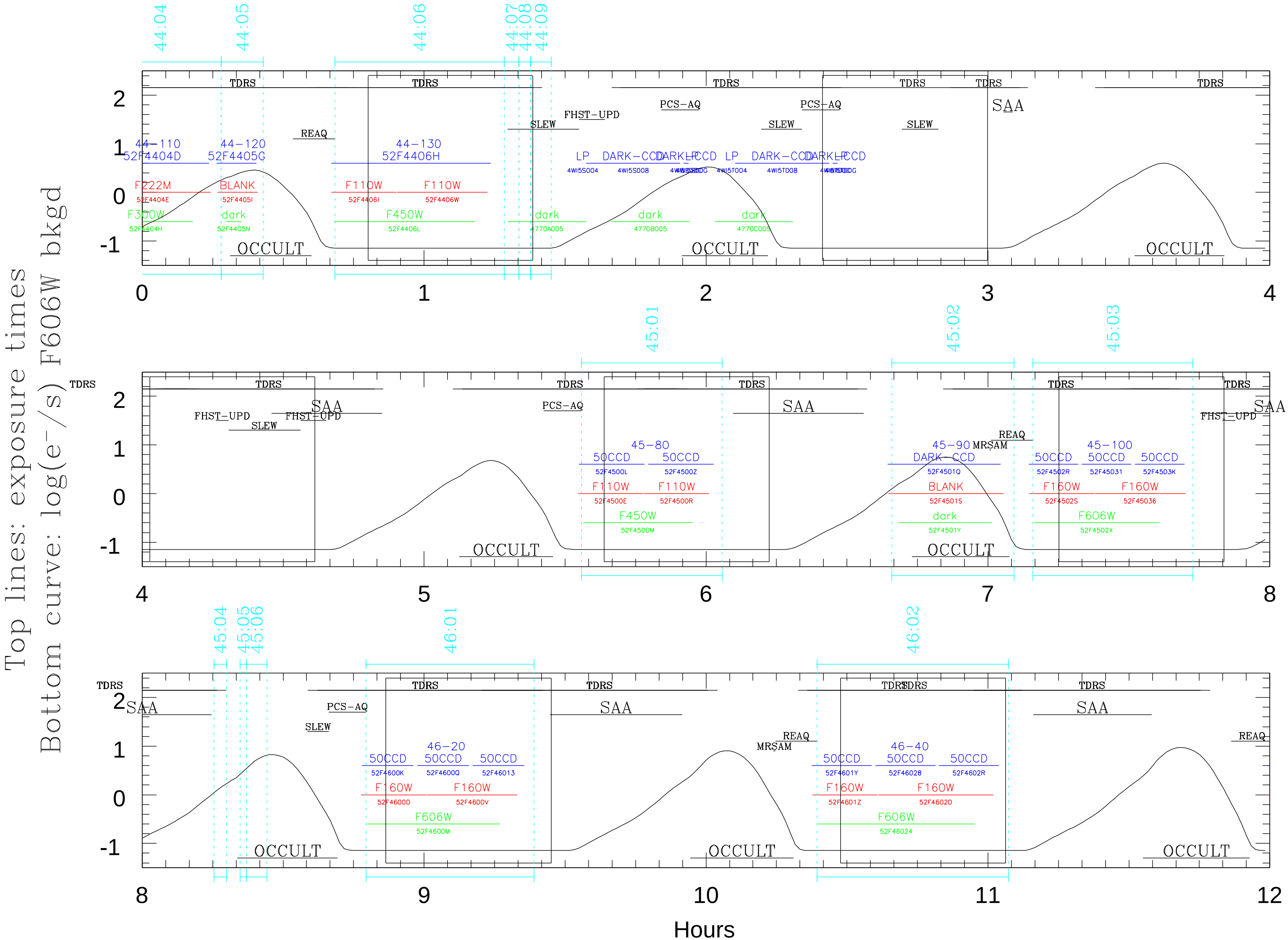

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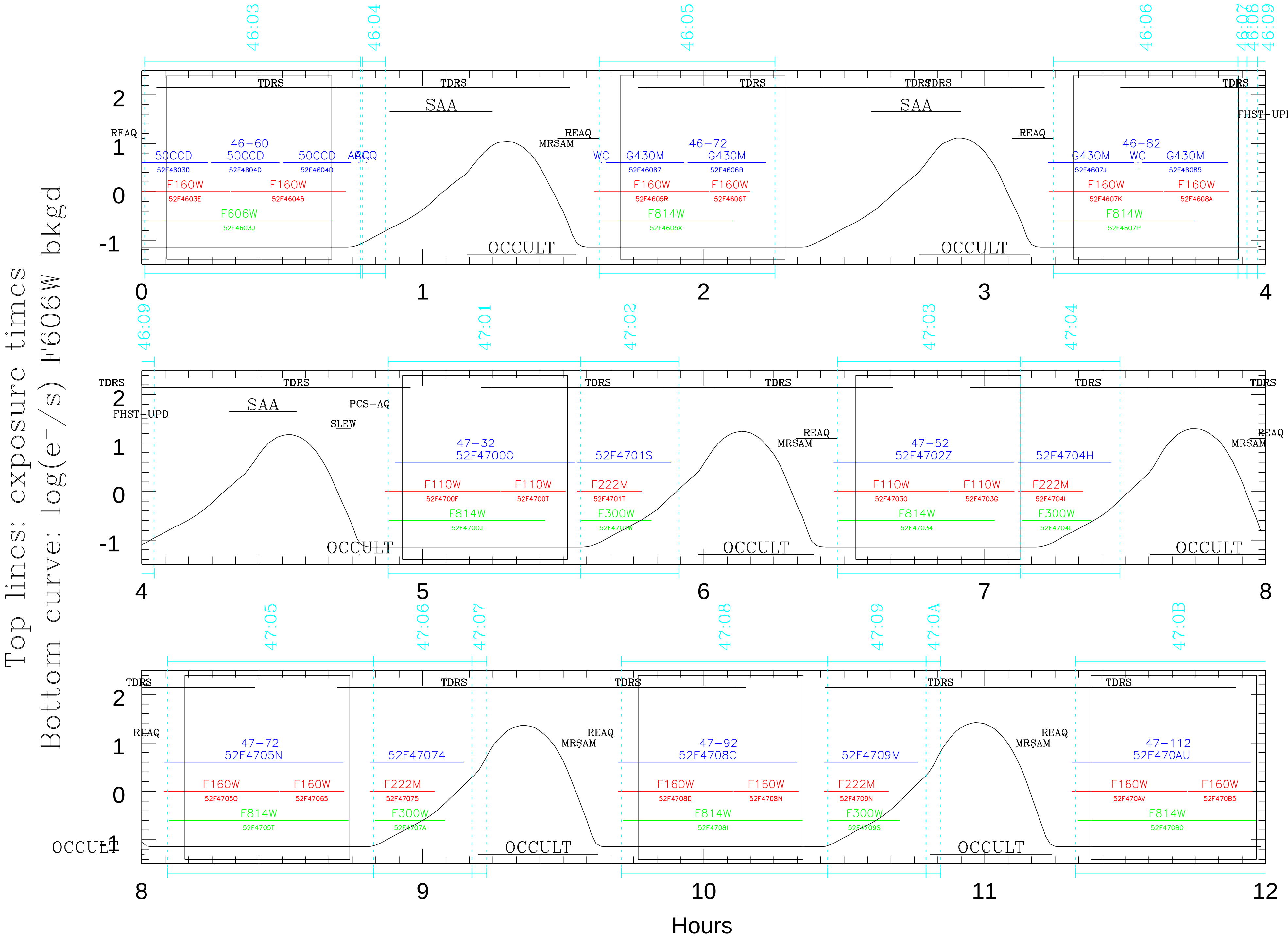
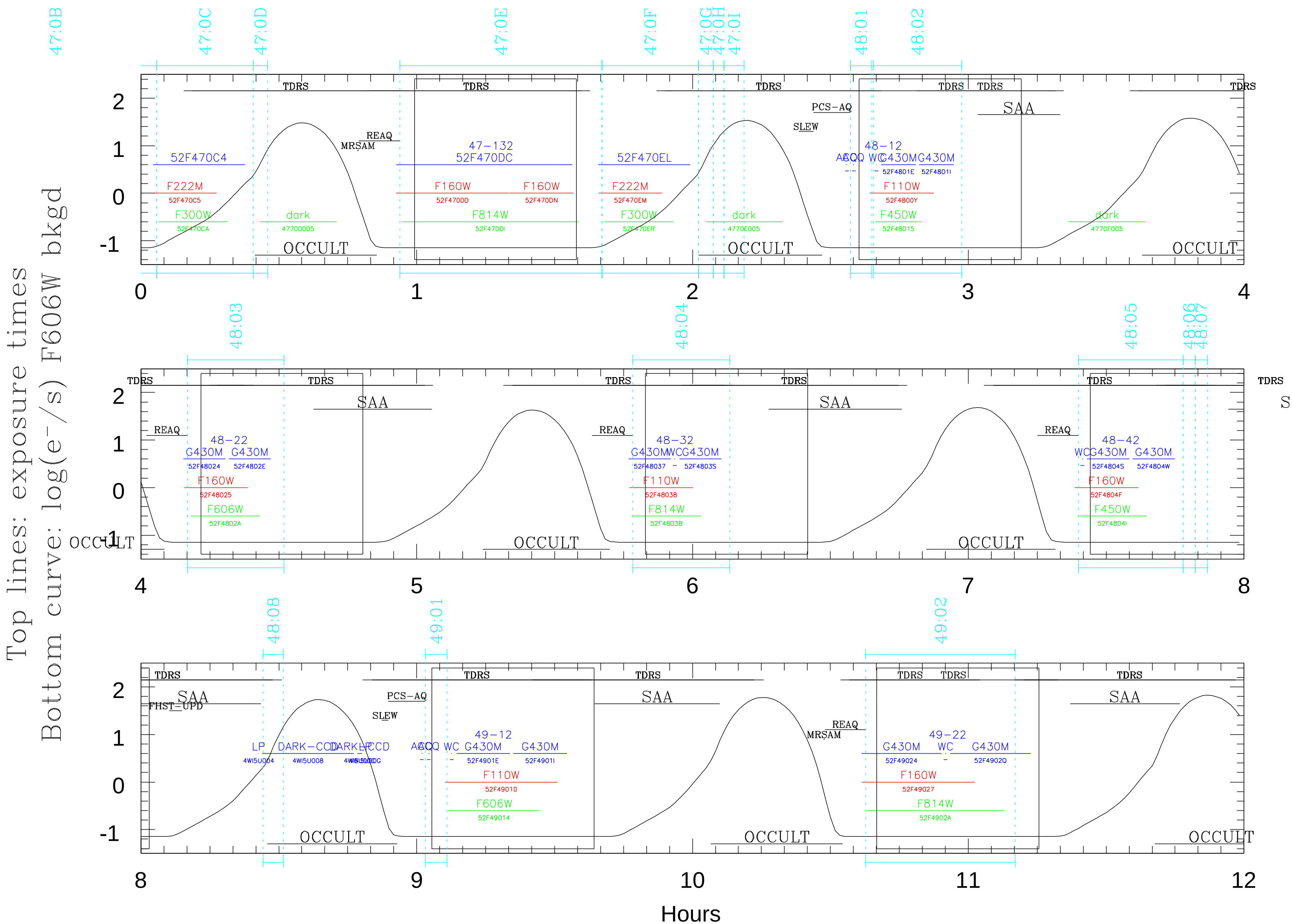
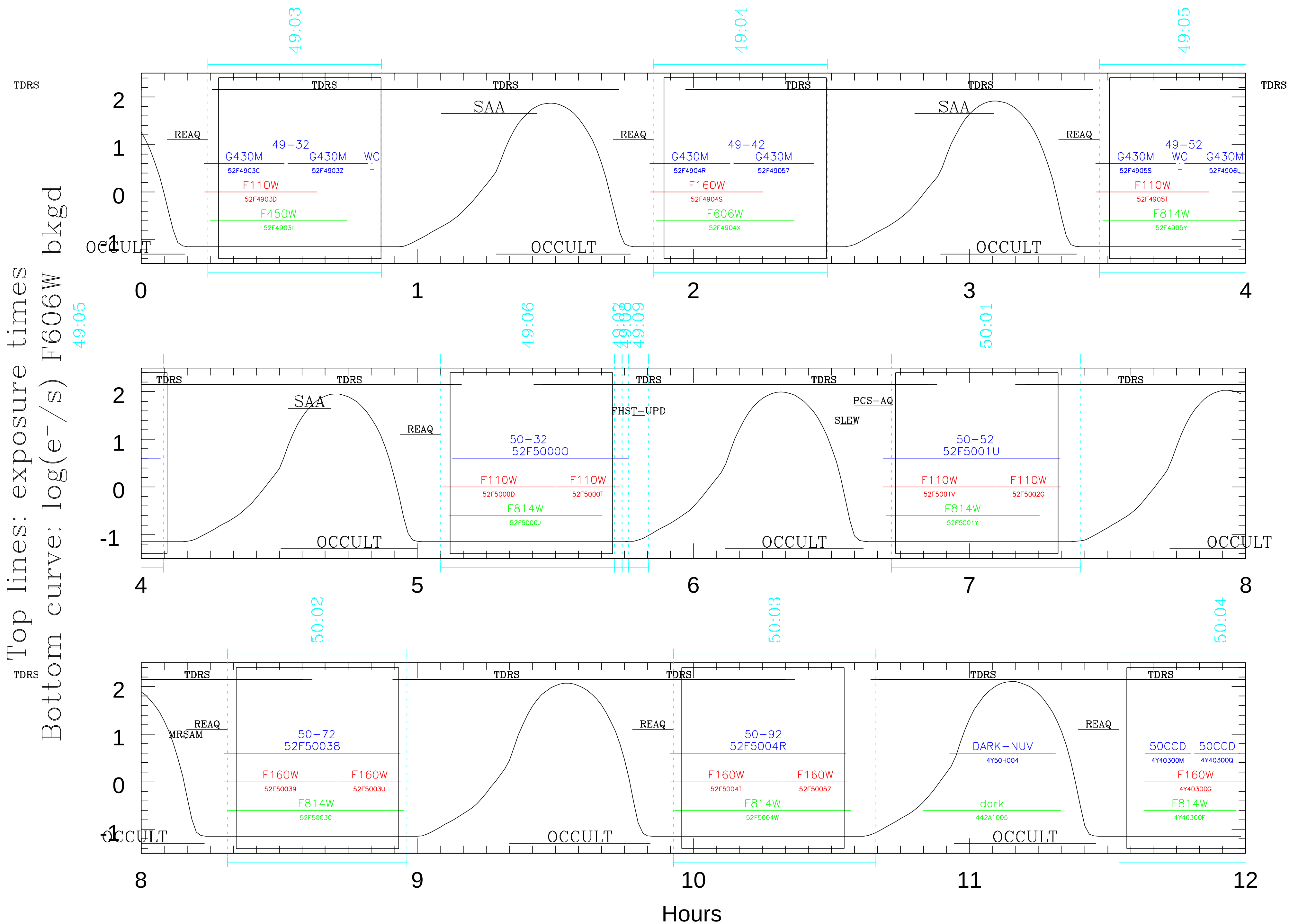


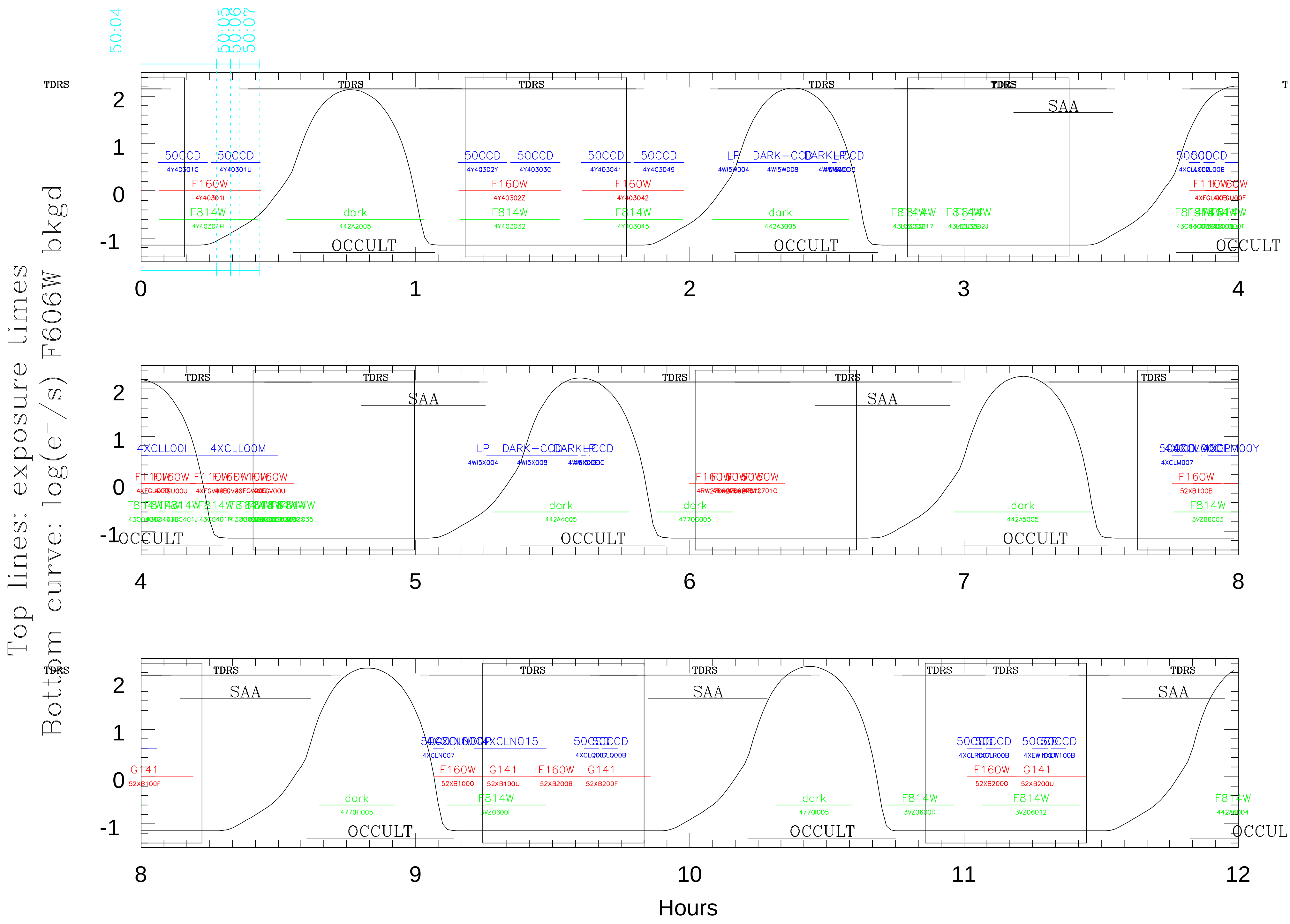
Day 282 = October 9



Day 282.5 = October 9



Day 283 = October 10



STIS Observing Log

Notes:

- This table was last updated: Tue Nov 3 14:55:58 EST 1998.
- The proposal **ID link** provides access to the relevant Phase 2 proposal information from the PRESTO website at STScI.
- The source of the **DQSKY** values are an iraf.stsdas.stis.iterstat mean DN/S after 10 iterations of 5 sigma median clipping of the original HST pipeline products, rootname_xxxxx, where xxxxx is:
  - 50CCD, g430m, and flanking fields: cr[[100:1000,100:1000]
  - F28X50LP: cr[[50:1000,250:775]
  - All datatypes from NUVMAMA: flt[sci,1][*,*]
  - FUV data and psfs: tbd

rootname	id	Linenum	Tdateobs	Ttimeobs	Texptime	Obsmode	Detector	Opt_elem	Aperture	CRsplit	Targname	DQ Sky (dn/s)	DQ Comments
o4y401010	8071	01.001	20/09/98	21:42:32	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401020	8071	01.001	20/09/98	21:43:45	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401030	8071	01.001	20/09/98	21:44:58	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401040	8071	01.001	20/09/98	21:46:11	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401050	8071	01.002	20/09/98	21:47:24	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401060	8071	01.002	20/09/98	21:48:37	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401070	8071	01.002	20/09/98	21:49:50	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401080	8071	01.002	20/09/98	21:51:03	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y401090	8071	01.003	20/09/98	21:52:16	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y4010a0	8071	01.003	20/09/98	21:53:29	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y4010b0	8071	01.003	20/09/98	21:54:42	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y4010c0	8071	01.003	20/09/98	21:55:55	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y4010d0	8071	01.004	20/09/98	21:57:08	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y4010e0	8071	01.004	20/09/98	21:58:21	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y4010f0	8071	01.004	20/09/98	21:59:34	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	-	-
o4y4010g0	8071	01.004	20/09/98	22:43:28	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	N/A	Lost_GSFAIL
o4y4010h0	8071	01.005	20/09/98	22:44:41	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010i0	8071	01.005	20/09/98	22:46:54	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010j0	8071	01.005	20/09/98	22:49:07	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010k0	8071	01.005	20/09/98	22:51:20	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010l0	8071	01.006	20/09/98	23:16:03	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010m0	8071	01.006	20/09/98	23:18:14	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010n0	8071	01.006	20/09/98	23:20:25	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010o0	8071	01.006	20/09/98	23:22:36	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255267	N/A	Lost_GSFAIL
o4y4010p0	8071	01.007	20/09/98	23:24:47	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255267	N/A	Lost_GSFAIL
o4y4010q0	8071	01.007	20/09/98	23:26:33	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255267	N/A	Lost_GSFAIL
o4y4010r0	8071	01.007	20/09/98	23:28:19	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255267	N/A	Lost_GSFAIL
o4y4010s0	8071	01.007	20/09/98	23:30:05	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255267	N/A	Lost_GSFAIL
o4y4010t0	8071	01.008	20/09/98	23:31:51	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	N/A	Lost_GSFAIL
o4y4010u0	8071	01.008	20/09/98	23:33:13	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	N/A	Lost_GSFAIL
o4y4010v0	8071	01.008	20/09/98	23:34:35	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	N/A	Lost_GSFAIL
o4y4010w0	8071	01.008	20/09/98	23:35:57	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255267	N/A	Lost_GSFAIL
o4y402010	8071	02.002	27/09/98	06:24:33	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.05399	-
o4y402020	8071	02.007	27/09/98	06:50:13	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.04788	-
o4y402030	8071	02.012	27/09/98	07:49:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.08246	-
o4y402040	8071	02.017	27/09/98	08:16:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.04720	-
o4y404010	8071	04.002	27/09/98	09:37:26	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.05554	-
o4y404020	8071	04.007	27/09/98	10:03:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.04830	-
o4y404030	8071	04.012	27/09/98	11:17:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.05177	-
o4y404040	8071	04.017	27/09/98	12:59:29	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.04850	-
o53505ofq	8058	05.010	28/09/98	01:32:43	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53505010	8058	05.040	28/09/98	01:41:09	1152.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00012	-
o53505020	8058	05.050	28/09/98	02:02:44	1740.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00017	-
o53505aoq	8058	05.060	28/09/98	02:35:47	1152.0	ACCUM	NUV	G230L	52X0.2	N/A	DARK	N/A	-
o53505030	8058	05.070	28/09/98	03:08:19	1152.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00021	-
o53505040	8058	05.080	28/09/98	03:31:38	1800.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00019	-
o53505b9q	8058	05.090	28/09/98	04:02:27	1152.0	ACCUM	NUV	G230L	52X0.2	N/A	DARK	N/A	-
o53505050	8058	05.100	28/09/98	04:46:23	1152.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00019	-
o53505060	8058	05.110	28/09/98	05:07:58	1800.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00015	-
o53505boq	8058	05.120	28/09/98	05:41:54	1020.0	ACCUM	NUV	G230L	52X0.2	N/A	DARK	N/A	-
o53505070	8058	05.130	28/09/98	06:21:36	1200.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00015	-
o53505080	8058	05.140	28/09/98	06:43:36	1740.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	0.00008	-
o53506ckq	8058	06.010	28/09/98	07:59:19	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53506010	8058	06.012	28/09/98	08:06:56	660.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00039	-
o53506020	8058	06.020	28/09/98	08:22:02	2283.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04764	-
o53506030	8058	06.030	28/09/98	09:49:25	540.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00021	-
o53506040	8058	06.040	28/09/98	10:02:31	2040.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04728	-
o53506050	8058	06.050	28/09/98	11:28:41	2700.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04935	-
o53506060	8058	06.060	28/09/98	13:09:54	2400.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04754	-
o53507e7q	8058	07.010	28/09/98	14:44:37	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53507010	8058	07.012	28/09/98	14:50:47	2283.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04742	-
o53507eyq	8058	07.030	28/09/98	15:31:11	1200.0	ACCUM	CCD	MIRVIS	50CCD	1	DARK	N/A	-
o53507020	8058	07.040	28/09/98	16:30:01	2100.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04766	-
o53507eyq	8058	07.050	28/09/98	17:07:19	1200.0	ACCUM	CCD	MIRVIS	50CCD	1	DARK	N/A	-
o53507030	8058	07.060	28/09/98	18:10:06	1863.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04762	-
o53507fdq	8058	07.070	28/09/98	18:44:03	2100.0	ACCUM	CCD	MIRVIS	50CCD	1	DARK	N/A	-
o53507040	8058	07.080	28/09/98	19:50:08	1800.0	ACCUM	CCD	MIRVIS	50CCD	2	HDFS	0.04758	-
o53507fxq	8058	07.090	28/09/98	20:21:42	2372.0	ACCUM	CCD	MIRVIS	50CCD	1	DARK	N/A	-
o53507050	8058	07.110	28/09/98	21:28:16	1772.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04805	-
o53508010	8058	08.012	28/09/98	22:20:51	0.0	ACCUM	CCD	MIRVIS	F28X50LP	1	BIAS	N/A	-
o53508g9q	8058	08.100	28/09/98	22:33:00	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53508020	8058	08.110	28/09/98	22:43:23	960.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	-0.00017	-
o53508030	8058	08.120	28/09/98	23:01:46	1984.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	-0.00021	-
o53508gpq	8058	08.130	28/09/98	23:38:46	840.0	ACCUM	NUV	G230L	52X0.2	N/A	DARK	N/A	-
o53508040	8058	08.140	29/09/98	00:04:33	1260.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	-0.00021	-
o53508050	8058	08.150	29/09/98	00:26:33	2484.0	ACCUM	NUV	G230L	52X0.2	N/A	HDFS	-0.00021	-
o53508hbq	8058	08.160	29/09/98	01:12:54	832.0	ACCUM	NUV	G230L	52X0.2	N/A	DARK	N/A	-
o53508hfq	8058	08.170	29/09/98	01:43:56	1344.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00014	-
o53508hoq	8058	08.180	29/09/98	02:06:48	2604.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00016	-
o53509hzq	8058	09.012	29/09/98	03:06:06	512.0	ACCUM	NUV	MIRVIS	F28X50LP	N/A	DARK	N/A	-
o53509i3q	8058	09.020	29/09/98	03:21:13	1320.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00012	-
o53509i9q	8058	09.030	29/09/98	03:44:04	2280.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00013	-
o53509iiq	8058	09.040	29/09/98	04:22:53	960.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	DARK	N/A	-
o53509inq	8058	09.050	29/09/98	04:54:24	1380.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00007	-
o53509iwq	8058	09.060	29/09/98	05:18:24	2604.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00011	-
o53509j6q	8058	09.070	29/09/98	06:02:31	960.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	DARK	N/A	-
o53509jbq	8058	09.080	29/09/98	06:30:59	1320.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00005	-
o53509jeq	8058	09.090	29/09/98	06:53:27	2304.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00010	-
o53510joq	8058	10.010	29/09/98	08:09:50	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53510010	8058	10.012	29/09/98	08:17:50	540.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00038	-
o53510020	8058	10.020	29/09/98	08:30:53	2640.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04792	-
o53510030	8058	10.030	29/09/98	10:01:40	540.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00031	-
o53510040	8058	10.040	29/09/98	10:14:48	2304.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04757	-
o53510050	8058	10.050	29/09/98	11:40:41	2940.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04989	-
o53510060	8058	10.060	29/09/98	13:21:16	2640.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04826	-
o53511lbq	8058	11.010	29/09/98	14:55:56	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53511010	8058	11.012	29/09/98	15:02:02	2304.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.01499	-
o53511020	8058	11.030	29/09/98	16:41:09	2304.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.01509	-
o53511030	8058	11.040	29/09/98	18:21:15	2004.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.01502	-
o53511040	8058	11.050	29/09/98	19:26:56	360.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00127	-
o53511050	8058	11.060	29/09/98	20:02:38	1980.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.01488	-
o53511060	8058	11.070	29/09/98	21:03:30	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00061	-
o53511070	8058	11.080	29/09/98	21:38:36	1500.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.01429	-
o53512n5q	8058	12.010	29/09/98	22:37:58	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53512n6q	8058	12.012	29/09/98	22:45:05	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o53512n7q	8058	12.012	29/09/98	22:48:51	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o53512n8q	8058	12.014	29/09/98	22:52:55	552.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00016	-
o53512neq	8058	12.030	29/09/98	23:06:52	2604.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00021	-
o53512nnq	8058	12.040	30/09/98	00:13:29	1664.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00015	-
o53512nwq	8058	12.050	30/09/98	00:41:47	2640.0	ACCUM	NUV	MIRNUV	F25QTZ	N/A	HDFS	-0.00017	-
o53512050	8058	12.060	30/09/98	01:54:59	1664.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00088	-
o53512060	8058	12.070	30/09/98	02:25:08	2304.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00090	-
o53513otq	8058	13.010	30/09/98	03:28:19	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53513ouq	8058	13.012	30/09/98	03:35:26	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o53513ovq	8058	13.012	30/09/98	03:39:12	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o53513010	8058	13.014	30/09/98	03:44:26	1140.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00089	-
o53513020	8058	13.080	30/09/98	04:06:03	2040.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00094	-
o53513030	8058	13.090	30/09/98	05:04:49	1664.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00095	-
o53513040	8058	13.100	30/09/98	05:33:11	2400.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00095	-
o53513050	8058	13.110	30/09/98	06:41:29	2264.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00096	-
o53513060	8058	13.120	30/09/98	07:24:34	1200.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00099	-
o53514qaq	8058	14.010	30/09/98	08:22:26	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53514010	8058	14.012	30/09/98	08:30:28	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00002	-
o53514020	8058	14.020	30/09/98	08:44:38	2604.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04783	-
o53514030	8058	14.030	30/09/98	10:13:45	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00070	-
o53514040	8058	14.040	30/09/98	10:27:51	2199.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04747	-
o53514050	8058	14.050	30/09/98	11:52:04	2640.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05140	-
o53514060	8058	14.060	30/09/98	13:32:18	2640.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04935	-
o53515rxq	8058	15.010	30/09/98	15:07:56	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53515010	8058	15.012	30/09/98	15:13:39	2340.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04799	-
o53515020	8058	15.030	30/09/98	16:52:18	2220.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04791	-
o53515030	8058	15.040	30/09/98	18:32:28	2304.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04778	-
o53515040	8058	15.050	30/09/98	19:34:50	540.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00053	-
o53515050	8058	15.060	30/09/98	20:12:58	1819.8	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04772	-
o53515t8q	8058	15.072	30/09/98	20:46:20	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53515060	8058	15.074	30/09/98	21:10:43	1140.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00011	-
o53515070	8058	15.090	30/09/98	21:45:29	2340.0	ACCUM	CCD	MIRVIS	50CCD	2	HDFS	0.04835	-
o53q17uaq	8073	17.010	01/10/98	01:28:17	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53q17ubq	8073	17.012	01/10/98	01:35:24	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o53q17ucq	8073	17.012	01/10/98	01:39:10	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o53q17010	8073	17.014	01/10/98	02:01:10	1440.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00087	-
o53q17020	8073	17.080	01/10/98	02:27:47	2640.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00089	-
o53q17030	8073	17.090	01/10/98	03:34:32	1984.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00094	-
o53q17040	8073	17.100	01/10/98	04:08:06	2400.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00096	-
o53q17050	8073	17.110	01/10/98	05:10:55	1984.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00099	-
o53q17060	8073	17.120	01/10/98	05:44:29	2200.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00100	-
o53q18vvq	8073	18.010	01/10/98	06:51:07	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53q18010	8073	18.012	01/10/98	06:59:10	960.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00009	-
o53q18020	8073	18.020	01/10/98	07:19:16	1400.0	ACCUM	CCD	MIRVIS	50CCD	2	HDFS	0.05067	-
o53q18030	8073	18.030	01/10/98	08:43:24	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00004	-
o53q18040	8073	18.040	01/10/98	08:57:32	2640.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04791	-
o53q18050	8073	18.050	01/10/98	10:25:45	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00011	-
o53q18060	8073	18.060	01/10/98	10:39:51	2304.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04755	-
o53q18070	8073	18.070	01/10/98	12:03:25	2940.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05135	-
o53q19xlq	8073	19.010	01/10/98	13:38:02	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53q19010	8073	19.012	01/10/98	13:44:17	2622.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02955	-
o53q19020	8073	19.030	01/10/98	15:23:25	2640.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02968	-
o53q19030	8073	19.040	01/10/98	17:03:29	2622.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02925	-
o53q19040	8073	19.050	01/10/98	18:03:02	720.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00012	-
o53q19050	8073	19.060	01/10/98	18:45:17	2100.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02896	-
o53q19060	8073	19.070	01/10/98	19:38:57	1140.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00007	-
o53q19070	8073	19.080	01/10/98	20:22:28	1902.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04766	-
o53q20zgq	8073	20.010	01/10/98	21:16:26	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53q20010	8073	20.014	01/10/98	21:25:11	1684.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00089	-
o53q20020	8073	20.030	01/10/98	21:55:52	2280.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00089	-
o53q20030	8073	20.040	01/10/98	22:50:46	2624.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00091	-
o53q20040	8073	20.050	01/10/98	23:39:51	2040.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00091	-
o53q20050	8073	20.060	02/10/98	00:18:09	2304.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00094	-
o53q20060	8073	20.070	02/10/98	01:01:54	2304.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00095	-
o53q21b9q	8073	21.010	02/10/98	01:57:58	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53q21baq	8073	21.012	02/10/98	02:05:05	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o53q21bbq	8073	21.012	02/10/98	02:08:51	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	GS_Recentering
o53q21010	8073	21.014	02/10/98	02:14:15	1800.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00097	-
o53q21020	8073	21.080	02/10/98	02:46:40	2304.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00099	-
o53q21030	8073	21.090	02/10/98	03:30:25	2700.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00100	-
o53q21040	8073	21.100	02/10/98	04:20:46	2304.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00101	-
o53q21050	8073	21.110	02/10/98	05:04:31	2800.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00102	-
o53q21060	8073	21.120	02/10/98	05:57:45	1380.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00101	-
o53q22cvq	8073	22.010	02/10/98	07:09:19	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o53q22010	8073	22.012	02/10/98	07:16:53	900.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00034	-
o53q22020	8073	22.020	02/10/98	07:35:56	2304.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04750	-
o53q22030	8073	22.030	02/10/98	08:55:33	660.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00040	-
o53q22040	8073	22.040	02/10/98	09:10:36	2460.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04758	-
o53q22050	8073	22.050	02/10/98	10:37:27	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00009	-
o53q22060	8073	22.060	02/10/98	10:51:33	2400.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04757	-
o53q22070	8073	22.070	02/10/98	12:09:06	450.0	ACCUM	CCD	MIRVIS	50CCD	2	HDFS	0.09026	-
o53q22080	8073	22.080	02/10/98	12:18:33	2400.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05047	-
o53q23erq	8073	23.010	02/10/98	13:49:44	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-

o53q23010	8073	23.012	02/10/98	13:55:27	2460.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05032	-
o53q23020	8073	23.030	02/10/98	15:34:34	2460.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04924	-
o53q23030	8073	23.040	02/10/98	16:21:32	1260.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00002	-
o53q23040	8073	23.050	02/10/98	17:16:47	2460.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04791	-
o53q23050	8073	23.060	02/10/98	18:03:42	1260.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00007	-
o53q23060	8073	23.070	02/10/98	18:55:35	2340.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04782	-
o52z24geq	8074	24.010	02/10/98	20:30:36	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z24010	8074	24.014	02/10/98	20:39:11	2024.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00088	-
o52z24020	8074	24.030	02/10/98	21:15:20	2604.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00090	-
o52z24030	8074	24.040	02/10/98	22:04:05	2580.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00090	-
o52z24040	8074	24.050	02/10/98	22:52:26	2304.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00093	-
o52z24050	8074	24.060	02/10/98	23:36:11	2304.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00094	-
o52z25htq	8074	25.010	03/10/98	00:32:18	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z25huq	8074	25.012	03/10/98	00:39:25	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o52z25hvq	8074	25.012	03/10/98	00:43:11	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o52z25010	8074	25.014	03/10/98	00:48:35	1980.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00095	-
o52z25020	8074	25.070	03/10/98	01:24:00	2400.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00097	-
o52z25030	8074	25.080	03/10/98	02:09:21	2340.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00100	-
o52z25040	8074	25.090	03/10/98	02:53:42	2640.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00100	-
o52z25050	8074	25.100	03/10/98	03:43:03	2640.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00102	-
o52z25060	8074	25.110	03/10/98	04:32:24	2100.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00103	-
o52z26jgq	8074	26.010	03/10/98	05:39:49	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z26010	8074	26.012	03/10/98	05:47:26	1344.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00005	-
o52z26020	8074	26.030	03/10/98	06:13:56	1983.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04798	-
o52z26030	8074	26.040	03/10/98	07:25:04	1020.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00034	-
o52z26040	8074	26.050	03/10/98	07:46:12	2280.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04802	-
o52z26050	8074	26.060	03/10/98	09:07:33	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00011	-
o52z26060	8074	26.070	03/10/98	09:21:52	2340.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02932	-
o52z26070	8074	26.080	03/10/98	10:40:03	760.0	ACCUM	CCD	MIRVIS	F28X50LP	2	HDFS	0.05641	-
o52z26080	8074	26.090	03/10/98	10:54:50	2400.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.03085	-
o52z27lgq	8074	27.005	03/10/98	12:20:26	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z27010	8074	27.010	03/10/98	12:28:00	120.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00003	-
o52z27020	8074	27.012	03/10/98	12:34:21	2580.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02951	-
o52z27030	8074	27.030	03/10/98	14:05:38	2760.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.03081	-
o52z27040	8074	27.040	03/10/98	15:46:00	2700.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04965	-
o52z27050	8074	27.050	03/10/98	16:36:55	1060.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00002	-
o52z27060	8074	27.060	03/10/98	17:27:50	2460.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04796	-
o52z27n0q	8074	27.070	03/10/98	18:12:53	1080.0	ACCUM	CCD	MIRVIS	50CCD	1	DARK	N/A	-
o52z28n2q	8074	28.010	03/10/98	19:06:38	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z28010	8074	28.014	03/10/98	19:15:23	1800.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00096	-
o52z28020	8074	28.030	03/10/98	19:47:48	2604.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00036	GSLOL,TEXPTIME~361s(tbd)
o52z28030	8074	28.040	03/10/98	20:36:33	2604.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00095	-
o52z28040	8074	28.050	03/10/98	21:25:18	2580.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00096	-
o52z28050	8074	28.060	03/10/98	22:13:39	2304.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00096	-
o52z29ohq	8074	29.010	03/10/98	23:09:27	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z29010	8074	29.014	03/10/98	23:18:02	1800.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00098	-
o52z29020	8074	29.030	03/10/98	23:50:39	2580.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00099	-
o52z29030	8074	29.039	04/10/98	00:39:00	2820.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00100	-
o52z29040	8074	29.041	04/10/98	01:31:21	2304.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00102	-
o52z29050	8074	29.050	04/10/98	02:15:06	2580.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00046	GSLOL,TEXPTIME~1155s(tbd)
o52z29060	8074	29.060	04/10/98	03:03:27	2604.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00104	-
o52z29070	8074	29.070	04/10/98	03:52:12	2604.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00105	-
o52z29080	8074	29.080	04/10/98	04:40:57	1452.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00104	-
o52z30qjq	8074	30.010	04/10/98	05:53:20	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z30010	8074	30.012	04/10/98	06:00:57	1200.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00009	-
o52z30020	8074	30.020	04/10/98	06:25:00	1983.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04783	-
o52z30030	8074	30.030	04/10/98	07:37:18	960.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00008	-
o52z30040	8074	30.040	04/10/98	07:57:21	2280.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04834	-
o52z30050	8074	30.050	04/10/98	09:19:31	660.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00006	-
o52z30060	8074	30.060	04/10/98	09:34:37	2304.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04834	-
o52z30070	8074	30.070	04/10/98	10:54:37	720.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00026	-
o52z30080	8074	30.080	04/10/98	11:10:45	2400.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04823	-
o52z31shq	8074	31.010	04/10/98	12:43:20	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52z31010	8074	31.012	04/10/98	12:49:01	2760.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04772	-
o52z31020	8074	31.030	04/10/98	14:16:48	3060.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05492	-
o52z31030	8074	31.040	04/10/98	15:56:54	2700.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05181	-
o52z31040	8074	31.050	04/10/98	16:47:49	832.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00002	-
o52z31050	8074	31.060	04/10/98	17:38:12	2700.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04851	-
o52z31060	8074	31.070	04/10/98	18:29:53	900.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00018	-
o4yf32u2q	8075	32.010	04/10/98	19:14:49	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf32010	8075	32.014	04/10/98	19:23:34	2460.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00091	-
o4yf32020	8075	32.030	04/10/98	20:09:36	2604.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00093	-
o4yf32030	8075	32.040	04/10/98	20:58:22	2304.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00093	-
o4yf32040	8075	32.050	04/10/98	21:41:48	2604.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00031	GSLOL,TEXPTIME~838s(tbd)
o4yf32050	8075	32.060	04/10/98	22:30:14	2904.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00096	-
o4yf33a6q	8075	33.010	05/10/98	01:38:27	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf33a7q	8075	33.012	05/10/98	01:45:34	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o4yf33a8q	8075	33.012	05/10/98	01:49:20	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o4yf33010	8075	33.050	05/10/98	01:54:44	2000.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00094	-
o4yf33020	8075	33.060	05/10/98	02:30:29	2604.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00098	-
o4yf33030	8075	33.070	05/10/98	03:19:14	2284.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00101	-
o4yf34b6q	8075	34.010	05/10/98	04:14:48	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf34010	8075	34.012	05/10/98	04:22:22	1740.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00007	-
o4yf34020	8075	34.090	05/10/98	04:55:28	1980.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04846	-
o4yf34030	8075	34.100	05/10/98	06:06:41	1440.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00019	-
o4yf34040	8075	34.110	05/10/98	06:35:03	1983.9	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02891	-
o4yf34050	8075	34.120	05/10/98	07:49:28	960.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00044	-
o4yf34060	8075	34.130	05/10/98	08:09:47	2040.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02885	-
o4yf34070	8075	34.140	05/10/98	09:31:01	720.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00042	-
o4yf34080	8075	34.150	05/10/98	09:47:21	2304.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02892	-
o4yf35010	8075	35.020	05/10/98	11:28:24	2340.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02866	-
o4yf35020	8075	35.030	05/10/98	12:45:52	720.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00015	-
o4yf35030	8075	35.040	05/10/98	13:01:58	2400.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04835	-
o4yf35040	8075	35.049	05/10/98	14:26:50	900.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00010	-
o4yf35050	8075	35.050	05/10/98	14:43:18	120.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00006	-
o4yf35060	8075	35.060	05/10/98	14:49:26	2400.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05071	-
o4yf35070	8075	35.080	05/10/98	16:08:07	2760.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05397	-
o4yf35080	8075	35.100	05/10/98	17:46:30	2624.0	ACCUM	CCD	MIRVIS	50CCD	2	HDFS	0.05236	-
o4yf35evq	8075	35.120	05/10/98	18:34:42	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf35090	8075	35.121	05/10/98	18:42:16	1200.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00008	-
o4yf36f0q	8075	36.010	05/10/98	19:29:28	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf36010	8075	36.030	05/10/98	19:38:13	2004.0	ACCUM	NUV	E230M	0.2X0.2FPC	N/A	HDFS	0.00089	-
o4yf36020	8075	36.040	05/10/98	20:14:14	2604.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00092	-
o4yf36030	8075	36.050	05/10/98	21:02:59	2604.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00093	-
o4yf36040	8075	36.060	05/10/98	21:51:44	2604.0	ACCUM	NUV	E230M	0.2X0.2FPD	N/A	HDFS	0.00096	-
o4yf36050	8075	36.070	05/10/98	22:40:29	2604.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00097	-
o4yf37gjq	8075	37.010	05/10/98	23:42:28	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf37010	8075	37.012	05/10/98	23:51:13	1800.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00098	-
o4yf37020	8075	37.030	06/10/98	00:23:38	2304.0	ACCUM	NUV	E230M	0.2X0.2FPE	N/A	HDFS	0.00101	-
o4yf37030	8075	37.040	06/10/98	01:07:23	2580.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00103	-
o4yf37040	8075	37.050	06/10/98	01:55:44	2304.0	ACCUM	NUV	E230M	0.2X0.2FPA	N/A	HDFS	0.00105	-
o4yf37050	8075	37.060	06/10/98	02:39:29	2904.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00105	-
o4yf37060	8075	37.070	06/10/98	03:33:14	1440.0	ACCUM	NUV	E230M	0.2X0.2FPB	N/A	HDFS	0.00108	-
o4yf38i7q	8075	38.010	06/10/98	04:35:28	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf38010	8075	38.012	06/10/98	04:43:05	1560.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00008	-
o4yf38020	8075	38.090	06/10/98	05:13:08	1680.0	ACCUM	CCD	MIRVIS	50CCD	2	HDFS	0.04863	-
o4yf38030	8075	38.100	06/10/98	06:19:00	1380.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00022	-
o4yf38040	8075	38.110	06/10/98	06:46:03	1983.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04863	-
o4yf39010	8075	39.020	06/10/98	11:39:43	2340.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04798	-
o4yf39jqq	8075	39.029	06/10/98	12:21:46	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o4yf39020	8075	39.030	06/10/98	12:56:47	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00015	-
o4yf39030	8075	39.040	06/10/98	13:10:55	2340.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04955	-
o4yf39040	8075	39.050	06/10/98	14:38:09	600.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00044	-
o4yf39050	8075	39.051	06/10/98	14:49:37	300.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00142	-
o4yf39060	8075	39.060	06/10/98	14:58:43	2623.8	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05142	-
o4yf39070	8075	39.080	06/10/98	16:18:45	2700.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.0598	-
o4yf39kyq	8075	39.090	06/10/98	17:08:38	960.0	ACCUM	CCD	MIRVIS	50CCD	1	DARK	N/A	-
o52f40l0q	8076	40.010	06/10/98	18:01:06	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52f40l1q	8076	40.012	06/10/98	18:08:19	2280.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f40lbq	8076	40.030	06/10/98	18:49:07	2640.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f40ljq	8076	40.040	06/10/98	19:35:07	2580.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f40ltq	8076	40.050	06/10/98	20:21:07	2880.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f40m3q	8076	40.060	06/10/98	21:12:07	2580.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f41mdq	8076	41.010	06/10/98	22:07:03	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52f41meq	8076	41.012	06/10/98	22:14:10	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o52f41mfq	8076	41.012	06/10/98	22:17:56	10.0	ACQ/PEAK	CCD	MIRVIS	0.2X0.2	1	HDFS	N/A	-
o52f41010	8076	41.014	06/10/98	22:23:06	1680.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f41020	8076	41.030	06/10/98	22:53:29	2640.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f41030	8076	41.040	06/10/98	23:41:43	2340.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f41040	8076	41.050	07/10/98	00:24:57	2280.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f41050	8076	41.060	07/10/98	01:08:11	3000.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f41060	8076	41.070	07/10/98	02:02:25	2340.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f41070	8076	41.080	07/10/98	02:45:39	2940.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f41080	8076	41.090	07/10/98	03:38:53	1260.0	ACCUM	FUV	G140L	52X0.2	N/A	HDFS	-	-
o52f42olq	8076	42.010	07/10/98	04:39:40	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52f42010	8076	42.012	07/10/98	04:47:14	1800.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00007	-
o52f42020	8076	42.110	07/10/98	05:21:35	1664.0	ACCUM	CCD	MIRVIS	F28X50LP	2	HDFS	0.02994	-
o52f42030	8076	42.120	07/10/98	06:31:14	1380.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00012	-
o52f42040	8076	42.130	07/10/98	06:58:33	1800.0	ACCUM	CCD	MIRVIS	F28X50LP	2	HDFS	0.03003	-
o52f42050	8076	42.140	07/10/98	08:13:09	1200.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00005	-
o52f42060	8076	42.150	07/10/98	08:37:28	2040.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02911	-
o52f42070	8076	42.160	07/10/98	09:53:32	832.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00012	-
o52f42080	8076	42.170	07/10/98	10:11:46	2340.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.02938	-
o52f42090	8076	42.180	07/10/98	11:27:58	112.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00056	-
o52f420a0	8076	42.190	07/10/98	11:43:01	2340.0	ACCUM	CCD	MIRVIS	F28X50LP	3	HDFS	0.03428	-
o52f43qvq	8076	43.010	07/10/98	13:20:30	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52f43010	8076	43.020	07/10/98	13:26:13	2400.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04855	-
o52f43020	8076	43.050	07/10/98	14:56:53	2760.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05492	-
o52f43030	8076	43.080	07/10/98	16:34:34	2700.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.05330	-
o52f43040	8076	43.090	07/10/98	17:25:34	832.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	-0.00006	-
o52f44uwq	8076	44.070	07/10/98	21:52:47	2700.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f44v4q	8076	44.090	07/10/98	22:38:04	480.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	DARK	N/A	-
o52f44v9q	8076	44.100	07/10/98	23:04:16	2760.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f44vjq	8076	44.110	07/10/98	23:51:16	1452.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f44vpq	8076	44.120	08/10/98	00:17:05	512.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	DARK	N/A	-
o52f44vuq	8076	44.130	08/10/98	00:41:30	2040.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f45010	8076	45.080	08/10/98	05:34:13	1680.0	ACCUM	CCD	MIRVIS	50CCD	2	HDFS	0.04910	-
o52f45z2q	8076	45.090	08/10/98	06:39:57	1440.0	ACCUM	CCD	MIRVIS	50CCD	1	DARK	N/A	-
o52f45020	8076	45.100	08/10/98	07:09:56	1899.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04924	-
o52f46010	8076	46.020	08/10/98	08:48:03	1983.9	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04818	-
o52f46020	8076	46.040	08/10/98	10:23:45	2304.0	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04882	-
o52f46030	8076	46.060	08/10/98	12:00:48	2623.8	ACCUM	CCD	MIRVIS	50CCD	3	HDFS	0.04878	-
o52f46agq	8076	46.070	08/10/98	12:47:36	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52f46040	8076	46.072	08/10/98	13:40:27	2004.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00005	-
o52f46050	8076	46.082	08/10/98	15:14:46	2200.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00013	-
o52f47b4q	8076	47.032	08/10/98	16:55:22	2304.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47bcq	8076	47.040	08/10/98	17:34:14	1200.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47biq	8076	47.052	08/10/98	18:29:03	2304.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47brq	8076	47.060	08/10/98	19:08:24	1200.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47bxq	8076	47.072	08/10/98	20:06:00	2300.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47c6q	8076	47.080	08/10/98	20:50:00	1200.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47ccq	8076	47.092	08/10/98	21:42:57	2300.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47ckq	8076	47.100	08/10/98	22:26:57	1200.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47cqq	8076	47.112	08/10/98	23:19:53	2300.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47cyq	8076	47.120	09/10/98	00:03:53	1200.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47d4q	8076	47.132	09/10/98	00:56:48	2300.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f47dcq	8076	47.140	09/10/98	01:40:48	1200.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f48diq	8076	48.010	09/10/98	02:34:46	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52f48010	8076	48.012	09/10/98	02:42:20	900.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00041	-
o52f48020	8076	48.022	09/10/98	04:10:31	1100.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00034	-
o52f48030	8076	48.032	09/10/98	05:47:24	1100.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00011	-
o52f48040	8076	48.042	09/10/98	07:27:08	1100.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00019	-
o52f49efq	8076	49.010	09/10/98	09:02:20	20.1	ACQ	CCD	MIRVIS	F28X50LP	1	HDFS	N/A	-
o52f49010	8076	49.012	09/10/98	09:09:54	1400.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00007	-
o52f49020	8076	49.022	09/10/98	10:38:01	2100.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00005	-
o52f49030	8076	49.032	09/10/98	12:14:54	2100.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00009	-
o52f49040	8076	49.042	09/10/98	13:51:46	2100.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00013	-
o52f49050	8076	49.052	09/10/98	15:28:37	2100.0	ACCUM	CCD	G430M	52X0.2	2	HDFS	0.00007	-
o52f50fhq	8076	50.032	09/10/98	17:08:52	2300.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f50fpq	8076	50.052	09/10/98	18:42:26	2304.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f50fyq	8076	50.072	09/10/98	20:19:18	2300.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o52f50g8q	8076	50.092	09/10/98	21:56:08	2300.0	ACCUM	FUV	MIRFUV	F25QTZ	N/A	HDFS	-	-
o4y403010	8071	03.002	09/10/98	23:39:21	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.04885	-
o4y403020	8071	03.007	10/10/98	00:05:01	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.07934	-
o4y403030	8071	03.012	10/10/98	01:10:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.04889	-
o4y403040	8071	03.017	10/10/98	01:37:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.05935	-
o4y408010	8071	08.002	10/10/98	12:51:38	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.04955	-
o4y408020	8071	08.007	10/10/98	14:05:11	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.04785	-

o4y408030	8071	08.012	10/10/98	14:33:11	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.06275	-
o4y408040	8071	08.017	10/10/98	15:41:58	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.04790	-
o4y405010	8071	05.002	10/10/98	19:25:47	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.07114	-
o4y405020	8071	05.007	10/10/98	20:32:21	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.04845	-
o4y405030	8071	05.012	10/10/98	21:00:21	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.06345	-
o4y405040	8071	05.017	10/10/98	22:09:09	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.04809	-
o4y409010	8071	09.002	11/10/98	13:03:52	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.05131	-
o4y409020	8071	09.007	11/10/98	14:17:02	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.04886	-
o4y409030	8071	09.012	11/10/98	14:45:02	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.06957	-
o4y409040	8071	09.017	11/10/98	15:53:47	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.04901	-
o4y406010	8071	06.002	11/10/98	17:32:57	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.04853	-
o4y406020	8071	06.007	11/10/98	17:58:37	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.07059	-
o4y406030	8071	06.012	11/10/98	19:07:03	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.04864	-
o4y406040	8071	06.017	11/10/98	19:34:03	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.06171	-
o4y407010	8071	07.002	11/10/98	20:46:26	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.04867	-
o4y407020	8071	07.007	11/10/98	21:12:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.06441	-
o4y407030	8071	07.012	11/10/98	22:20:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.04878	-
o4y407040	8071	07.017	11/10/98	22:47:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.05985	-
o4y410010	8071	10.002	12/10/98	14:29:31	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.04952	-
o4y410020	8071	10.007	12/10/98	14:55:11	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.06231	-
o4y410030	8071	10.012	12/10/98	16:04:55	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.04923	-
o4y410040	8071	10.017	12/10/98	16:31:55	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.06199	-
o4y412010	8071	12.001	14/10/98	13:14:21	2800.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05406	-
o4y412020	8071	12.009	14/10/98	14:49:40	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05494	-
o4y412030	8071	12.017	14/10/98	16:26:25	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05459	-
o4y412040	8071	12.025	14/10/98	18:03:08	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05440	-
o4y412050	8071	12.033	14/10/98	19:39:52	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05394	-
o4y413010	8071	13.001	19/10/98	06:06:53	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413020	8071	13.001	19/10/98	06:08:06	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413030	8071	13.001	19/10/98	06:09:19	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413040	8071	13.001	19/10/98	06:10:32	0.2	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413050	8071	13.002	19/10/98	06:11:45	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413060	8071	13.002	19/10/98	06:12:58	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413070	8071	13.002	19/10/98	06:14:11	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413080	8071	13.002	19/10/98	06:15:24	0.4	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y413090	8071	13.003	19/10/98	06:16:37	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130a0	8071	13.003	19/10/98	06:17:50	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130b0	8071	13.003	19/10/98	06:19:03	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130c0	8071	13.003	19/10/98	06:20:16	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130d0	8071	13.004	19/10/98	06:21:29	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130e0	8071	13.004	19/10/98	06:22:42	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130f0	8071	13.004	19/10/98	06:23:55	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130g0	8071	13.004	19/10/98	06:25:08	1.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130h0	8071	13.005	19/10/98	06:26:21	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130i0	8071	13.005	19/10/98	06:28:34	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130j0	8071	13.005	19/10/98	06:30:47	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130k0	8071	13.005	19/10/98	07:40:30	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130l0	8071	13.006	19/10/98	07:43:57	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130m0	8071	13.006	19/10/98	07:46:08	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130n0	8071	13.006	19/10/98	07:48:19	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130o0	8071	13.006	19/10/98	07:50:30	20.0	ACCUM	CCD	MIRVIS	50CCD	4	SAO255271	-	-
o4y4130p0	8071	13.007	19/10/98	07:52:41	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255271	-	-
o4y4130q0	8071	13.007	19/10/98	07:54:27	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255271	-	-
o4y4130r0	8071	13.007	19/10/98	07:56:13	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255271	-	-
o4y4130s0	8071	13.007	19/10/98	07:57:59	15.0	ACCUM	CCD	MIRVIS	50CCD	3	SAO255271	-	-
o4y4130t0	8071	13.008	19/10/98	07:59:45	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130u0	8071	13.008	19/10/98	08:01:07	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130v0	8071	13.008	19/10/98	08:02:29	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y4130w0	8071	13.008	19/10/98	08:03:51	10.0	ACCUM	CCD	MIRVIS	50CCD	2	SAO255271	-	-
o4y411010	8071	11.001	29/10/98	11:07:26	2800.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05343	-
o4y411020	8071	11.009	29/10/98	12:41:07	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05372	-
o4y411030	8071	11.017	29/10/98	14:17:49	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05595	-
o4y411040	8071	11.025	29/10/98	15:54:33	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	NIC	0.05556	-

This page was last updated on November 23, 1998.

WFPC2 Observing Logs

Two logs are available:

- Master Log.
- Pointing Log.

Master Log

Notes:

- This table was last updated: Tue Nov 21, 1998.
- The **proposal ID** is the proposal containing the observation. See the Phase 2 information for details.
- **Nominal RA, DEC** refer to the commanded position of the V1 axis of the satellite, as given in the Science Header file (.shh).
- **Nominal roll** refers to the commanded orientation of the V3 axis of the satellite, as given in the Science Header file.
- **Included?** lists the chips (1,2,3 and/or 4) that were included in the Version 1 images; "yes" means all chips were included, "no" means none was.
- Each **Data quality** note is preceded by the chip(s) it refers to, in square brackets. No number means that the comment refers to all chips. Bias jumps and scattered Earth light were removed by subtraction of a median-filtered background before the images were used in the Version 1 combination.

```
 Fullname Shortname Proposal    Start (UT)       Filter   Exp time  Nominal RA
Nominal DEC  Nominal roll Included? Data Quality notes
U5350501R    0501      8058   09/28/98 01:39:14    F300W    900.000  22 32 55.670  -60
33 09.369    229.652    yes      nothing
U5350504R    0504      8058   09/28/98 03:10:14    F300W    900.000  22 32 55.643  -60
33 11.877    229.653    yes      nothing
U5350507R    0507      8058   09/28/98 04:46:14    F300W    900.000  22 32 55.615  -60
33 14.385    229.653    yes      [3] Double bias jump
U535050AR    050A      8058   09/28/98 06:23:14    F300W   1000.000  22 32 55.615  -60
33 14.385    229.653    yes      nothing
U5350601R    0601      8058   09/28/98 08:06:14    F300W    400.000  22 32 55.790  -60
32 58.574    231.652    yes      nothing
U5350603R    0603      8058   09/28/98 09:48:14    F300W    300.000  22 32 55.790  -60
32 58.574    231.652    yes      nothing
U5350806R    0806      8058   09/28/98 22:41:14    F300W    700.000  22 32 55.685  -60
33 07.748    229.952    yes      nothing
U5350809R    0809      8058   09/29/98 00:06:14    F300W   1000.000  22 32 55.656  -60
33 10.255    229.952    yes      nothing
U535080GR    080G      8058   09/29/98 01:42:14    F300W   1100.000  22 32 55.344  -60
33 07.527    229.954    yes      nothing
U5350903R    0903      8058   09/29/98 03:20:14    F300W   1000.000  22 32 55.383  -60
33 03.716    230.654    yes      nothing
U5350908R    0908      8058   09/29/98 04:56:14    F300W   1100.000  22 32 55.722  -60
33 03.966    230.652    yes      nothing
U535090DR    090D      8058   09/29/98 06:32:14    F300W   1000.000  22 32 56.062  -60
33 04.216    230.651    yes      nothing
U5351001R    1001      8058   09/29/98 08:17:14    F300W    300.000  22 32 55.656  -60
33 10.255    229.952    yes      nothing
U5351003R    1003      8058   09/29/98 10:00:14    F300W    300.000  22 32 55.626  -60
33 12.761    229.953    yes      nothing
U5351102R    1102      8058   09/29/98 16:43:14    F300W   2000.000  22 32 55.525  -60
32 53.284    230.653    yes      nothing
U5351103R    1103      8058   09/29/98 18:23:14    F300W   1700.000  22 32 55.864  -60
32 53.535    230.652    yes      [3] Bias jump
U5351104R    1104      8058   09/29/98 19:25:14    F300W    300.000  22 32 55.724  -60
33 03.968    230.652    yes      nothing
U5351105R    1105      8058   09/29/98 20:02:14    F300W   1800.000  22 32 55.864  -60
32 53.535    230.652    yes      nothing
U5351106R    1106      8058   09/29/98 21:02:14    F300W    350.000  22 32 55.724  -60
33 03.968    230.652    yes      [1] Double bias jump
U5351201R    1201      8058   09/29/98 22:52:14    F300W    500.000  22 32 56.107  -60
33 00.470    231.351    yes      nothing
U5351203R    1203      8058   09/30/98 00:15:14    F300W   1300.000  22 32 55.391  -60
33 02.409    231.353    yes      nothing
U5351205R    1205      8058   09/30/98 01:51:14    F300W   1400.000  22 32 55.721  -60
33 02.683    231.352    yes      nothing
U5351301R    1301      8058   09/30/98 03:42:14    F300W    900.000  22 32 55.740  -60
33 01.064    231.652    yes      [1] Charge trail, masked
U5351303R    1303      8058   09/30/98 05:05:14    F300W   1400.000  22 32 55.797  -60
33 01.113    231.652    yes      nothing
U5351305R    1305      8058   09/30/98 06:42:14    F300W   2000.000  22 32 55.747  -60
33 01.069    231.652    yes      nothing
U5351401R    1401      8058   09/30/98 08:29:14    F300W    300.000  22 32 55.769  -60
33 00.191    231.352    yes      nothing
U5351403R    1403      8058   09/30/98 10:12:14    F300W    300.000  22 32 55.769  -60
33 00.191    231.352    yes      nothing
U5351504R    1504      8058   09/30/98 19:33:14    F300W    400.000  22 32 55.751  -60
33 01.073    231.652    yes      [4] Charge trail, masked
U5351506R    1506      8058   09/30/98 21:09:14    F300W   1000.000  22 32 55.751  -60
33 01.073    231.652    yes      [1] Two trails, masked
U53Q1701R    1701      8073   10/01/98 01:59:14    F300W   1200.000  22 32 55.667  -60
33 10.262    229.952    yes      [1] Charge trail, masked
U53Q1703R    1703      8073   10/01/98 03:35:14    F300W   1700.000  22 32 55.645  -60
33 10.247    229.952    yes      nothing
U53Q1705R    1705      8073   10/01/98 05:12:14    F300W   1700.000  22 32 55.702  -60
33 10.284    229.952    yes      nothing
U53Q1801R    1801      8073   10/01/98 06:58:14    F300W    700.000  22 32 55.643  -60
33 11.877    229.653    yes      nothing
U53Q1803R    1803      8073   10/01/98 08:42:14    F300W    300.000  22 32 55.643  -60
33 11.877    229.653    yes      nothing
U53Q1805R    1805      8073   10/01/98 10:24:14    F300W    300.000  22 32 55.670  -60
33 09.369    229.652    yes      nothing
U53Q1901R    1901      8073   10/01/98 13:45:14    F300W   2400.000  22 32 56.148  -60
32 57.522    229.951    yes      nothing
U53Q1904R    1904      8073   10/01/98 18:01:14    F300W    500.000  22 32 55.656  -60
33 10.255    229.952    yes      nothing
U53Q1905R    1905      8073   10/01/98 18:45:14    F300W   1900.000  22 32 55.500  -60
33 23.204    229.953    yes      nothing
U53Q1906R    1906      8073   10/01/98 19:37:14    F300W    900.000  22 32 55.656  -60
33 10.255    229.952    yes      nothing
U53Q2001R    2001      8073   10/01/98 21:23:14    F300W   1400.000  22 32 55.737  -60
33 06.505    230.652    yes      nothing
U53Q2003R    2003      8073   10/01/98 22:51:14    F300W   2400.000  22 32 55.686  -60
33 06.468    230.652    yes      nothing
U53Q2005R    2005      8073   10/02/98 00:19:14    F300W   2000.000  22 32 55.686  -60
33 06.468    230.652    yes      nothing
U53Q2101R    2101      8073   10/02/98 02:12:14    F300W   1500.000  22 32 55.696  -60
33 02.662    231.352    yes      nothing
U53Q2103R    2103      8073   10/02/98 03:31:14    F300W   2400.000  22 32 55.743  -60
33 02.701    231.352    yes      nothing
U53Q2105M    2105      8073   10/02/98 05:05:14    F300W   2700.000  22 32 55.743  -60
33 02.701    231.352    no       RECENTERED
U53Q2201R    2201      8073   10/02/98 07:16:14    F300W    600.000  22 32 55.691  -60
33 06.471    230.652    yes      [3] Possible trail
U53Q2203R    2203      8073   10/02/98 08:54:14    F300W    400.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U53Q2205R    2205      8073   10/02/98 10:36:14    F300W    300.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U53Q2303R    2303      8073   10/02/98 16:20:14    F300W   1000.000  22 32 55.694  -60
33 05.192    231.352    yes      nothing
U53Q2305R    2305      8073   10/02/98 18:02:14    F300W   1000.000  22 32 55.694  -60
33 05.192    231.352    yes      [3] Large streak
U52Z2402R    2402      8074   10/02/98 21:17:14    F300W   2300.000  22 32 55.740  -60
33 01.064    231.652    yes      nothing
U52Z2404R    2404      8074   10/02/98 22:53:14    F300W   2000.000  22 32 55.797  -60
33 01.113    231.652    yes      [2] Charge trail, masked
U52Z2501R    2501      8074   10/03/98 00:46:14    F300W   1800.000  22 32 55.638  -60
33 11.874    229.653    yes      nothing
U52Z2503R    2503      8074   10/03/98 02:10:14    F300W   2100.000  22 32 55.638  -60
33 11.874    229.653    yes      [1] Charge trail, masked
U52Z2601R    2601      8074   10/03/98 05:46:14    F300W   1100.000  22 32 55.712  -60
33 03.572    231.652    yes      nothing
U52Z2603R    2603      8074   10/03/98 07:23:14    F300W    800.000  22 32 55.751  -60
33 01.073    231.652    yes      nothing
U52Z2605R    2605      8074   10/03/98 09:06:14    F300W    300.000  22 32 55.712  -60
33 03.572    231.652    yes      nothing
U52Z2606R    2606      8074   10/03/98 09:21:14    F300W   2100.000  22 32 55.544  -60
33 13.983    231.653    yes      nothing
U52Z2607R    2607      8074   10/03/98 10:56:14    F300W   2100.000  22 32 55.882  -60
33 14.276    231.652    yes      nothing
U52Z2704R    2704      8074   10/03/98 16:35:14    F300W    800.000  22 32 55.330  -60
33 09.166    229.654    no       [2,3] Faint moving object; no pointing information
U52Z2802R    2802      8074   10/03/98 19:49:14    F300W   2147.000  22 32 55.667  -60
33 10.262    229.952    no       INTERRUPTED
U52Z2804R    2804      8074   10/03/98 21:26:14    F300W   2300.000  22 32 55.645  -60
33 10.247    229.952    yes      nothing
U52Z2901R    2901      8074   10/03/98 23:16:14    F300W   1500.000  22 32 55.679  -60
33 06.463    230.652    yes      nothing
U52Z2903R    2903      8074   10/04/98 00:40:14    F300W   2600.000  22 32 55.737  -60
33 06.505    230.652    yes      [1] Charge trail, masked
U52Z2905R    2905      8074   10/04/98 02:16:14    F300W   2144.000  22 32 55.686  -60
33 06.468    230.652    no       INTERRUPTED
U52Z2907R    2907      8074   10/04/98 03:53:14    F300W   2300.000  22 32 55.686  -60
33 06.468    230.652    yes      nothing
U52Z3001R    3001      8074   10/04/98 06:00:14    F300W    900.000  22 32 55.685  -60
33 07.748    229.952    yes      [3] Charge trail, masked, [4] Bias jump
U52Z3003R    3003      8074   10/04/98 07:35:14    F300W    700.000  22 32 55.685  -60
33 07.748    229.952    yes      nothing
U52Z3005R    3005      8074   10/04/98 09:18:14    F300W    400.000  22 32 55.685  -60
33 07.748    229.952    yes      nothing
U52Z3104R    3104      8074   10/04/98 16:46:14    F300W    600.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U52Z3106R    3106      8074   10/04/98 18:28:14    F300W    600.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U4YF3202R    3202      8075   10/04/98 20:10:14    F300W   2300.000  22 32 55.696  -60
33 02.662    231.352    yes      nothing
U4YF3204R    3204      8075   10/04/98 21:42:14    F300W   2135.000  22 32 55.743  -60
33 02.701    231.352    yes      INTERRUPTED; [3] Charge trail, masked
U4YF3302R    3302      8075   10/05/98 02:32:14    F300W   2300.000  22 32 55.797  -60
33 01.113    231.652    yes      [4] Charge trail, masked
U4YF3401R    3401      8075   10/05/98 04:21:14    F300W   1500.000  22 32 55.732  -60
33 02.692    231.352    yes      nothing
U4YF3403R    3403      8075   10/05/98 06:05:14    F300W   1200.000  22 32 55.694  -60
33 05.192    231.352    yes      nothing
U4YF3405R    3405      8075   10/05/98 07:48:14    F300W    700.000  22 32 55.769  -60
33 00.191    231.352    yes      nothing
U4YF3407R    3407      8075   10/05/98 09:29:14    F300W    500.000  22 32 55.732  -60
33 02.692    231.352    yes      nothing
U4YF3506R    3506      8075   10/05/98 18:41:14    F300W   1000.000  22 32 55.751  -60
33 01.073    231.652    yes      nothing
U4YF3602R    3602      8075   10/05/98 20:15:14    F300W   2300.000  22 32 55.607  -60
33 11.855    229.653    yes      nothing
U4YF3604R    3604      8075   10/05/98 21:52:14    F300W   2300.000  22 32 55.607  -60
33 11.855    229.653    yes      [3] Bias jump
U4YF3701R    3701      8075   10/05/98 23:49:14    F300W   1500.000  22 32 55.667  -60
33 10.262    229.952    yes      nothing
U4YF3703R    3703      8075   10/06/98 01:08:14    F300W   2300.000  22 32 55.645  -60
33 10.247    229.952    yes      Scattered Earth light (cross-shaped)
U4YF3705R    3705      8075   10/06/98 02:40:14    F300W   2600.000  22 32 55.702  -60
33 10.284    229.952    yes      [1] Three trails, masked
U4YF3801R    3801      8075   10/06/98 04:42:14    F300W   1300.000  22 32 55.615  -60
33 14.385    229.653    yes      [3] Charge trail, masked
U4YF3803R    3803      8075   10/06/98 06:17:14    F300W   1200.000  22 32 55.615  -60
33 14.385    229.653    yes      [3] Charge trail, masked
U52F4002R    4002      8076   10/06/98 18:50:14    F300W   2400.000  22 32 55.350  -60
33 06.220    230.654    yes      Moving object, Scattered Earth light (cross-shaped)
U52F4004R    4004      8076   10/06/98 20:22:14    F300W   2700.000  22 32 55.723  -60
33 03.967    230.652    yes      Scattered Earth light (cross-shaped)
U52F4101R    4101      8076   10/06/98 22:21:14    F300W   1500.000  22 32 55.694  -60
33 05.192    231.352    yes      Scattered Earth light (cross-shaped)
U52F4103R    4103      8076   10/06/98 23:43:14    F300W   2100.000  22 32 55.769  -60
33 00.191    231.352    yes      Scattered Earth light (cross-shaped)
U52F4105R    4105      8076   10/07/98 01:09:14    F300W   2800.000  22 32 55.732  -60
33 02.692    231.352    yes      Scattered Earth light (cross-shaped)
U52F4107R    4107      8076   10/07/98 02:47:14    F300W   2700.000  22 32 55.694  -60
33 05.192    231.352    yes      Scattered Earth light (cross-shaped)
U52F4201R    4201      8076   10/07/98 04:46:14    F300W   1500.000  22 32 55.691  -60
33 06.471    230.652    yes      Scattered Earth light (cross-shaped)
U52F4203R    4203      8076   10/07/98 06:29:14    F300W   1200.000  22 32 55.657  -60
33 08.975    230.653    yes      Scattered Earth light (cross-shaped)
U52F4205R    4205      8076   10/07/98 08:11:14    F300W    900.000  22 32 55.657  -60
33 08.975    230.653    yes      Scattered Earth light (cross-shaped)
U52F4206R    4206      8076   10/07/98 08:37:14    F300W   1800.000  22 32 55.174  -60
33 19.155    230.654    yes      nothing
U52F4207R    4207      8076   10/07/98 09:52:14    F300W    600.000  22 32 55.724  -60
33 03.968    230.652    yes      Scattered Earth light (cross-shaped)
U52F4304R    4304      8076   10/07/98 17:24:14    F300W    600.000  22 32 55.694  -60
33 05.192    231.352    yes      nothing
U52F4401R    4401      8076   10/07/98 21:52:14    F300W   2400.000  22 32 55.750  -60
33 01.072    231.652    yes      nothing
U52F4404R    4404      8076   10/07/98 23:53:14    F300W   1200.000  22 32 56.089  -60
33 01.366    231.651    yes      nothing
U52F4702R    4702      8076   10/08/98 17:36:14    F300W    900.000  22 32 55.664  -60
33 09.173    230.153    yes      nothing
U52F4704R    4704      8076   10/08/98 19:10:14    F300W    900.000  22 32 55.664  -60
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33 09.173    230.153    yes      nothing
U52F4706R    4706     8076   10/08/98 20:51:14    F300W    900.000  22 32 55.664  -60
33 09.173    230.153    yes      nothing
U52F4708R    4708     8076   10/08/98 22:28:14    F300W    900.000  22 32 55.664  -60
33 09.173    230.153    yes      nothing
U52F470AR    470A     8076   10/09/98 00:05:14    F300W    900.000  22 32 55.664  -60
33 09.173    230.153    yes      [3] Charge trail, masked
U52F470CR    470C     8076   10/09/98 01:42:14    F300W    900.000  22 32 55.664  -60
33 09.173    230.153    yes      nothing

U5350502R    0502     8058   09/28/98 02:04:14    F450W   1500.000  22 32 55.643  -60
33 11.877    229.653    yes      [1] Charge trail, masked
U5350505R    0505     8058   09/28/98 03:33:14    F450W   1500.000  22 32 55.643  -60
33 11.877    229.653    yes      [1] Charge trail, masked
U5350508R    0508     8058   09/28/98 05:09:14    F450W   1500.000  22 32 55.615  -60
33 14.385    229.653    yes      nothing
U5350709R    0709     8058   09/28/98 21:30:14    F450W   1500.000  22 32 55.632  -60
33 11.870    229.653    yes      nothing
U5350807R    0807     8058   09/28/98 23:03:14    F450W   1700.000  22 32 55.685  -60
33 07.748    229.952    yes      nothing
U535080AR    080A     8058   09/29/98 00:28:14    F450W   2300.000  22 32 55.656  -60
33 10.255    229.952    yes      [3] Bias jump
U535080HR    080H     8058   09/29/98 02:08:14    F450W   2300.000  22 32 55.344  -60
33 07.527    229.954    yes      nothing
U5350904R    0904     8058   09/29/98 03:45:14    F450W   2000.000  22 32 55.722  -60
33 03.966    230.652    yes      nothing
U5351202R    1202     8058   09/29/98 23:08:14    F450W   2300.000  22 32 55.391  -60
33 02.409    231.353    yes      [1] Bias jump
U5351204R    1204     8058   09/30/98 00:43:14    F450W   2400.000  22 32 55.391  -60
33 02.409    231.353    yes      nothing
U5351501R    1501     8058   09/30/98 15:14:14    F450W   2100.000  22 32 56.040  -60
33 03.855    231.651    yes      nothing
U5351502R    1502     8058   09/30/98 16:54:14    F450W   2000.000  22 32 55.442  -60
32 58.273    231.653    yes      nothing
U5351503R    1503     8058   09/30/98 18:34:14    F450W   2000.000  22 32 55.442  -60
32 58.273    231.653    yes      nothing
U5351505R    1505     8058   09/30/98 20:12:14    F450W   1700.000  22 32 55.780  -60
32 58.565    231.652    yes      nothing
U53Q1806R    1806     8073   10/01/98 10:39:14    F450W   2000.000  22 32 56.000  -60
33 09.568    229.651    yes      nothing
U53Q1807R    1807     8073   10/01/98 12:05:14    F450W   2700.000  22 32 55.292  -60
33 11.665    229.654    yes      nothing
U53Q1902R    1902     8073   10/01/98 15:25:14    F450W   2400.000  22 32 55.160  -60
33 22.984    229.954    yes      nothing
U53Q1903R    1903     8073   10/01/98 17:05:14    F450W   2400.000  22 32 55.160  -60
33 22.984    229.954    yes      nothing
U53Q2106R    2106     8073   10/02/98 05:58:14    F450W   1100.000  22 32 55.721  -60
33 02.683    231.352    yes      nothing
U53Q2202R    2202     8073   10/02/98 07:35:14    F450W   2000.000  22 32 55.680  -60
33 06.464    230.652    yes      nothing
U53Q2204R    2204     8073   10/02/98 09:10:14    F450W   2200.000  22 32 55.680  -60
33 06.464    230.652    yes      nothing
U53Q2206R    2206     8073   10/02/98 10:51:14    F450W   2100.000  22 32 56.020  -60
33 06.712    230.651    yes      nothing
U52Z2502R    2502     8074   10/03/98 01:25:14    F450W   2200.000  22 32 55.638  -60
33 11.874    229.653    yes      nothing
U52Z2504R    2504     8074   10/03/98 02:54:14    F450W   2400.000  22 32 55.607  -60
33 11.855    229.653    yes      nothing
U52Z2506R    2506     8074   10/03/98 04:33:14    F450W   1900.000  22 32 55.607  -60
33 11.855    229.653    yes      nothing
U52Z2602R    2602     8074   10/03/98 06:13:14    F450W   1700.000  22 32 56.040  -60
33 03.855    231.651    yes      nothing
U52Z2702R    2702     8074   10/03/98 14:07:14    F450W   2500.000  22 32 55.446  -60
32 58.713    229.653    yes      nothing
U52Z2803R    2803     8074   10/03/98 20:37:14    F450W   2300.000  22 32 55.667  -60
33 10.262    229.952    yes      nothing
U52Z2805R    2805     8074   10/03/98 22:14:14    F450W   2000.000  22 32 55.645  -60
33 10.247    229.952    yes      [1] Charge trail, masked
U52Z2902R    2902     8074   10/03/98 23:52:14    F450W   2300.000  22 32 55.737  -60
33 06.505    230.652    yes      [1] Charge trail, masked
U52Z2904R    2904     8074   10/04/98 01:32:14    F450W   2000.000  22 32 55.737  -60
33 06.505    230.652    yes      nothing
U52Z3103R    3103     8074   10/04/98 15:58:14    F450W   2400.000  22 32 55.680  -60
33 06.464    230.652    yes      nothing
U52Z3105R    3105     8074   10/04/98 17:38:14    F450W   2400.000  22 32 55.680  -60
33 06.464    230.652    yes      nothing
U4YF3201R    3201     8075   10/04/98 19:21:14    F450W   2100.000  22 32 55.696  -60
33 02.662    231.352    yes      nothing
U4YF3203R    3203     8075   10/04/98 20:59:14    F450W   2000.000  22 32 55.743  -60
33 02.701    231.352    yes      nothing
U4YF3404R    3404     8075   10/05/98 06:34:14    F450W   1700.000  22 32 55.588  -60
32 49.491    231.353    no       [1] Bias jump; rotation, pointing uncertain
U4YF3501R    3501     8075   10/05/98 11:30:14    F450W   2100.000  22 32 56.294  -60
32 48.454    231.650    yes      nothing
U4YF3502R    3502     8075   10/05/98 13:01:14    F450W   2100.000  22 32 56.080  -60
33 01.356    231.651    yes      nothing
U4YF3503R    3503     8075   10/05/98 14:49:14    F450W   2100.000  22 32 55.362  -60
33 03.271    231.654    yes      nothing
U4YF3504R    3504     8075   10/05/98 16:10:14    F450W   2500.000  22 32 55.362  -60
33 03.271    231.654    yes      nothing
U4YF3804R    3804     8075   10/06/98 06:45:14    F450W   1700.000  22 32 55.605  -60
33 14.378    229.653    1,4      [2,3] Moving object
U4YF3901R    3901     8075   10/06/98 11:41:14    F450W   2100.000  22 32 55.335  -60
33 07.523    229.954    yes      nothing
U52F4003R    4003     8076   10/06/98 19:36:14    F450W   2400.000  22 32 55.350  -60
33 06.220    230.654    yes      Scattered Earth light (cross-shaped)
U52F4005R    4005     8076   10/06/98 21:13:14    F450W   2400.000  22 32 55.723  -60
33 03.967    230.652    yes      Scattered Earth light (cross-shaped)
U52F4202R    4202     8076   10/07/98 05:21:14    F450W   1400.000  22 32 56.204  -60
32 53.785    230.650    yes      nothing
U52F4209R    4209     8076   10/07/98 11:42:14    F450W   2100.000  22 32 55.514  -60
33 19.406    230.653    yes      Scattered Earth light (cross-shaped)
U52F4403R    4403     8076   10/07/98 23:06:14    F450W   2500.000  22 32 55.750  -60
33 01.072    231.652    yes      nothing
U52F4406R    4406     8076   10/08/98 00:43:14    F450W   1800.000  22 32 56.089  -60
33 01.366    231.651    yes      nothing
U52F4501R    4501     8076   10/08/98 05:35:14    F450W   1400.000  22 32 55.741  -60
33 01.064    231.652    yes      [1] Moving object
U52F4801R    4801     8076   10/09/98 02:41:14    F450W    600.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U52F4804R    4804     8076   10/09/98 07:26:14    F450W    900.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U52F4903R    4903     8076   10/09/98 12:16:14    F450W   1800.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing

U535050BR    050B     8058   09/28/98 06:45:14    F606W   1500.000  22 32 55.670  -60
33 09.369    229.652    1,2,4    [1] Charge trail, masked; [3] moving object
U5350602R    0602     8058   09/28/98 08:21:14    F606W   2000.000  22 32 55.442  -60
32 58.273    231.653    yes      nothing
U5350604R    0604     8058   09/28/98 10:02:14    F606W   1800.000  22 32 55.442  -60
32 58.273    231.653    yes      nothing
U5350605R    0605     8058   09/28/98 11:30:14    F606W   2400.000  22 32 55.780  -60
32 58.565    231.652    yes      nothing
U5350909R    0909     8058   09/29/98 05:20:14    F606W   2300.000  22 32 55.722  -60
33 03.966    230.652    yes      [1] Bias jump
U535090ER    090E     8058   09/29/98 06:55:14    F606W   2000.000  22 32 56.062  -60
33 04.216    230.651    2,3,4    [1] Charge trail, not masked
U5351002R    1002     8058   09/29/98 08:30:14    F606W   2400.000  22 32 55.645  -60
33 10.248    229.952    2,3,4    [1] Charge trail, not masked
U5351004R    1004     8058   09/29/98 10:14:14    F606W   2000.000  22 32 55.985  -60
33 10.466    229.951    yes      nothing
U5351101R    1101     8058   09/29/98 15:03:14    F606W   2000.000  22 32 55.525  -60
32 53.284    230.653    1,2,3    [4] Big cosmic ray, imperfectly masked
U5351107R    1107     8058   09/29/98 21:38:14    F606W   1400.000  22 32 56.204  -60
32 53.785    230.650    2,3,4    [1] Two charge trails, not masked
U5351206R    1206     8058   09/30/98 02:26:14    F606W   2000.000  22 32 55.721  -60
33 02.683    231.352    yes      nothing
U5351302R    1302     8058   09/30/98 04:07:14    F606W   1800.000  22 32 55.797  -60
33 01.113    231.652    yes      nothing
U5351304R    1304     8058   09/30/98 05:34:14    F606W   2100.000  22 32 55.797  -60
33 01.113    231.652    yes      nothing
U5351507R    1507     8058   09/30/98 21:45:14    F606W   2100.000  22 32 55.741  -60
33 01.064    231.652    yes      nothing
U53Q1702R    1702     8073   10/01/98 02:29:14    F606W   2400.000  22 32 55.645  -60
33 10.247    229.952    4        [1] Charge trail, not masked; [2,3] Moving object
U53Q1907R    1907     8073   10/01/98 20:22:14    F606W   1700.000  22 32 55.305  -60
33 10.030    229.954    2,3,4    nothing
U53Q2002R    2002     8073   10/01/98 21:57:14    F606W   2000.000  22 32 55.686  -60
33 06.468    230.652    2,3,4    [1] Charge trail, not masked; [2,3] Moving object
U53Q2207R    2207     8073   10/02/98 12:20:14    F606W   2100.000  22 32 56.020  -60
33 06.712    230.651    yes      nothing
U53Q2301R    2301     8073   10/02/98 13:56:14    F606W   2200.000  22 32 55.344  -60
33 04.904    231.354    yes      nothing
U53Q2302R    2302     8073   10/02/98 15:36:14    F606W   2200.000  22 32 55.344  -60
33 04.904    231.354    yes      nothing
U53Q2304R    2304     8073   10/02/98 17:16:14    F606W   2200.000  22 32 55.683  -60
33 05.184    231.352    yes      nothing
U52Z2604R    2604     8074   10/03/98 07:46:14    F606W   2000.000  22 32 56.040  -60
33 03.855    231.651    no       Rotation, pointing uncertain
U52Z2701R    2701     8074   10/03/98 12:34:14    F606W   2300.000  22 32 55.836  -60
33 25.038    229.652    2,4      [3] Moving object
U52Z2906R    2906     8074   10/04/98 03:04:14    F606W   2300.000  22 32 55.686  -60
33 06.468    230.652    yes      nothing
U52Z2908R    2908     8074   10/04/98 04:42:14    F606W   1200.000  22 32 55.654  -60
33 06.445    230.653    yes      [1] Wide charge trail, masked
U52Z3002R    3002     8074   10/04/98 06:24:14    F606W   1700.000  22 32 55.675  -60
33 07.741    229.952    no       [1,3,4] Moving object
U52Z3004R    3004     8074   10/04/98 07:57:14    F606W   2000.000  22 32 55.675  -60
33 07.741    229.952    yes      [3] Cosmic ray burst
U4YF3205R    3205     8075   10/04/98 22:31:14    F606W   2600.000  22 32 55.743  -60
33 02.701    231.352    2,3,4    [1] Charge trails, not masked
U4YF3301R    3301     8075   10/05/98 01:52:14    F606W   1700.000  22 32 55.797  -60
33 01.113    231.652    yes      nothing
U4YF3303R    3303     8075   10/05/98 03:20:14    F606W   2000.000  22 32 55.797  -60
33 01.113    231.652    yes      [1] Charge trail, masked
U4YF3406R    3406     8075   10/05/98 08:09:14    F606W   1800.000  22 32 55.927  -60
32 49.771    231.351    yes      nothing
U4YF3408R    3408     8075   10/05/98 09:47:14    F606W   2000.000  22 32 55.927  -60
32 49.771    231.351    yes      nothing
U4YF3601R    3601     8075   10/05/98 19:36:14    F606W   1700.000  22 32 55.638  -60
33 11.874    229.653    1,2,4    [3] Charge trails, not masked
U4YF3603R    3603     8075   10/05/98 21:04:14    F606W   2300.000  22 32 55.607  -60
33 11.855    229.653    yes      nothing
U4YF3605R    3605     8075   10/05/98 22:41:14    F606W   2300.000  22 32 55.654  -60
33 11.884    229.653    yes      [1] Charge trail, masked; [3] Bias jump
U4YF3902R    3902     8075   10/06/98 13:10:14    F606W   2100.000  22 32 55.335  -60
33 07.523    229.954    yes      nothing
U4YF3903R    3903     8075   10/06/98 14:58:14    F606W   2400.000  22 32 55.675  -60
33 07.741    229.952    yes      [2] Strange cross-shaped feature
U4YF3904R    3904     8075   10/06/98 16:20:14    F606W   2400.000  22 32 55.675  -60
33 07.741    229.952    yes      Scattered Earth light (cross-shaped)
U52F4104R    4104     8076   10/07/98 00:26:14    F606W   2100.000  22 32 55.732  -60
33 02.692    231.352    yes      Scattered Earth light (cross-shaped)
U52F4204R    4204     8076   10/07/98 06:58:14    F606W   1500.000  22 32 55.174  -60
33 19.155    230.654    2,4      [1] Charge trail, not masked
U52F4208R    4208     8076   10/07/98 10:11:14    F606W   2100.000  22 32 55.514  -60
33 19.406    230.653    no       Rotation, pointing uncertain
U52F4301R    4301     8076   10/07/98 13:27:14    F606W   2100.000  22 32 56.098  -60
33 00.462    231.351    yes      nothing
U52F4302R    4302     8076   10/07/98 14:58:14    F606W   2500.000  22 32 56.098  -60
33 00.462    231.351    yes      Scattered Earth light (cross-shaped)
U52F4503R    4503     8076   10/08/98 07:11:14    F606W   1600.000  22 32 56.080  -60
33 01.356    231.651    2,3,4    [1] Charge trail, not masked
U52F4601R    4601     8076   10/08/98 08:49:14    F606W   1700.000  22 32 55.972  -60
33 12.075    229.651    2,3,4    [1] Charge trail, not masked
U52F4602R    4602     8076   10/08/98 10:25:14    F606W   2000.000  22 32 55.264  -60
33 14.173    229.654    1,2,4    [1] Charge trail, masked
U52F4603R    4603     8076   10/08/98 12:02:14    F606W   2400.000  22 32 55.264  -60
33 14.173    229.654    2,4      [1] Charge trail, not masked
U52F4802R    4802     8076   10/09/98 04:12:14    F606W    900.000  22 32 55.691  -60
33 06.471    230.652    2,3,4    [1] Charge trail, not masked
U52F4901R    4901     8076   10/09/98 09:09:14    F606W   1200.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U52F4904R    4904     8076   10/09/98 13:53:14    F606W   1800.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing

U5350606R    0606     8058   09/28/98 13:11:14    F814W   2100.000  22 32 55.780  -60
32 58.565    231.652    yes      nothing
U5350701R    0701     8058   09/28/98 14:51:14    F814W   2000.000  22 32 56.000  -60
33 09.568    229.651    yes      nothing
U5350703R    0703     8058   09/28/98 16:31:14    F814W   1800.000  22 32 56.000  -60
33 09.568    229.651    yes      nothing
U5350705R    0705     8058   09/28/98 18:11:14    F814W   1700.000  22 32 55.292  -60
33 11.665    229.654    yes      nothing
U5350707R    0707     8058   09/28/98 19:52:14    F814W   1500.000  22 32 55.292  -60
33 11.665    229.654    yes      nothing
U5351005R    1005     8058   09/29/98 11:42:14    F814W   2700.000  22 32 55.985  -60
33 10.466    229.951    yes      nothing
U5351006R    1006     8058   09/29/98 13:23:14    F814W   2400.000  22 32 55.276  -60
33 12.536    229.954    yes      nothing
U5351306R    1306     8058   09/30/98 07:25:14    F814W   1000.000  22 32 55.747  -60
33 01.069    231.652    yes      nothing
U5351402R    1402     8058   09/30/98 08:44:14    F814W   2300.000  22 32 55.344  -60
33 04.904    231.354    yes      nothing
U5351404R    1404     8058   09/30/98 10:27:14    F814W   2000.000  22 32 55.721  -60
33 02.683    231.352    yes      nothing
U5351405M    1405     8058   09/30/98 11:53:14    F814W   2400.000  22 32 55.683  -60
33 05.184    231.352    yes      nothing
U5351406R    1406     8058   09/30/98 13:34:14    F814W   2400.000  22 32 56.022  -60
33 05.463    231.351    yes      nothing
U53Q1704R    1704     8073   10/01/98 04:09:14    F814W   2100.000  22 32 55.645  -60
33 10.247    229.952    yes      [1] Charge trail, masked
```

```
U53Q1706R    1706     8073   10/01/98 05:46:14    F814W   1900.000  22 32 55.702  -60
33 10.284    229.952    yes      nothing
U53Q1802R    1802     8073   10/01/98 07:19:14    F814W   1200.000  22 32 55.660  -60
33 09.363    229.653    yes      [1] Charge trail, masked
U53Q1804R    1804     8073   10/01/98 08:57:14    F814W   2400.000  22 32 56.000  -60
33 09.568    229.651    yes      nothing
U53Q2004R    2004     8073   10/01/98 23:40:14    F814W   1800.000  22 32 55.686  -60
33 06.468    230.652    yes      nothing
U53Q2006R    2006     8073   10/02/98 01:03:14    F814W   2000.000  22 32 55.654  -60
33 06.445    230.653    yes      nothing
U53Q2102R    2102     8073   10/02/98 02:48:14    F814W   2000.000  22 32 55.696  -60
33 02.662    231.352    yes      [3] Bias jump
U53Q2104R    2104     8073   10/02/98 04:21:14    F814W   2000.000  22 32 55.743  -60
33 02.701    231.352    yes      nothing
U53Q2306R    2306     8073   10/02/98 18:55:14    F814W   2100.000  22 32 55.683  -60
33 05.184    231.352    yes      [2] Faint moving object
U52Z2401R    2401     8074   10/02/98 20:37:14    F814W   1800.000  22 32 55.740  -60
33 01.064    231.652    yes      nothing
U52Z2403R    2403     8074   10/02/98 22:05:14    F814W   2300.000  22 32 55.797  -60
33 01.113    231.652    yes      nothing
U52Z2405R    2405     8074   10/02/98 23:37:14    F814W   2000.000  22 32 55.797  -60
33 01.113    231.652    yes      [1] Two trails, masked
U52Z2703R    2703     8074   10/03/98 15:47:14    F814W   2400.000  22 32 55.320  -60
33 09.158    229.654    no       Rotation, pointing uncertain
U52Z2705R    2705     8074   10/03/98 17:27:14    F814W   2200.000  22 32 55.320  -60
33 09.158    229.654    no       Rotation, pointing uncertain
U52Z2801R    2801     8074   10/03/98 19:13:14    F814W   1500.000  22 32 55.667  -60
33 10.262    229.952    yes      nothing
U52Z3006R    3006     8074   10/04/98 09:34:14    F814W   2000.000  22 32 56.015  -60
33 07.959    229.951    yes      nothing
U52Z3007R    3007     8074   10/04/98 11:10:14    F814W   2100.000  22 32 56.015  -60
33 07.959    229.951    yes      nothing
U52Z3101R    3101     8074   10/04/98 12:50:14    F814W   2500.000  22 32 55.341  -60
33 06.215    230.654    yes      nothing
U52Z3102R    3102     8074   10/04/98 14:18:14    F814W   2800.000  22 32 55.341  -60
33 06.215    230.654    yes      Scattered Earth light (cross-shaped)
U4YF3402R    3402     8075   10/05/98 04:55:14    F814W   1700.000  22 32 56.060  -60
33 02.962    231.351    yes      nothing
U4YF3505R    3505     8075   10/05/98 17:48:14    F814W   2400.000  22 32 55.741  -60
33 01.064    231.652    yes      [4] Moving object
U4YF3702R    3702     8075   10/06/98 00:25:14    F814W   2000.000  22 32 55.667  -60
33 10.262    229.952    yes      [1] Charge trail, masked
U4YF3704R    3704     8075   10/06/98 01:56:14    F814W   2000.000  22 32 55.645  -60
33 10.247    229.952    yes      nothing
U4YF3706R    3706     8075   10/06/98 03:34:14    F814W   1200.000  22 32 55.702  -60
33 10.284    229.952    yes      nothing
U4YF3802R    3802     8075   10/06/98 05:12:14    F814W   1400.000  22 32 55.605  -60
33 14.378    229.653    yes      nothing
U52F4001R    4001     8076   10/06/98 18:07:14    F814W   2100.000  22 32 55.350  -60
33 06.220    230.654    yes      nothing
U52F4102R    4102     8076   10/06/98 22:55:14    F814W   2400.000  22 32 55.769  -60
33 00.191    231.352    yes      nothing
U52F4106R    4106     8076   10/07/98 02:04:14    F814W   2100.000  22 32 55.732  -60
33 02.692    231.352    yes      nothing
U52F4108R    4108     8076   10/07/98 03:40:14    F814W   1000.000  22 32 55.694  -60
33 05.192    231.352    yes      Scattered Earth light (cross-shaped)
U52F4303R    4303     8076   10/07/98 16:36:14    F814W   2400.000  22 32 55.382  -60
33 02.404    231.353    yes      nothing
U52F4604R    4604     8076   10/08/98 13:39:14    F814W   1700.000  22 32 55.670  -60
33 09.369    229.652    no       Rotation, pointing uncertain
U52F4605R    4605     8076   10/08/98 15:16:14    F814W   1800.000  22 32 55.670  -60
33 09.369    229.652    no       Rotation, pointing uncertain
U52F4701R    4701     8076   10/08/98 16:54:14    F814W   2000.000  22 32 55.664  -60
33 09.173    230.153    yes      nothing
U52F4703R    4703     8076   10/08/98 18:30:14    F814W   2000.000  22 32 55.633  -60
33 11.678    230.153    yes      nothing
U52F4705R    4705     8076   10/08/98 20:07:14    F814W   2300.000  22 32 55.633  -60
33 11.678    230.153    yes      nothing
U52F4707R    4707     8076   10/08/98 21:44:14    F814W   2300.000  22 32 55.633  -60
33 11.678    230.153    yes      [1] Cosmic ray burst
U52F4709R    4709     8076   10/08/98 23:21:14    F814W   2300.000  22 32 55.633  -60
33 11.678    230.153    yes      [4] Charge trail, masked
U52F470BR    470B     8076   10/09/98 00:58:14    F814W   2300.000  22 32 55.633  -60
33 11.678    230.153    yes      nothing
U52F4803R    4803     8076   10/09/98 05:49:14    F814W    900.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U52F4902R    4902     8076   10/09/98 10:39:14    F814W   1800.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U52F4905R    4905     8076   10/09/98 15:30:14    F814W   1800.000  22 32 55.691  -60
33 06.471    230.652    yes      nothing
U52F5001R    5001     8076   10/09/98 17:08:14    F814W   2000.000  22 32 55.664  -60
33 09.173    230.153    yes      nothing
U52F5002R    5002     8076   10/09/98 18:44:14    F814W   2000.000  22 32 55.633  -60
33 11.678    230.153    yes      nothing
U52F5003R    5003     8076   10/09/98 20:21:14    F814W   2300.000  22 32 55.633  -60
33 11.678    230.153    yes      [1] Charge trail, masked
U52F5004R    5004     8076   10/09/98 21:57:14    F814W   2300.000  22 32 55.633  -60
33 11.678    230.153    yes      nothing
```

Pointing Log

The pointing log has not yet been included here.

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NICMOS Observing Log

Logfile for the Hubble Deep Field South NICMOS observations. This listing contains basic information about the datasets, as well as a few useful "derived quantities" (e.g. an approximate measure of sky brightness, useful for screening out data with high background levels), and comments based on a preliminary visual inspection.

Note: The images have been named in such a way as to make the names more useful.

Image naming convention: prefixNN_VV_LLL

```
prefix:  j   - F110W image HDF-S field
         h   - F160W image HDF-S field
         k   - F222M image HDF-S field
         drk - Dark image

NN:      Number of samples (Ns)

VV:      Visit number (5-50)

LLL:     Exposure logsheet line number
         from the proposal
```

The original suffixs have been retained. For each image there should be 6 files associated with it. They are:

- raw - raw image no calibration
- ima - pipeline calibrated individual reads
- cal - pipeline calibrated and crrej image
- spt - engineering telemetry
- jif - jitter image
- jit - jitter file

```
****************************************************************************************************
Image = Filename
Oldim = Original dataset name (in the archive)
UT_observed = Obs start time (DDD:HH:MM:SS 1998)
Daynum = Obs start time (UT decimal day)
Filt = Filter
Exp = Exposure time in seconds
Ns  = Number of samples
Sky = Mean "sky" background in DN/s
RMS = Sky rms in DN/s (excluding objects and vignetted region)
Xsh = X shift from reference image in pixels
Ysh = Y shift from reference image in pixels
Ori = rotation angle from reference image in degrees
Wt  = Weight used for final drizzled mosaic
USED = Image was used in final drizzled mosaic
A = Scattered light  -- Determined from plots of the first differences between imsets
B = SAA impacted (CR persistence) -- Flagged if occurred within 90min of SAA exit
(Check image rms for significance)
C = Moving objects
D = Large cosmic ray hits
E = Bars (horizontal)
F = Bands (vertical)
G = Quadrant bias jumps
Comments = Data quality comments (CR=giant cosmic ray, MO=moving object, Number
indicates in which read it occurred)
****************************************************************************************************
```

Image	Oldim	UT_observed	Daynum	Filt	Exp	Ns	Sky	RMS	Xsh	Ysh	Ori	Wt	USED	A	B	C	D	E	F	G	Comments
j10_05_053	n53505afq	271:02:02:45	271.0852	F110W	512	10	-1.7100E-4	0.00927	-41.2021	-16.9527	-175.402	1.0000	y	-	-	-	-	-	-	y	
j20_05_054	n53505ajq	271:02:11:26	271.0913	F110W	1152	20	6.66000E-5	0.00499	-41.1902	-16.9716	-175.402	1.0000	y	-	-	-	-	-	-	y	
j10_05_083	n53505b2q	271:03:31:39	271.1470	F110W	512	10	3.01000E-4	0.00976	-41.1831	-16.9408	-175.402	1.0000	y	y	-	-	-	-	-	-	
j20_05_084	n53505b5q	271:03:40:20	271.1530	F110W	1152	20	8.40000E-5	0.00501	-41.1712	-16.9597	-175.402	1.0000	y	-	-	-	-	-	-	y	
j10_05_113	n53505boq	271:05:07:59	271.2139	F110W	512	10	2.81000E-4	0.00979	-40.1882	-29.3429	-175.402	1.0000	y	y	-	-	-	-	-	y	
j20_05_114	n53505bsq	271:05:16:40	271.2199	F110W	1152	20	4.28000E-4	0.00506	-40.1563	-29.3599	-175.402	1.0000	y	-	-	-	y	-	-	y	CR-8,7,5,4
j15_06_063	n53506dwq	271:13:10:03	271.5486	F110W	832	15	0.00378	0.01910	12.5479	52.0819	-173.396	0.5342	-	-	y	-	-	-	-	-	
j25_06_064	n53506e0q	271:13:24:04	271.5584	F110W	1472	25	9.03000E-4	0.00745	12.4343	52.0104	-173.396	0.6054	-	-	y	-	-	-	-	y	
j15_07_015	n53507e9q	271:14:50:12	271.6182	F110W	832	15	0.00395	0.02150	-53.9397	-6.7369	-175.403	0.5032	-	-	y	-	-	-	-	-	
j25_07_016	n53507edq	271:15:04:13	271.6279	F110W	1472	25	0.00118	0.00828	-53.9278	-6.7558	-175.403	0.5315	-	-	y	-	-	-	-	y	
j15_07_043	n53507eoq	271:16:30:07	271.6876	F110W	832	15	-7.8900E-4	0.03480	-53.9308	-6.7260	-175.403	0.5037	-	-	y	y	-	-	-	-	HUGE MO-9
j20_07_044	n53507esq	271:16:44:08	271.6973	F110W	1152	20	0.0013	0.00928	-53.9189	-6.7449	-175.403	0.5512	-	-	y	y	-	-	-	y	MO-18-16,same
j15_07_063	n53507f4q	271:18:10:12	271.7571	F110W	832	15	0.00293	0.01850	-28.1872	-17.0833	-175.400	0.5252	-	-	y	-	-	-	-	y	
j20_07_064	n53507f8q	271:18:24:13	271.7668	F110W	1152	20	9.61000E-4	0.00803	-28.1743	-17.1122	-175.400	0.6547	-	-	y	-	-	-	-	y	
j10_07_083	n53507fjq	271:19:50:14	271.8265	F110W	512	10	7.82000E-4	0.01280	-28.1773	-17.0823	-175.400	0.8103	y	-	y	-	-	-	-	-	
j20_07_084	n53507fnq	271:19:58:55	271.8326	F110W	1152	20	3.58000E-4	0.00654	-28.1763	-17.0923	-175.400	0.8021	y	-	y	-	-	-	-	y	
j20_09_063	n53509ixq	272:05:18:25	272.2211	F110W	1152	20	-3.8300E-4	0.00559	-14.2531	21.3700	-174.399	1.0000	y	y	-	-	-	-	-	y	
j25_09_064	n53509j2q	272:05:37:46	272.2346	F110W	1472	25	1.11000E-4	0.00452	-14.2183	21.3231	-174.399	0.9065	y	-	-	-	y	-	-	y	CR-9
j25_09_094	n53509jiq	272:07:07:29	272.2969	F110W	1472	25	-2.4400E-5	0.00430	-26.6755	20.1720	-174.400	1.0000	y	-	-	-	-	-	-	y	
j20_10_023	n53510jwq	272:08:28:56	272.3534	F110W	1152	20	-7.0700E-5	0.00518	-32.1947	-9.6187	-175.101	1.0000	y	-	y	-	y	-	-	-	CR-12
j25_10_024	n53510k1q	272:08:48:17	272.3669	F110W	1472	25	1.26000E-4	0.00425	-32.1819	-9.6476	-175.101	1.0000	y	-	y	-	-	-	-	-	
j15_10_043	n53510keq	272:10:12:51	272.4256	F110W	832	15	-3.3100E-4	0.00675	-44.4835	-10.6428	-175.102	1.0000	y	-	y	-	-	-	-	y	
j25_10_044	n53510khq	272:10:26:52	272.4353	F110W	1472	25	2.26000E-4	0.00437	-44.4706	-10.6717	-175.102	1.0000	y	-	y	-	-	-	-	y	
j10_11_043	n53511lyq	272:18:21:24	272.7649	F110W	512	10	0.00266	0.01930	-19.6656	74.2140	-174.400	0.6733	-	-	y	-	-	-	-	y	
j25_11_044	n53511m2q	272:18:30:05	272.7709	F110W	1472	25	7.99000E-4	0.00784	-19.4985	74.1500	-174.400	0.5805	-	-	y	-	y	-	-	y	CR-8
j15_11_063	n53511mcq	272:20:00:36	272.8337	F110W	832	15	3.98000E-6	0.00859	-19.5104	74.1689	-174.400	0.7520	y	-	y	-	-	-	-	y	
j20_11_064	n53511mhq	272:20:14:37	272.8435	F110W	1152	20	3.87000E-4	0.00554	-19.5085	74.1490	-174.400	1.0000	y	-	y	-	-	-	-	y	
j15_11_083	n53511muq	272:21:36:34	272.9004	F110W	832	15	-2.2000E-4	0.00636	-32.0056	72.8935	-174.402	1.0000	y	-	y	-	-	-	-	y	
j15_11_084	n53511mzq	272:21:50:35	272.9101	F110W	832	15	6.04000E-4	0.00628	-32.0076	72.9134	-174.402	1.0000	y	-	y	-	-	-	-	y	
j20_12_033	n53512nfq	272:23:06:53	272.9631	F110W	1152	20	-4.4300E-4	0.00496	18.0599	32.2451	-173.696	1.0000	y	-	-	-	-	-	-	y	
j25_12_034	n53512njq	272:23:26:14	272.9766	F110W	1472	25	1.09000E-4	0.00417	18.0786	32.1565	-173.696	1.0000	y	-	-	-	-	-	-	y	
j20_12_053	n53512nxq	273:00:41:48	273.0290	F110W	1152	20	-3.2800E-4	0.00597	18.0480	32.2640	-173.696	0.8966	y	y	-	-	-	-	-	-	
j25_12_054	n53512o2q	273:01:01:09	273.0425	F110W	1472	25	2.39000E-4	0.00421	18.0609	32.2351	-173.696	1.0000	y	-	-	-	-	-	-	y	
j20_14_023	n53514qiq	273:08:42:41	273.3630	F110W	1152	20	-3.2000E-4	0.00513	19.7654	19.8724	-173.695	1.0000	y	-	y	-	-	-	-	y	
j25_14_024	n53514qnq	273:09:02:02	273.3764	F110W	1472	25	2.33000E-4	0.00425	19.7892	19.8346	-173.695	1.0000	y	-	y	-	-	-	-	y	
j15_14_043	n53514r0q	273:10:25:54	273.4347	F110W	832	15	6.92000E-5	0.00711	6.0104	30.9330	-173.696	1.0000	y	-	y	-	-	-	-	y	
j20_14_044	n53514r3q	273:10:39:55	273.4444	F110W	1152	20	5.04000E-4	0.00557	6.0401	30.8354	-173.696	1.0000	y	-	y	-	-	-	-	y	
j20_14_053	n53514rbq	273:11:52:13	273.4946	F110W	1152	20	0.00323	0.01530	7.4421	18.4833	-173.696	0.5405	-	-	y	-	-	-	-	-	
j25_14_054	n53514rgq	273:12:11:34	273.5080	F110W	1472	25	6.45000E-4	0.00635	7.4570	18.4345	-173.696	0.6681	-	-	y	-	-	-	-	y	
j20_14_063	n53514rmq	273:13:32:27	273.5642	F110W	1152	20	0.00321	0.01800	-4.8532	17.1169	-173.697	0.5106	-	-	y	-	-	-	-	y	
j25_14_064	n53514rqq	273:13:51:48	273.5776	F110W	1472	25	7.35000E-4	0.00709	-4.9137	17.2215	-173.697	0.5675	-	-	y	-	-	-	-	y	
j15_15_093	n53515tlq	273:21:43:32	273.9052	F110W	832	15	-2.7000E-4	0.00642	14.3267	39.5758	-173.395	1.0000	y	-	y	-	-	-	-	-	
j25_15_094	n53515tpq	273:21:57:33	273.9150	F110W	1472	25	6.41000E-5	0.00420	14.3386	39.5568	-173.395	1.0000	y	-	y	-	-	-	-	y	
j20_17_083	n53q17uiq	274:02:27:36	274.1025	F110W	1152	20	-6.8100E-5	0.00524	-31.9262	-9.6929	-175.102	1.0000	y	-	-	-	-	-	-	-	
j25_17_084	n53q17ulq	274:02:46:57	274.1159	F110W	1472	25	1.87000E-4	0.00433	-31.9124	-9.7317	-175.102	1.0000	y	-	-	-	-	-	-	y	
j15_18_063	n53q18wyq	274:10:37:54	274.4430	F110W	832	15	6.12000E-5	0.00774	-53.7220	-6.8060	-175.404	0.8817	y	-	y	-	-	-	-	y	
j25_18_064	n53q18x2q	274:10:51:55	274.4527	F110W	1472	25	3.45000E-4	0.00491	-53.7091	-6.8349	-175.404	0.8277	y	-	y	-	-	-	-	y	
j25_18_073	n53q18x9q	274:12:03:34	274.5025	F110W	1472	25	0.00239	0.01440	-28.0738	-17.1124	-175.402	0.4948	-	-	y	-	-	-	-	-	
j25_18_074	n53q18xeq	274:12:28:15	274.5196	F110W	1472	25	5.75000E-4	0.00598	-28.0600	-17.1512	-175.402	0.6461	-	-	y	-	-	-	-	y	
j20_19_015	n53q19xnq	274:13:43:37	274.5720	F110W	1152	20	0.00324	0.01810	-50.3196	53.1823	-175.105	0.4824	-	-	y	-	-	-	-	-	
j25_19_016	n53q19xrq	274:14:02:58	274.5854	F110W	1472	25	7.67000E-4	0.00716	-50.3166	53.1525	-175.105	0.5409	-	-	y	-	y	-	-	y	CR-14
j20_19_033	n53q19xxq	274:15:23:34	274.6414	F110W	1152	20	0.00294	0.01850	-14.4159	-72.2728	-175.102	0.4056	-	-	y	-	-	-	-	-	
j25_19_034	n53q19y2q	274:15:42:55	274.6548	F110W	1472	25	8.12000E-4	0.00721	-14.4021	-72.3117	-175.102	0.4923	-	-	y	-	-	-	-	y	
j15_20_053	n53q20afq	274:23:39:12	274.9856	F110W	832	15	-6.9700E-4	0.00667	-13.2045	10.4703	-174.400	1.0000	y	-	y	-	-	-	-	y	
j20_20_054	n53q20aiq	274:23:53:13	274.9953	F110W	1152	20	1.21000E-4	0.00490	-13.2035	10.4603	-174.400	1.0000	y	-	-	-	-	-	-	y	
j15_20_073	n53q20ary	275:01:05:15	275.0425	F110W	832	15	-2.2500E-4	0.00717	-12.0857	10.6403	-174.400	1.0000	y	-	-	-	-	-	-	y	
j25_20_074	n53q20b2q	275:01:15:16	275.0523	F110W	1472	25	1.78000E-4	0.00444	-12.0609	10.5924	-174.400	1.0000	y	-	-	-	-	-	-	y	
j15_21_083	n53q21bhq	275:02:46:41	275.1158	F110W	832	15	-2.3700E-4	0.00644	6.9748	31.0376	-173.697	1.0000	y	-	-	-	-	-	-	y	
j25_21_084	n53q21bkq	275:03:00:42	275.1255	F110W	1472	25	1.74000E-4	0.00451	6.9887	30.9908	-173.697	1.0000	y	-	y	-	y	-	-	y	CR-12
j15_21_103	n53q21c2q	275:04:20:07	275.1806	F110W	832	15	-2.5600E-4	0.00683	5.2111	30.7843	-173.697	1.0000	y	-	-	-	-	-	-	y	
j25_21_104	n53q21c5q	275:04:34:08	275.1904	F110W	1472	25	1.76000E-4	0.00449	5.2240	30.7554	-173.697	1.0000	y	-	y	-	y	-	-	y	CR-3
j15_22_083	n53q22eqq	275:12:18:42	275.5130	F110W	832	15	0.00256	0.01540	-25.2471	9.0885	-174.404	0.5734	-	-	y	-	-	-	-	-	
j25_22_084	n53q22etq	275:12:32:43	275.5227	F110W	1472	25	5.13000E-4	0.00717	-25.2937	9.1543	-174.404	0.5808	-	-	y	-	y	-	-	y	CR-14
j15_23_015	n53q23etq	275:13:54:52	275.5798	F110W	832	15	0.00482	0.02150	19.9354	19.7786	-173.695	0.5268	-	-	y	-	-	-	-	-	
j25_23_016	n53q23ewq	275:14:08:53	275.5895	F110W	1472	25	0.00117	0.00820	19.9582	19.7507	-173.695	0.5963	-	-	y	-	-	-	-	y	
j15_23_033	n53q23f3q	275:15:34:43	275.6491	F110W	832	15	0.00438	0.02240	19.9563	19.7706	-173.695	0.5134	-	-	y	-	-	-	-	-	
j25_23_034	n53q23f7q	275:15:48:44	275.6588	F110W	1472	25	7.13000E-4	0.00836	19.9701	19.7317	-173.695	0.5026	-	-	y	-	-	-	-	y	
j15_23_053	n53q23fiq	275:17:14:50	275.7186	F110W	832	15	0.00246	0.01680	7.5594	18.4144	-173.697	0.5705	-	-	y	-	-	-	-	-	
j25_23_054	n53q23fpq	275:17:28:51	275.7284	F110W	1472	25	4.81000E-4	0.00662	7.5713	18.3955	-173.696	0.6795	-	-	y	-	-	-	-	y	
j15_25_073	[illegible]	276:01:24:01	276.0583	F110W	832	15	-8.9800E-5	0.00667	-40.4375	-18.2945	-175.401	1.0000	y	-	-	-	-	-	-	y	
j25_25_074	[illegible]	276:01:38:02	276.0681	F110W	1472	25	1.78000E-4	0.00425	-40.4355	-18.3144	-175.401	1.0000	y	-	-	-	-	-	-	y	
j20_25_093	[illegible]	276:02:53:03	276.1202	F110W	1152	20	-3.0100E-4	0.00557	-39.3636	-18.1791	-175.401	1.0000	y	-	-	-	-	-	-	y	
j25_25_094	[illegible]	276:03:12:24	276.1336	F110W	1472	25	1.14000E-4	0.00433	-39.3488	-18.2279	-175.401	1.0000	y	-	-	-	-	-	-	y	
j10_25_113	[illegible]	276:04:31:45	276.1887	F110W	512	10	8.02000E-4	0.01090	-38.2537	-18.1782	-175.401	1.0000	y	-	-	-	-	-	-	-	
j20_25_114	[illegible]	276:04:40:26	276.1948	F110W	1152	20	-3.8700E-5	0.00459	-38.3388	-18.2270	-175.401	1.0000	y	-	-	-	-	-	-	y	
j15_26_033	[illegible]	276:06:11:59	276.2583	F110W	832	15	-3.2900E-4	0.00655	3.3169	25.8157	-173.400	1.0000	y	-	-	-	-	-	-	y	
j20_26_034	[illegible]	276:06:26:00	276.2681	F110W	1152	20	2.70000E-4	0.00515	3.3298	25.7868	-173.400	1.0000	y	-	-	-	-	-	-	y	
j20_27_033	[illegible]	276:14:05:47	276.5873	F110W	1152	20	0.00365	0.01880	-33.6519	46.8486	-175.404	0.5090	-	-	y	-	-	-	-	-	
j25_27_034	[illegible]	276:14:25:08	276.6008	F110W	1472	25	8.91000E-4	0.00727	-33.6371	46.7998	-175.404	0.5447	-	-	y	-	-	-	-	y	
j20_27_043	[illegible]	276:15:45:52	276.6569	F110W	1152	20	0.00296	0.01810	-29.1732	-4.6703	-175.403	0.5108	-	-	y	-	-	-	-	-	
j25_27_044	[illegible]	276:16:05:13	276.6703	F110W	1472	25	7.98000E-4	0.00705	-29.1722	-4.6802	-175.403	0.5593	-	-	y	-	-	-	-	y	
j15_27_063	[illegible]	276:17:25:53	276.7263	F110W	832	15	0.0017	0.01320	-29.2437	-4.5666	-175.403	0.6356	-	-	y	-	-	-	-	y	MO-6
j25_28_064	[illegible]	276:19:11:44	276.7998	F110W	1472	25	-6.3600E-4	0.00457	-32.7070	-9.5182	-175.098	0.8435	y	-	-	-	-	-	-	y	
[illegible]	n4yf32u4q	277:19:19:55	277.8055	F110W	1472	25	-4.7000E-4	0.00444	7.1350	31.0432	-173.696	0.8843	y	-	-	-	-	-	-	y	
j15_32_019	n4yf32u9q	277:19:44:36	277.8226	F110W	832	15	6.14000E-4	0.00741	7.1370	31.0233	-173.696	1.0000	y	-	-	-	-	-	-	y	
j15_32_043	n4yf32usq	277:20:57:13	277.8734	F110W	832	15	-4.6100E-4	0.00658	5.1685	30.7240	-173.696	1.0000	y	-	-	-	-	-	-	y	
j25_32_044	n4yf32uwq	277:21:11:44	277.8831	F110W	1472	25	3.66000E-5	0.00419	5.5314	30.6951	-173.696	1.0000	y	-	-	-	-	-	-	y	
j15_34_093	n4yf34bbq	278:04:53:33	278.2039	F110W	832	15	3.59000E-5	0.00679	-6.2231	30.1655	-173.698	1.0000	y	-	-	-	-	-	-	y	
j20_34_094	n4yf34bfq	278:05:07:34	278.2136	F110W	1152	20	2.06000E-4	0.00461	-6.1993	30.1277	-173.698	1.0000	y	-	-	-	-	-	-	y	
j15_34_113	n4yf34btq	278:06:33:01	278.2729	F110W	832	15	-3.3200E-4	0.00687	10.9720	96.5403	-173.697	1.0000	y	-	-	-	-	-	-	y	
j20_34_114	n4yf34bxq	278:06:47:02	278.2827	F110W	1152	20	1.46000E-4	0.00512	-10.9849	96.5114	-173.697	1.0000	y	-	-	-	-	-	-	y	
j15_34_133	n4yf34caq	278:08:07:45	278.3387	F110W	832	15	2.67000E-4	0.00704	-1.5480	95.3127	-173.698	1.0000	y	-	-	-	-	-	-	y	
j20_34_134	n4yf34ceq	278:08:21:46	278.3484	F110W	1152	20	2.90000E-4	0.00517	-1.5341	95.2738	-173.698	1.0000	y	-	-	-	-	-	-	y	
j15_34_153	n4yf34csq	278:09:45:19	278.4065	F110W	832	15	7.38000E-4	0.00841	-1.5480	95.3127	-173.698	0.7616	y	-	-	-	-	-	-	y	
j25_34_154	n4yf34cvq	278:09:59:20	278.4162	F110W	1472	25	3.32000E-4	0.00521	-1.5341	95.2738	-173.698	0.7205	y	-	-	-	-	-	-	y	
j20_35_105	n4yf35e1q	278:17:46:39	278.7407	F110W	1152	20	0.00296	0.00682	-13.3760	30.0016	-173.395	0.7891	-	-	y	-	-	-	-	y	CR-5
j25_35_106	n4yf35eoq	278:18:06:00	278.7542	F110W	1472	25	1.61000E-4	0.00444	-14.3285	38.9429	-173.395	1.0000	y	-	-	-	-	-	-	y	
j10_36_033	n4yf36f2q	278:19:34:34	278.8157	F110W	512	10	7.67000E-5	0.00900	-40.5661	-17.3927	-175.404	1.0000	y	-	-	-	-	-	-	y	
j20_36_034	n4yf36f7q	278:19:43:15	278.8217	F110W	1152	20	-4.9600E-5	0.00420	-40.5641	-17.4126	-175.404	1.0000	y	-	-	-	-	-	-	y	
j10_36_053	n4yf36fnq	278:21:02:20	278.8766	F110W	512	10	-3.0300E-4	0.00769	-39.4749	-17.2446	-175.404	1.0000	y	-	-	-	-	-	-	y	
j20_36_054	n4yf36frq	278:21:11:01	278.8827	F110W	1152	20	3.25000E-5	0.00574	-39.4653	-17.2446	-175.404	1.0000	y	-	-	-	-	-	-	y	
j20_36_073	n4yf36g9q	278:22:39:50	278.9443	F110W	1152	20	-4.5800E-4	0.00567	-41.0622	-17.4612	-175.404	1.0000	y	-	-	-	-	-	-	y	
j25_36_074	n4yf36gcq	278:22:59:11	278.9578	F110W	1472	25	9.91000E-5	0.00421	-41.1484	-17.5001	-175.404	1.0000	y	-	-	-	-	-	-	y	
j15_38_113	n4yf38ixq	279:06:44:06	279.2806	F110W	832	15	-2.3500E-4	0.00719	-39.3689	-29.7146	-175.403	1.0000	y	-	-	-	-	-	-	y	
j20_38_114	n4yf38ixq	279:06:58:07	279.2904	F110W	1152	20	3.81000E-4	0.00518	-39.3461	-29.7326	-175.403	1.0000	y	-	-	-	-	-	-	y	
j15_39_023	n4yf39jnq	279:11:39:34	279.4858	F110W	832	15	-3.9800E-5	0.00846	-20.8499	-2.4666	-175.097	0.6642	-	-	y	-	-	-	-	y	
j25_39_024	n4yf39jlq	279:11:53:35	279.4955	F110W	1472	25	1.13000E-4	0.00528	-20.8181	-2.4490	-175.097	0.6658	-	-	y	-	-	-	-	y	MO-2
j15_40_043	n52f40kkq	279:19:35:08	279.8161	F110W	832	15	3.63000E-4	0.00855	-9.9370	11.0138	-174.396	0.7957	y	-	-	-	-	-	-	y	
j25_40_044	n52f40lpq	279:19:49:09	279.8258	F110W	1472	25	-1.1300E-5	0.00431	-0.9222	11.7550	-174.396	1.0000	y	-	-	-	-	-	-	y	
j15_40_063	n52f40m4q	279:21:12:08	279.8834	F110W	832	15	-2.2200E-4	0.00876	-14.5714	22.9766	-174.397	0.7708	y	-	-	-	-	-	-	y	
j25_40_064	n52f40m7q	279:21:26:09	279.8932	F110W	1472	25	1.50000E-4														

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0.00423  -14.5694   22.9567  -174.397  1.0000   y   -   -   -   -   -   y   -
  j20_41_033  n52f41moq  279:22:53:10   279.9538 F110W    1152    20 -4.2100E-4
0.00530    4.2690   43.2519  -173.694  1.0000   y   y   -   -   -   -   y   y
  j25_41_034  n52f41mrq  279:23:12:51   279.9620 F110W    1472    25 2.88000E-4
0.00433    4.3494   43.1592  -173.694  1.0000   y   -   y   -   -   y   -   CR-
9,11
  j15_41_053  n52f41n9q  280:00:24:58   280.0173 F110W     832    15 7.69000E-4
0.00935    5.7269   30.9554  -173.694  0.7162   y   y   -   -   -   y   -   CR-
2,11
  j25_41_054  n52f41ndq  280:00:38:59   280.0271 F110W    1472    25 -4.0300E-5
0.00434    5.7388   30.9365  -173.694  1.0000   y   -   -   -   -   -   y   y
  j15_42_173  n52f42q5q  280:10:09:44   280.4234 F110W     832    15 6.00000E-4
0.00890   -7.5555  -52.3684  -174.401  0.6797   -   -   y   -   -   -   -   -
  j25_42_174  n52f42q9q  280:10:23:45   280.4332 F110W    1472    25 2.83000E-4
0.00544   -7.5635  -52.3893  -174.401  0.6511   -   -   y   -   y   -   y   -
  j15_42_193  n52f42qkq  280:11:40:59   280.4868 F110W     832    15    0.00181
0.01500   -7.6954  -52.1711  -174.401  0.4879   -   -   y   -   -   -   y   -
  j25_42_194  n52f42qnq  280:11:55:00   280.4965 F110W    1472    25 4.79000E-4
0.00609   -7.6935  -52.1910  -174.401  0.5894   -   -   y   -   y   -   y   -   CR-19
  j15_43_023  n52f43qxq  280:13:25:38   280.5595 F110W     832    15 4.50000E-4
0.00984   -7.8917   42.0595  -173.695  0.5923   -   -   y   -   -   -   y   -
  j25_43_024  n52f43r0q  280:13:39:39   280.5692 F110W    1472    25 3.13000E-4
0.00585   -7.8778   42.0206  -173.695  0.5941   -   -   y   -   -   -   y   -
  j20_43_053  n52f43r7q  280:14:57:02   280.6229 F110W    1152    20     0.0012
0.01080   -7.9006   42.0485  -173.695  0.5885   -   -   y   -   -   -   y   -
  j25_43_054  n52f43rcq  280:15:16:23   280.6364 F110W    1472    25 3.12000E-4
0.00562   -7.7944   41.9080  -173.695  0.6811   -   -   y   -   y   -   y   -   CR-16
  j20_44_103  n52f44vaq  280:23:04:17   280.9613 F110W    1152    20 -4.1600E-4
0.00543   13.5663   38.4160  -173.395  1.0000   y   -   y   -   y   -   y   -   CR-11
  j25_44_104  n52f44vfq  280:23:23:38   280.9748 F110W    1472    25 3.58000E-4
0.00418   13.5792   38.3871  -173.395  1.0000   y   -   -   -   -   -   y   -
  j15_44_123  n52f44vvq  281:00:41:31   281.0288 F110W     832    15 1.98000E-4
0.00718    1.3064   36.8924  -173.396  1.0000   y   -   y   -   -   -   y   -
  j20_44_134  n52f44vzq  281:00:55:32   281.0386 F110W    1152    20 3.31000E-4
0.00490    1.3193   36.8635  -173.396  1.0000   y   -   y   -   y   -   y   -   CR-5
  j15_45_083  n52f45yuq  281:05:34:04   281.2320 F110W     832    15 -1.1100E-4
0.00643   13.6521   38.5651  -173.389  1.0000   y   -   y   -   -   -   y   -
  j15_45_084  n52f45yxq  281:05:48:05   281.2417 F110W     832    15 8.78000E-4
0.00643   13.6968   38.5192  -173.389  1.0000   y   -   -   -   -   -   y   -
  j25_47_034  n52f47b5q  281:16:53:14   281.7036 F110W    1472    25 -5.4000E-4
0.00452  -27.0660   -5.3579  -174.896  0.8597   y   -   y   -   -   -   y   -
  j15_47_035  n52f47b8q  281:17:17:55   281.7208 F110W     832    15 7.88000E-4
0.00644  -27.0641   -5.3778  -174.896  1.0000   y   -   -   -   -   -   y   -
  j25_47_054  n52f47bjq  281:18:29:04   281.7702 F110W    1472    25 2.86000E-4
0.00438  -25.9118  -17.7444  -174.895  1.0000   y   -   -   -   -   -   y   -
  j15_47_055  n52f47bnq  281:18:53:45   281.7873 F110W     832    15 6.10000E-4
0.00630  -25.9118  -17.7444  -174.895  1.0000   y   -   y   -   -   -   y   -
  j15_48_016  n52f48dkq  282:02:39:52   282.1110 F110W     832    15 1.41000E-4
0.00652  -13.3079   10.8040  -174.391  1.0000   y   -   -   -   -   -   y   -
  j15_48_036  n52f48dwq  282:05:47:33   282.2414 F110W     832    15 -1.5600E-4
0.00655  -13.3452   10.7780  -174.391  1.0000   y   -   y   -   -   -   y   -
  j15_49_016  n52f49ehq  282:09:07:26   282.3802 F110W    1472    25 -1.7300E-4
0.00522  -13.1785   10.5130  -174.395  0.6910   -   -   y   -   -   -   y   -
  j25_49_036  n52f49euq  282:12:15:03   282.5104 F110W    1472    25 -1.8100E-4
0.00639  -13.1676   10.5040  -174.395  0.5749   -   -   y   -   -   -   y   -
  j15_49_056  n52f49f8q  282:15:28:46   282.6450 F110W    1472    25 -4.2200E-4
0.00511  -13.1557   10.4851  -174.395  0.7787   y   -   y   -   -   -   y   -
  j25_50_034  n52f50fiq  282:17:06:44   282.7130 F110W    1472    25 -5.4800E-4
0.00433  -26.6935   -5.6731  -174.901  0.9020   y   -   y   -   -   -   y   -
  j15_50_035  n52f50flq  282:17:31:25   282.7302 F110W     832    15 6.52000E-4
0.00635  -26.7025   -5.6840  -174.901  1.0000   y   -   -   -   -   -   y   -
  j25_50_054  n52f50fqq  282:18:42:27   282.7795 F110W    1472    25 -4.2300E-4
0.00429  -25.6843  -17.9130  -174.901  1.0000   y   -   -   -   -   -   y   -
  j15_50_055  n52f50fvq  282:19:07:08   282.7966 F110W     832    15 6.16000E-4
0.00635  -25.6952  -17.9040  -174.901  1.0000   y   -   -   -   -   -   y   -

  h10_05_143  n53505c9q  271:06:43:37   271.2803 F160W     512    10 8.18000E-5
0.00967  -42.0094   -4.6700  -175.399  1.0000   y   -   -   -   -   -   y   y
  h20_05_144  n53505cdq  271:06:52:18   271.2869 F160W    1152    20 2.64000E-4
0.00519  -41.9965   -4.6988  -175.399  1.0000   y   -   -   -   -   -   y   y
  h15_06_023  n53506csq  271:08:20:05   271.3473 F160W     832    15 -1.6100E-4
0.00641   24.8350   53.3808  -173.392  1.0000   y   -   -   -   -   -   y   y
  h25_06_024  n53506cvq  271:08:34:06   271.3570 F160W    1472    25 2.59000E-4
0.00439   24.8807   53.3242  -173.392  1.0000   y   -   -   -   -   -   y   y
  h15_06_043  n53506daq  271:10:00:34   271.4171 F160W     832    15 -9.8200E-5
0.00652   24.9076   53.3569  -173.392  1.0000   y   -   -   -   -   -   y   y
  h20_06_044  n53506deq  271:10:14:35   271.4268 F160W    1152    20 3.73000E-4
0.00512   24.9186   53.3977  -173.392  1.0000   y   -   -   -   -   -   y   y
  h20_06_053  n53506dlq  271:11:28:50   271.4784 F160W    1152    20 2.43000E-4
0.00904   12.6499   51.9030  -173.393  0.6432   -   -   y   -   -   -   -   y
  h25_06_054  n53506dqq  271:11:48:11   271.4918 F160W    1472    25 3.03000E-4
0.00539   12.6518   51.8940  -173.393  0.8149   y   -   -   -   -   -   y   y
  h25_07_114  n53507fyq  271:21:28:22   271.8947 F160W    1472    25 -5.1500E-4
0.00498  -40.3608  -18.2037  -175.390  0.8163   y   -   y   -   -   -   y   y
  h15_08_123  n53508ggq  271:23:01:49   271.9596 F160W     832    15 -3.5900E-4
0.00656  -33.4526    2.7505  -175.098  1.0000   y   -   -   -   -   -   -   y
  h20_08_124  n53508gjq  271:23:15:50   271.9693 F160W    1152    20 4.12000E-4
0.00516  -33.4308    2.7325  -175.098  1.0000   y   -   -   -   -   -   y   y
  h20_08_153  n53508h0q  272:00:26:34   272.0185 F160W    1152    20 -6.3800E-4
0.00540  -32.4424   -9.4994  -175.098  1.0000   y   -   -   -   -   -   -   y
  h25_08_154  n53508h5q  272:00:45:55   272.0319 F160W    1472    25 8.06000E-5
0.00439  -32.4176   -9.5472  -175.098  1.0000   y   -   -   -   -   -   y   y
  h15_08_173  n53508hpq  272:02:06:49   272.0881 F160W     832    15 -2.6000E-4
0.00534  -21.0890    3.9326  -175.097  1.0000   y   -   -   -   -   -   -   y
  h25_08_184  n53508htq  272:02:26:10   272.1015 F160W    1472    25 2.06000E-4
0.00440  -21.0661    3.9047  -175.097  1.0000   y   -   -   -   -   -   y   y
  h15_09_033  n53509iaq  272:03:44:05   272.1556 F160W     832    15 -2.4900E-4
0.00651  -14.2919   21.3993  -174.396  1.0000   y   -   -   -   -   -   y   y
  h25_09_034  n53509ieq  272:03:58:06   272.1653 F160W    1472    25 1.37000E-4
0.00465  -14.2383   21.3743  -174.396  1.0000   y   -   -   -   -   -   y   y
  h25_10_053  n53510kpq  272:11:40:50   272.4867 F160W    1472    25    0.00108
0.01060  -44.3863  -10.7610  -175.099  0.5503       -   y   -   -   -   -   y
  h15_10_054  n53510kuq  272:12:05:31   272.5038 F160W    1472    25 4.59000E-4
0.00555  -44.3744  -10.7799  -175.099  0.7802   y   -   y   -   -   -   y   y
  h20_10_063  n53510l0q  272:13:21:25   272.5565 F160W    1152    20    0.00304
0.01760  -18.6037  -21.0039  -175.096  0.5119   -   -   y   -   -   -   -   y
  h25_10_064  n53510l5q  272:13:40:46   272.5700 F160W    1472    25 9.04000E-4
0.00715  -18.6008  -21.0338  -175.096  0.6058   -   -   y   -   -   -   y   y
  h15_11_015  n53511ldq  272:15:01:22   272.6259 F160W     832    15    0.00339
0.02150   -7.2940   75.4702  -174.396  0.4765   -   -   y   -   -   -   -   -
  h25_11_016  n53511lgq  272:15:15:23   272.6357 F160W    1472    25 7.60000E-4
0.00836   -7.1379   75.4151  -174.396  0.5002   -   -   y   -   -   -   -   y
  h15_11_033  n53511lnq  272:16:41:18   272.6953 F160W     832    15    0.00336
0.02130   -7.1835   75.4709  -174.396  0.4829   -   -   y   -   -   -   y   y
  h25_11_034  n53511lsq  272:16:55:19   272.7051 F160W    1472    25 8.50000E-4
0.00816   -7.1041   75.3782  -174.396  0.5182   -   -   y   -   -   -   y   y
  h15_12_073  n53512ojq  273:02:25:07   273.1008 F160W     832    15 -1.9400E-4
0.00665    6.1345   30.8476  -173.694  1.0000   y   -   -   -   -   -   y   y
  h25_12_074  n53512omq  273:02:39:08   273.1105 F160W    1472    25 9.60000E-5
0.00441    6.1435   30.8585  -173.694  1.0000   y   -   -   -   -   -   y   y
  h15_13_083  n53513p1q  273:04:05:52   273.1707 F160W     832    15 4.76000E-5
0.00663   12.1520   39.3654  -173.393  1.0000   y   -   -   -   -   -   y   y
  h20_13_084  n53513p4q  273:04:19:53   273.1805 F160W    1152    20 4.53000E-4
0.00529   12.1610   39.3764  -173.393  1.0000   y   -   -   -   -   -   y   y
  h15_13_103  n53513pjq  273:05:33:10   273.2314 F160W     832    15 -2.7400E-4
0.00692   12.1321   39.3635  -173.393  1.0000   y   y   -   -   -   -   -   y
  h25_13_104  n53513pnq  273:05:47:11   273.2411 F160W    1472    25 2.90000E-4
0.00471   12.1550   39.3356  -173.393  1.0000   y   -   -   -   -   -   -   y
  h15_13_123  n53513q5q  273:07:23:55   273.3083 F160W     832    15 6.07000E-5
0.00653   14.0697   39.4831  -173.393  1.0000   y   -   -   -   -   -   -   y
  h15_15_015  n53515rzq  273:15:13:04   273.6341 F160W     832    15    0.00316
0.02170    3.4412   25.8308  -173.393  0.5140   -   -   y   -   -   -   -   -
  h25_15_016  n53515s2q  273:15:27:05   273.6438 F160W    1472    25 6.97000E-4
0.00842    3.4820   25.8248  -173.393  0.5174   -   -   y   -   -   -   y   y
  h20_15_033  n53515s9q  273:16:52:27   273.7031 F160W    1152    20    0.00256
0.01760   25.3394   53.3591  -173.391  0.4944   -   -   y   -   -   -   -   y
  h25_15_034  n53515seq  273:17:11:48   273.7165 F160W    1472    25 4.51000E-4
0.00707   25.2298   53.2479  -173.391  0.5458   -   -   y   -   y   -   -   y   CR-
14,4,17
  h15_15_043  n53515slq  273:18:32:37   273.7726 F160W     832    15    0.00133
0.01290   25.3244   53.3074  -173.391  0.6112   -   -   y   -   -   -   -   y
  h25_15_044  n53515spq  273:18:46:38   273.7824 F160W    1472    25 1.92000E-4
0.00597   25.2337   53.2080  -173.391  0.7381   y   -   y   -   -   -   -   y
  h15_15_063  n53515syq  273:20:11:01   273.8410 F160W     832    15 -7.8700E-5
0.00755   12.8337   51.7812  -173.392  0.9033   y   -   y   -   -   -   y   y
  h15_15_064  n53515t4q  273:20:25:02   273.8507 F160W     832    15 8.61000E-4
0.00685   12.8308   51.8111  -173.392  1.0000   y   -   y   -   -   -   y   y
  h15_17_103  n53q17v1q  274:04:08:05   274.1723 F160W     832    15 6.76000E-4
0.00642  -31.8390   -9.8120  -175.099  1.0000   y   -   -   -   -   -   y   y
  h25_17_104  n53q17v5q  274:04:22:06   274.1820 F160W    1472    25 2.06000E-4
0.00462  -31.8172   -9.8300  -175.099  1.0000   y   -   -   -   -   -   y   y
  h15_17_123  n53q17vkq  274:05:44:28   274.2392 F160W     832    15 -4.7900E-4
0.00715  -33.9220   -9.9861  -175.100  1.0000   y   y   -   -   -   -   y   y
  h20_17_124  n53q17vpq  274:05:58:29   274.2490 F160W    1152    20 5.38000E-4
0.00544  -33.8992  -10.0140  -175.100  1.0000   y   -   -   -   -   -   y   y
  h20_18_023  n53q18w3q  274:07:17:19   274.3037 F160W    1152    20 -3.6500E-4
0.00517  -41.2992   -5.8664  -175.400  1.0000   y   -   y   -   -   -   -   y
  h20_18_043  n53q18wgq  274:08:55:35   274.3719 F160W    1152    20 -7.8500E-5
0.00529  -53.5801   -6.9700  -175.401  1.0000   y   -   y   -   -   -   -   y
  h25_18_044  n53q18wlq  274:09:14:56   274.3854 F160W    1472    25 1.76000E-4
0.00472  -53.5473   -6.9970  -175.401  1.0000   y   -   y   -   y   -   y   y   CR-16
  h20_19_043  n53q19y8q  274:17:03:38   274.7108 F160W    1152    20    0.00216
0.01550  -14.3504  -72.2736  -175.098  0.4812   -   -   y   -   -   -   -   y
  h25_19_044  n53q19ydq  274:17:22:59   274.7243 F160W    1472    25 5.22000E-4
0.00648  -14.3365  -72.3124  -175.098  0.6165   -   -   y   -   -   -   y   y
  h15_19_063  n53q19yqq  274:18:43:15   274.7800 F160W     832    15 7.91000E-4
0.00999  -26.7644  -73.2496  -175.100  0.7001   y   -   y   -   -   -   y   y
  h20_19_064  n53q19yuq  274:18:57:16   274.7898 F160W    1152    20 6.60000E-4
0.00600  -26.7435  -73.2576  -175.100  0.8570   y   -   y   -   -   -   y   y
  h10_19_083  n53q19z4q  274:20:20:31   274.8476 F160W     512    10 -8.2800E-5
0.00964  -19.7185   -8.3021  -175.099  1.0000   y   -   y   -   -   -   y   y
  h25_19_084  n53q19z8q  274:20:29:12   274.8536 F160W    1472    25 -8.7400E-5
0.00453  -19.7375   -8.3140  -175.099  1.0000   y   -   y   -   -   -   y   y
  h15_20_033  n53q20zsq  274:21:55:39   274.9136 F160W     832    15 -1.5400E-4
0.00646  -13.1621   10.2965  -174.397  1.0000   y   -   -   -   -   -   y   y
  h25_20_034  n53q20zwq  274:22:09:40   274.9234 F160W    1472    25 -4.4700E-5
0.00441  -13.1214   10.2904  -174.397  1.0000   y   -   -   -   -   -   y   y
  h05_21_123  n53q21cnq  275:05:57:06   275.2480 F160W     192     5      INDEF
INDEF     INDEF     INDEF     INDEF  0.0000   -   -   -   -   -   -   y   y
  h20_21_124  n53q21cqq  275:06:00:27   275.2503 F160W    1152    20 -2.8700E-4
0.00535    6.1802   30.7918  -173.694  1.0000   y   -   -   -   -   -   y   y
  h15_22_023  n53q22d3q  275:07:33:59   275.3153 F160W     832    15 -9.9700E-5
0.00638  -12.8597   10.2859  -174.400  1.0000   y   -   y   -   -   -   y   y
  h25_22_024  n53q22d7q  275:07:48:00   275.3250 F160W    1472    25 1.60000E-4
0.00448  -12.8776   10.2641  -174.400  1.0000   y   -   y   -   -   -   y   y
  h15_22_043  n53q22dlq  275:09:08:39   275.3810 F160W     832    15 -2.2700E-5
0.00710  -12.8347   10.3386  -174.400  1.0000   y   -   y   -   -   -   y   -
  h25_22_044  n53q22doq  275:09:22:40   275.3907 F160W    1472    25 7.24000E-5
0.00467  -12.8567   10.2561  -174.400  1.0000   y   -   y   -   -   -   y   -
  h15_22_063  n53q22e3q  275:10:49:36   275.4511 F160W     832    15 2.93000E-4
0.00847  -25.2243    9.1138  -174.401  0.7769   y   -   y   -   -   -   -   y
  h25_22_064  n53q22e6q  275:11:03:37   275.4608 F160W    1472    25 2.21000E-4
0.00536  -25.2483    9.0511  -174.401  0.7610   y   -   y   -   y   -   -   y
  h15_23_073  n53q23g3q  275:18:53:38   275.7873 F160W     832    15 6.08000E-5
0.00821    7.6718   18.4484  -173.693  0.8322   y   -   y   -   -   -   -   y
  h25_23_074  n53q23g7q  275:19:07:39   275.7970 F160W    1472    25 -7.0200E-6
0.00484    7.6667   18.3977  -173.693  0.9026   y   -   y   -   -   -   -   y
  h25_24_018  n52z24ggq  275:20:35:32   275.8580 F160W    1472    25 -4.4400E-4
0.00456   14.2198   39.3873  -173.397  1.0000   y   -   y   -   -   -   -   y
  h20_24_043  n52z24gyq  275:22:03:26   275.9190 F160W    1152    20 -6.0600E-4
0.00545   12.1696   39.1863  -173.397  1.0000   y   -   -   -   -   -   -   y
  h25_24_044  n52z24h2q  275:22:22:47   275.9325 F160W    1472    25 2.92000E-4
0.00454   12.1079   39.2003  -173.397  1.0000   y   -   -   -   -   -   -   y
  h15_24_063  n52z24hjq  275:23:35:32   275.9830 F160W     832    15 6.19000E-5
0.00646   12.1655   39.1256  -173.397  1.0000   y   -   -   -   -   -   y   y
  h25_24_064  n52z24hnq  275:23:49:33   275.9927 F160W    1472    25 1.84000E-4
0.00450   12.1694   39.0858  -173.397  1.0000   y   -   -   -   -   -   y   y
  h15_26_053  n52z26k9q  276:07:44:15   276.3224 F160W     832    15 -7.4400E-5
0.00649    3.3905   25.8359  -173.397  1.0000   y   -   y   -   -   -   -   y
  h25_26_054  n52z26kdq  276:07:58:16   276.3321 F160W    1472    25 1.96000E-4
0.00471    3.4293   25.8497  -173.397  1.0000   y   -   y   -   y   -   y   y   CR-17
  h15_26_073  n52z26krq  276:09:19:50   276.3888 F160W     832    15 1.00000E-4
0.00745   21.3046  -23.9536  -173.395  1.0000   y   -   y   -   -   -   y   y
  h25_26_074  n52z26kuq  276:09:33:51   276.3985 F160W    1472    25 2.62000E-4
0.00491   21.2847  -23.9556  -173.395  0.8743   y   -   y   -   -   -   y   y
  h15_26_093  n52z26l4q  276:10:54:59   276.4549 F160W     832    15    0.00101
0.01060    8.8521  -25.2550  -173.396  0.6675   -   -   y   -   -   -   y   -
  h25_26_094  n52z26l9q  276:11:09:00   276.4646 F160W    1472    25 4.64000E-4
0.00603    8.8650  -25.2839  -173.396  0.6800   -   -   y   -   -   -   -   y
  h15_27_015  n52z27llq  276:12:32:21   276.5225 F160W     832    15    0.00168
0.01320  -47.5897  -83.1290  -175.402  0.5341   -   -   y   -   -   -   -   y
  h25_27_016  n52z27loq  276:12:46:22   276.5322 F160W    1472    25 6.34000E-4
0.00685  -47.5698  -83.1270  -175.402  0.5492   -   -   y   -   y   -   -   y   CR-
15,Trail-20
  h20_28_043  n52z28nmq  276:20:35:54   276.8582 F160W    1152    20 -7.5200E-4
0.00555  -32.6058   -9.5757  -175.095  1.0000   y   -   -   -   -   -   y   -
  h25_28_044  n52z28nqq  276:20:55:15   276.8717 F160W    1472    25 8.39000E-5
0.00448  -32.6108   -9.6265  -175.095  1.0000   y   -   -   -   y   -   -   -
  h15_28_063  n52z28o7q  276:22:13:00   276.9257 F160W     832    15 -5.2100E-4
0.00692  -31.8295   -9.4996  -175.095  1.0000   y   y   -   -   -   -   y   -
  h25_28_064  n52z28obq  276:22:27:01   276.9354 F160W    1472    25 -9.5000E-5
0.00446  -31.8076   -9.5176  -175.095  1.0000   y   -   -   -   -   -   y   y
  h25_32_063  n4yf32vfq  277:22:29:35   277.9372 F160W    1472    25 -4.1100E-4
0.00451    5.6576   30.6903  -173.693  1.0000   y   -   -   -   y   -   y   -   CR-16
  h25_32_064  n4yf32vkq  277:22:54:16   277.9543 F160W    1472    25 1.29000E-4
0.00436    5.6316   30.6476  -173.693  1.0000   y   y   -   -   y   -   -   y
  h10_33_053  n4yf33aaq  278:01:51:05   278.0771 F160W     512    10 1.41000E-4
0.00968   12.0941   40.2641  -173.392  1.0000   y   -   -   -   y   -   y   -   CR-7
  h25_33_054  n4yf33afq  278:01:59:46   278.0832 F160W    1472    25 -2.4700E-5
0.00439   12.0909   40.1934  -173.392  1.0000   y   -   -   -   -   -   -   y
  h15_33_073  n4yf33avq  278:03:18:35   278.1379 F160W     832    15 -3.2500E-4
0.00694   12.2082   40.1245  -173.392  1.0000   y   -   -   -   -   -   y   -
  h25_33_074  n4yf33azq  278:03:32:36   278.1476 F160W    1472    25 -4.1800E-5
0.00458   12.2260   40.0459  -173.392  1.0000   y   -   -   -   -   -   y   -
  h15_35_023  n4yf35d4q  278:11:28:32   278.4781 F160W     832    15 -9.7900E-5
0.00882   -5.7480  101.1030  -173.394  0.6423   -   -   y   -   -   -   -   y
  h25_35_024  n4yf35d8q  278:11:42:33   278.4879 F160W    1472    25 1.19000E-4
0.00556   -5.7380  101.1040  -173.394  0.6529   -   -   y   -   -   -   -   y
  h15_35_043  n4yf35dhq  278:13:00:01   278.5417 F160W     832    15 6.21000E-4
0.01100    1.9256   37.5991  -173.393  0.5782   -   -   y   -   -   -   y   -
  h25_35_044  n4yf35dmq  278:13:14:02   278.5514 F160W    1472    25 4.26000E-4
0.00635    2.0240   37.5183  -173.393  0.5878   -   -   y   -   -   -   -   y
  h15_35_063  n4yf35dyq  278:14:47:29   278.6163 F160W     832    15 -1.3200E-4
0.00908   28.0877   28.0967  -173.391  0.5995   -   -   y   -   -   -   -   y
  h25_35_064  n4yf35e2q  278:15:01:30   278.6260 F160W    1472    25 4.98000E-5
0.00575   28.0987   28.0877  -173.391  0.6157   -   -   y   -   -   -   -   y
  h20_35_083  n4yf35e9q  278:16:08:16   278.6724 F160W    1152    20    0.00231
0.01470   28.0421   28.1525  -173.391  0.5476   -   y   y   -   -   -   -   -
  h25_35_084  n4yf35efq  278:16:27:37   278.6859 F160W    1472    25 4.84000E-4
0.00615   28.1076   28.0987  -173.391  0.7030   y   -   y   -   -   -   -   y
  h15_37_033  n4yf37gwq  279:00:23:37   279.0164 F160W     832    15 -4.7500E-4
0.00671  -32.7857   -8.9704  -175.099  1.0000   y   -   -   -   -   -   -   -
  h25_37_034  n4yf37gzq  279:00:37:38   279.0261 F160W    1472    25 -2.2900E-5
0.00438  -32.7857   -8.9704  -175.099  1.0000   y   -   -   -   -   -   -   y
  h15_37_053  n4yf37hhq  279:01:55:05   279.0799 F160W     832    15 -5.9100E-4
0.00712  -32.0123   -8.8644  -175.099  1.0000   y   -   -   -   -   -   -   y
  h25_37_054  n4yf37hkq  279:02:09:06   279.0897 F160W    1472    25 -3.7800E-5
0.00445  -31.9895   -8.8923  -175.099  1.0000   y   -   -   -   -   -   -   y
  h25_37_073  n4yf37i2q  279:03:32:35   279.1476 F160W    1472    25 -8.0200E-4
0.00504  -34.0785   -9.1072  -175.099  0.8466   y   -   -   -   -   -   -   -
  h10_38_093  n4yf38icq  279:05:11:13   279.2161 F160W     512    10 -3.7500E-5
0.00916  -39.3940  -29.7042  -175.400  1.0000   y   -   y   -   y   -   -   y   CR-5
  h20_38_094  n4yf38ifq  279:05:19:54   279.2221 F160W    1152    20 3.60000E-4
0.00522  -39.3820  -29.7231  -175.400  1.0000   y   -   y   -   -   -   -   y
  h15_39_043  n4yf39jvq  279:13:08:58   279.5479 F160W     832    15 5.63000E-4
0.01190  -20.6343    3.9068  -175.094  0.5503   -   y   y   -   -   -   -   y
  h25_39_044  n4yf39k0q  279:13:22:59   279.5576 F160W    1472    25 4.43000E-6
0.00657  -20.6702    3.8631  -175.094  0.5627   -   -   y   -   y   -   -   y   CR-17
  h20_39_063  n4yf39kcq  279:14:56:46   279.6227 F160W    1152    20 -3.0800E-4
0.00784  -33.0147    2.7934  -175.095  0.5812   -   -   y   -   -   -   -   y
  h25_39_064  n4yf39khq  279:15:16:07   279.6362 F160W    1472    25 4.22000E-6
0.00540  -32.9581    2.7286  -175.095  0.6877   -   -   y   -   -   -   -   y
  h20_39_083  n4yf39knq  279:16:18:54   279.6798 F160W    1152    20 9.31000E-4
0.01120  -33.0504    2.8502  -175.095  0.5798   -   y   y   -   -   -   -   y
  h25_39_084  n4yf39ktq  279:16:38:15   279.6932 F160W    1472    25 1.98000E-4
0.00538  -33.0395    2.8412  -175.095  0.8056   y   -   y   -   -   -   -   y
  h10_40_015  n52f40l2q  279:18:06:15   279.7543 F160W     512    10 -4.2800E-4
0.00938   -0.7474   11.6745  -174.393  1.0000   y   -   y   -   y   -   -   y   CR-3
  h25_40_016  n52f40l6q  279:18:14:56   279.7604 F160W    1472    25 -1.6100E-4
0.00447   -0.7563   11.6636  -174.393  1.0000   y   y   y   -   -   -   -   y
  h15_41_073  n52f41nvq  280:02:02:26   280.0850 F160W     832    15 2.03000E-4
0.00734    5.7755   30.9229  -173.691  1.0000   y   y   -   -   -   -   -   -
  h25_41_074  n52f41nyq  280:02:16:27   280.0948 F160W    1472    25 9.58000E-5
0.00449    5.7684   30.8921  -173.691  1.0000   y   -   -   -   -   -   -   -
  h20_41_093  n52f41ogq  280:03:38:54   280.1520 F160W    1152    20 -4.3000E-4
0.00551    7.0869   18.5719  -173.691  1.0000   y   y   -   -   -   -   -   -
  h10_42_113  n52f42oqq  280:05:19:35   280.2219 F160W     512    10 1.85000E-4
0.00920  -32.1124   73.3180  -174.400  1.0000   y   -   y   -   -   -   -   y
  h20_42_114  n52f42otq  280:05:28:16   280.2280 F160W    1152    20 4.64000E-4
0.00539  -32.1204   73.2971  -174.400  1.0000   y   -   y   -   -   -   -   y
  h10_42_133  n52f42p6q  280:06:56:31   280.2892 F160W     512    10 -2.7600E-4
0.01000    5.1486  -51.5318  -174.397  1.0000   y   -   y   -   -   -   -   y
  h20_42_134  n52f42paq  280:07:05:12   280.2953 F160W    1152    20 2.09000E-4
0.00533    5.1396  -51.5427  -174.397  1.0000   y   -   y   -   -   -   -   y
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  h15_42_153  n52f42pnq  280:08:35:26   280.3579 F160W      832    15 -1.1600E-4
0.00735    5.0235  -51.3833  -174.397  0.8902   y   -   y   -   -   -   y   -
  h20_42_154  n52f42prq  280:08:49:27   280.3677 F160W     1152    20 3.88000E-4
0.00559    4.9847  -51.3971  -174.397  0.9003   y   y   y   -   -   -   -   y
  h20_43_083  n52f43riq  280:16:34:43   280.6908 F160W     1152    20 -6.2600E-5
0.00667   18.2054   32.4532  -173.690  0.7744   y   y   y   -   -   -   -   -
  h25_43_084  n52f43rnq  280:16:54:04   280.7042 F160W     1472    25 -6.9000E-5
0.00479   18.2562   32.4481  -173.690  0.8858   y   -   y   -   y   -   -   y   CR-19
  h15_45_103  n52f45z8q  281:07:10:02   281.2986 F160W      832    15 -2.2200E-4
0.00692    1.5224   36.9969  -173.387  1.0000   y   -   y   -   -   -   y   -
  h20_45_104  n52f45zcq  281:07:24:03   281.3084 F160W     1152    20 4.84000E-4
0.00534    1.5732   36.9918  -173.387  1.0000   y   -   y   -   y   -   -   y
  h15_46_023  n52f46zkq  281:08:47:54   281.3666 F160W      832    15 -5.5100E-5
0.00752  -52.9830  -20.3356  -175.402  0.8347   y   -   y   -   -   -   -   -
  h20_46_024  n52f46zoq  281:09:01:55   281.3763 F160W     1152    20 5.70000E-4
0.00572  -53.0139  -20.3285  -175.402  0.8516   y   -   y   -   -   -   -   y
  h15_46_043  n52f46zuq  281:10:23:54   281.4333 F160W      832    15 2.27000E-5
0.00818  -27.4292  -30.5004  -175.400  0.7331   y   -   y   -   -   -   y   -
  h25_46_044  n52f46zyq  281:10:37:55   281.4430 F160W     1472    25 6.28000E-5
0.00531  -27.4590  -30.5034  -175.400  0.7197   y   -   y   -   y   -   -   y
  h20_46_063  n52f46a5q  281:12:00:57   281.5007 F160W     1152    20 -3.8700E-5
0.00758  -27.5948  -30.2454  -175.400  0.6116   -   -   y   -   -   -   y   -
  h25_46_064  n52f46abq  281:12:20:18   281.5141 F160W     1472    25 2.07000E-4
0.00534  -27.6276  -30.2185  -175.400  0.7109   y   -   y   -   y   -   -   y
  h25_46_074  n52f46aiq  281:13:37:57   281.5680 F160W     1472    25 -1.1000E-4
0.00732  -41.2920   -4.7101  -175.401  0.5498   -   -   y   -   -   -   -   y
  h10_46_075  n52f46apq  281:14:02:38   281.5852 F160W      512    10    0.00119
0.00991  -41.3267   -4.6633  -175.401  1.0000   y   y   y   -   y   -   -   y
  h25_46_084  n52f46atq  281:15:14:55   281.6353 F160W     1472    25 -1.8100E-4
0.00639  -41.4635   -4.3954  -175.401  0.7003   y   -   y   -   -   -   -   -
  h15_46_085  n52f46azq  281:15:39:36   281.6525 F160W      832    15 6.24000E-4
0.00691  -41.5043   -4.3893  -175.401  1.0000   y   -   y   -   -   -   -   y
  h25_47_074  n52f47byq  281:20:06:01   281.8375 F160W     1472    25 -4.7500E-4
0.00455  -25.8203  -17.7024  -174.892  1.0000   y   -   -   -   -   -   y   -
  h15_47_075  n52f47c2q  281:20:30:42   281.8546 F160W      832    15 7.44000E-4
0.00654  -25.8403  -17.7043  -174.892  1.0000   y   -   -   -   -   -   -   y
  h25_47_094  n52f47cdq  281:21:42:58   281.9048 F160W     1472    25 -3.9600E-4
0.00451  -25.8213  -17.6924  -174.892  1.0000   y   -   -   -   -   -   -   y
  h15_47_095  n52f47cgq  281:22:07:39   281.9220 F160W      832    15 7.72000E-4
0.00657  -25.8313  -17.6934  -174.892  1.0000   y   -   -   -   -   -   -   y
  h25_47_114  n52f47crq  281:23:19:54   281.9721 F160W     1472    25 -3.7100E-4
0.00459  -25.8104  -17.7014  -174.892  1.0000   y   -   -   -   -   -   -   y
  h15_47_115  n52f47cuq  281:23:44:35   281.9893 F160W      832    15 7.85000E-4
0.00651  -25.8004  -17.7004  -174.892  1.0000   y   -   -   -   y   -   -   y
  h25_47_134  n52f47d5q  282:00:56:49   282.0395 F160W     1472    25 -3.1600E-4
0.00469  -25.7995  -17.7104  -174.892  1.0000   y   -   -   -   -   -   -   y
  h15_47_135  n52f47d8q  282:01:21:30   282.0566 F160W      832    15 7.92000E-4
0.00646  -25.7895  -17.7094  -174.892  1.0000   y   -   -   -   y   -   -   y
  h15_48_026  n52f48dqq  282:04:10:40   282.1741 F160W      832    15 -2.2700E-4
0.00663  -13.2699   10.6778  -174.388  1.0000   y   -   y   -   y   -   -   -   CR-3
  h15_48_046  n52f48e3q  282:07:24:25   282.3086 F160W      832    15 1.30000E-5
0.00699  -13.2539   10.7195  -174.388  1.0000   y   -   y   -   -   -   y   -
  h25_49_026  n52f49enq  282:10:38:10   282.4432 F160W     1472    25 -2.6700E-4
0.00609  -13.2016   10.4936  -174.391  0.6222   -   -   y   -   -   -   -   -
  h25_49_046  n52f49f2q  282:13:51:55   282.5777 F160W     1472    25 -1.8100E-4
0.00646  -13.1916   10.4945  -174.391  0.6311   -   -   y   -   y   -   -   -   CR-
13,15
  h25_50_074  n52f50fzq  282:20:19:19   282.8467 F160W     1472    25 -5.2300E-4
0.00449  -25.5989  -17.9118  -174.898  1.0000   y   -   -   -   -   -   -   -
  h15_50_075  n52f50g4q  282:20:44:00   282.8639 F160W      832    15 7.71000E-4
0.00651  -25.5899  -17.9008  -174.898  1.0000   y   -   -   -   -   -   -   y
  h25_50_094  n52f50g9q  282:21:56:09   282.9140 F160W     1472    25 -3.8400E-4
0.00448  -25.5909  -17.8909  -174.898  1.0000   y   -   -   -   -   -   -   -
  h15_50_095  n52f50gdq  282:22:20:50   282.9311 F160W      832    15 8.01000E-4
0.00664  -25.6088  -17.9127  -174.898  1.0000   y   -   -   -   y   -   -   y   CR-
3,13

  k20_05_045  n53505a8q  271:01:37:52   271.0680 F222M     1152    20      INDEF
INDEF  -42.1154   -4.7335  -175.399  1.0000   y   -   -   -   -   -   -   -
  k20_05_073  n53505auq  271:03:08:20   271.1308 F222M     1152    20      INDEF
INDEF  -41.1540  -16.9982  -175.399  1.0000   y   -   -   -   -   -   -   -
  k20_05_103  n53505bhq  271:04:44:59   271.1979 F222M     1152    20      INDEF
INDEF  -40.0728  -29.5627  -175.399  1.0000   y   -   -   -   y   -   -   -   CR-10
  k20_05_133  n53505c3q  271:06:21:37   271.2650 F222M     1152    20      INDEF
INDEF  -39.9920  -29.4643  -175.399  1.0000   y   -   -   -   -   -   -   -
  k10_06_015  n53506cmq  271:08:04:28   271.3364 F222M      512    10      INDEF
INDEF   12.5727   51.8632  -173.393  1.0000   y   -   y   -   -   -   -   -
  k10_06_033  n53506d3q  271:09:46:20   271.4072 F222M      512    10      INDEF
INDEF   12.5021   51.8664  -173.393  1.0000   y   -   y   -   -   -   -   -
  k20_08_143  n53508guq  272:00:04:34   272.0032 F222M     1152    20      INDEF
INDEF  -32.4411   -9.6328  -175.098  1.0000   y   -   -   -   -   -   -   -
  k05_08_173  n53508hgq  272:01:41:11   272.0703 F222M      192     5      INDEF
INDEF  -21.0290    3.8150  -175.097  1.0000   y   -   -   -   -   -   -   -
  k20_08_174  n53508hkq  272:01:44:32   272.0726 F222M     1152    20      INDEF
INDEF  -21.1166    3.7863  -175.097  1.0000   y   -   -   -   -   -   -   -
  k20_09_023  n53509i4q  272:03:18:53   272.1381 F222M     1152    20      INDEF
INDEF   -1.9994   22.5815  -174.395  1.0000   y   -   -   -   y   -   -   -   CR-16
  k05_09_053  n53509ioq  272:04:54:25   272.2045 F222M      192     5      INDEF
INDEF  -14.2249   21.3225  -174.396  1.0000   y   -   -   -   -   -   -   -
  k20_09_054  n53509itq  272:04:57:46   272.2068 F222M     1152    20      INDEF
INDEF  -14.3363   21.3317  -174.396  1.0000   y   -   -   -   -   -   -   -
  k10_10_015  n53510jqq  272:08:15:22   272.3440 F222M      512    10      INDEF
INDEF  -32.4882   -9.7681  -175.098  1.0000   y   -   y   -   -   -   -   -
  k10_10_033  n53510k8q  272:09:58:35   272.4157 F222M      512    10      INDEF
INDEF  -31.4313  -22.0837  -175.098  1.0000   y   -   y   -   -   -   -   -
  k10_11_073  n53511mnq  272:21:00:20   272.8752 F222M      512    10      INDEF
INDEF  -14.4732   22.6245  -174.397  1.0000   y   -   y   -   -   -   -   -
  k15_12_017  n53512n9q  272:22:50:41   272.9519 F222M      832    15      INDEF
INDEF   -7.8990   41.6568  -173.695  1.0000   y   -   y   -   -   -   -   -
  k10_12_043  n53512noq  273:00:13:30   273.0094 F222M      512    10      INDEF
INDEF   18.2540   32.0430  -173.693  1.0000   y   -   -   -   -   -   -   -
  k20_12_044  n53512nsq  273:00:22:11   273.0154 F222M     1152    20      INDEF
INDEF   18.0225   32.2514  -173.693  1.0000   y   -   -   -   -   -   -   -
  k10_12_063  n53512o7q  273:01:50:02   273.0764 F222M      512    10      INDEF
INDEF    6.2373   30.7040  -173.694  1.0000   y   -   -   -   -   -   -   -
  k20_12_064  n53512odq  273:01:58:43   273.0824 F222M     1152    20      INDEF
INDEF    6.0894   30.8804  -173.694  1.0000   y   -   -   -   -   -   -   -
  k10_13_093  n53513pbq  273:05:04:10   273.2112 F222M      512    10      INDEF
INDEF   12.3789   39.0833  -173.393  1.0000   y   -   -   -   -   -   -   -
  k20_13_094  n53513peq  273:05:12:51   273.2173 F222M     1152    20      INDEF
INDEF   12.0093   39.3686  -173.393  1.0000   y   -   -   -   -   -   -   -
  k10_14_015  n53514qcq  273:08:28:00   273.3528 F222M      512    10      INDEF
INDEF    4.5823   42.9711  -173.693  1.0000   y   -   y   -   -   -   -   -
  k10_14_033  n53514quq  273:10:10:40   273.4241 F222M      512    10      INDEF
INDEF    4.4758   42.9305  -173.693  1.0000   y   -   y   -   -   -   -   -
  k05_15_077  n53515taq  273:21:08:13   273.8807 F222M      192     5      INDEF
INDEF   14.0087   39.0623  -173.392  1.0000   y   -   y   -   -   -   -   -
  k20_15_078  n53515teq  273:21:11:34   273.8830 F222M     1152    20      INDEF
INDEF   13.4875   39.6643  -173.392  1.0000   y   -   y   -   -   -   -   -
  k15_17_113  n53q17vcq  274:05:10:16   274.2155 F222M      832    15      INDEF
INDEF  -33.9117  -10.1086  -175.100  1.0000   y   -   -   -   -   -   -   -
  k20_17_114  n53q17vgq  274:05:24:17   274.2252 F222M     1152    20      INDEF
INDEF  -33.9553   -9.9722  -175.100  1.0000   y   -   -   -   -   -   -   -
  k15_18_015  n53q18vxq  274:06:56:42   274.2894 F222M      832    15      INDEF
INDEF  -40.7295  -18.2528  -175.400  1.0000   y   -   y   -   -   -   -   -
  k10_18_033  n53q18w9q  274:08:40:19   274.3613 F222M      512    10      INDEF
INDEF  -40.6462  -18.3853  -175.400  1.0000   y   -   y   -   -   -   -   -
  k10_18_053  n53q18wrq  274:10:22:40   274.4324 F222M      512    10      INDEF
INDEF  -41.6779   -5.9165  -175.400  1.0000   y   -   y   -   -   -   -   -
  k10_19_053  n53q19yjq  274:17:59:52   274.7499 F222M      512    10      INDEF
INDEF  -32.4400   -9.5423  -175.100  1.0000   y   -   y   -   -   -   -   -
  k10_20_017  n53q20ziq  274:21:21:32   274.8900 F222M      512    10      INDEF
INDEF  -14.9492   10.0580  -174.397  1.0000   y   -   y   -   -   -   -   -
  k15_20_018  n53q20znq  274:21:30:13   274.8960 F222M      832    15      INDEF
INDEF  -15.0028   10.0930  -174.397  1.0000   y   -   y   -   -   -   -   -
  k20_20_043  n53q20a4q  274:22:50:07   274.9515 F222M     1152    20      INDEF
INDEF  -13.3197   10.3484  -174.397  1.0000   y   -   -   -   -   -   -   -
  k25_20_044  n53q20a8q  274:23:09:28   274.9649 F222M     1472    25      INDEF
INDEF  -13.2947   10.4011  -174.397  1.0000   y   -   -   -   -   -   -   -
  k15_20_063  n53q20anq  275:00:18:08   275.0126 F222M      832    15      INDEF
INDEF  -13.2549   10.4050  -174.397  1.0000   y   -   -   -   -   -   -   -
  k25_20_064  n53q20arq  275:00:32:09   275.0223 F222M     1472    25      INDEF
INDEF  -13.2877   10.4320  -174.397  1.0000   y   -   -   -   -   -   -   -
  k20_21_093  n53q21brq  275:03:29:46   275.1457 F222M     1152    20      INDEF
INDEF    5.3736   30.6997  -173.694  1.0000   y   -   -   -   -   -   -   -
  k25_21_094  n53q21bvq  275:03:49:07   275.1591 F222M     1472    25      INDEF
INDEF    5.3179   30.7546  -173.694  1.0000   y   -   -   -   -   -   -   -
  k25_21_113  n53q21ccq  275:05:03:52   275.2110 F222M     1472    25      INDEF
INDEF    5.4838   30.6000  -173.694  1.0000   y   -   -   -   -   -   -   -
  k25_21_114  n53q21cgq  275:05:28:33   275.2281 F222M     1472    25      INDEF
INDEF    5.4015   30.7225  -173.694  1.0000   y   -   -   -   -   -   -   -
  k15_22_015  n53q22cxq  275:07:14:25   275.3017 F222M      832    15      INDEF
INDEF  -13.3420   10.1654  -174.400  1.0000   y   -   y   -   -   -   -   -
  k10_22_033  n53q22dfq  275:08:52:28   275.3698 F222M      512    10      INDEF
INDEF  -13.3219   10.2679  -174.400  1.0000   y   -   y   -   -   -   -   -
  k10_22_055  n53q22dwq  275:10:34:22   275.4405 F222M      512    10      INDEF
INDEF  -13.3349   10.1962  -174.400  1.0000   y   -   y   -   -   -   -   -
  k20_23_043  n53q23feq  275:16:18:27   275.6795 F222M     1152    20      INDEF
INDEF    7.2701   18.3257  -173.694  1.0000   y   -   y   -   -   -   -   -
  k20_23_063  n53q23fxq  275:18:00:37   275.7504 F222M     1152    20      INDEF
INDEF    7.3519   18.4141  -173.694  1.0000   y   -   y   -   -   -   -   -
  k20_24_033  n52z24gnq  275:21:15:19   275.8857 F222M     1152    20      INDEF
INDEF   14.0263   39.3956  -173.397  1.0000   y   -   y   -   -   -   -   -
  k25_24_034  n52z24grq  275:21:34:40   275.8991 F222M     1472    25      INDEF
INDEF   14.0768   39.2900  -173.397  1.0000   y   -   y   -   -   -   -   -
  k15_25_083  n52z25ibq  276:02:08:42   276.0894 F222M      832    15      INDEF
INDEF  -40.6390  -18.2540  -175.398  1.0000   y   -   -   -   -   -   -   -
  k25_25_084  n52z25ifq  276:02:22:43   276.0991 F222M     1472    25      INDEF
INDEF  -40.5307  -18.3338  -175.398  1.0000   y   -   -   -   -   -   -   -
  k20_25_103  n52z25iwq  276:03:42:24   276.1544 F222M     1152    20      INDEF
INDEF  -39.3573  -18.2087  -175.398  1.0000   y   -   -   -   y   -   -   -   CR-15
  k25_25_104  n52z25j0q  276:04:01:45   276.1679 F222M     1472    25      INDEF
INDEF  -39.4330  -18.2563  -175.398  1.0000   y   -   -   -   -   -   -   -
  k05_26_015  n52z26jiq  276:05:44:58   276.2396 F222M      192     5      INDEF
INDEF   15.5433   26.7935  -173.396  1.0000   y   -   y   -   -   -   -   -
  k20_26_016  n52z26jmq  276:05:48:19   276.2419 F222M     1152    20      INDEF
INDEF   15.2933   27.1910  -173.396  1.0000   y   -   y   -   -   -   -   -
  k15_26_043  n52z26k3q  276:07:21:59   276.3069 F222M      832    15      INDEF
INDEF   13.9816   39.4414  -173.396  1.0000   y   -   y   -   -   -   -   -
  k10_26_063  n52z26klq  276:09:04:28   276.3781 F222M      512    10      INDEF
INDEF   15.3138   26.9820  -173.396  1.0000   y   -   y   -   -   -   -   -
  k15_27_053  n52z27miq  276:16:33:50   276.6902 F222M      832    15      INDEF
INDEF  -29.4584   -4.6982  -175.400  1.0000   y   -   y   -   -   -   -   -
  k20_28_033  n52z28nbq  276:19:47:47   276.8249 F222M     1152    20      INDEF
INDEF  -32.5877   -9.7778  -175.095  1.0000   y   -   y   -   -   -   -   -
  k25_28_034  n52z28nfq  276:20:07:08   276.8383 F222M     1472    25      INDEF
INDEF  -32.7229   -9.7308  -175.095  1.0000   y   -   y   -   -   -   -   -
  k20_28_053  n52z28nxq  276:21:24:39   276.8921 F222M     1152    20      INDEF
INDEF  -31.9039   -9.6806  -175.095  1.0000   y   -   -   -   -   -   -   -
  k25_28_054  n52z28o0q  276:21:44:00   276.9055 F222M     1472    25      INDEF
INDEF  -31.9037   -9.5801  -175.095  1.0000   y   -   -   -   -   -   -   -
  k20_32_033  n4yf32ugq  277:20:08:57   277.8395 F222M     1152    20      INDEF
INDEF    7.1581   30.9450  -173.693  1.0000   y   -   y   -   -   -   -   -
  k25_32_034  n4yf32ulq  277:20:28:18   277.8530 F222M     1472    25      INDEF
INDEF    7.4276   30.8609  -173.693  1.0000   y   -   y   -   -   -   -   -
  k20_33_063  n4yf33alq  278:02:30:28   278.1045 F222M     1152    20      INDEF
INDEF   12.0817   40.2700  -173.392  1.0000   y   -   -   -   -   -   -   -
  k25_33_064  n4yf33apq  278:02:49:49   278.1179 F222M     1472    25      INDEF
INDEF   12.2565   40.1264  -173.392  1.0000   y   -   -   -   -   -   -   -
  k25_34_104  n4yf34bmq  278:06:03:36   278.2525 F222M     1472    25      INDEF
INDEF    6.9745   19.2915  -173.694  1.0000   y   -   y   -   -   -   -   -
  k15_34_123  n4yf34c4q  278:07:46:18   278.3238 F222M      832    15      INDEF
INDEF    4.3392   43.8114  -173.694  1.0000   y   -   -   -   -   -   -   -
  k10_34_143  n4yf34cmq  278:09:27:51   278.3943 F222M      512    10      INDEF
INDEF    5.8725   31.4520  -173.694  1.0000   y   -   y   -   -   -   -   -
  k20_36_043  n4yf36fdq  278:20:14:01   278.8431 F222M     1152    20      INDEF
INDEF  -39.5126  -17.2392  -175.401  1.0000   y   -   y   -   -   -   -   -
  k25_36_044  n4yf36fhq  278:20:33:22   278.8565 F222M     1472    25      INDEF
INDEF  -39.5167  -17.2999  -175.401  1.0000   y   -   -   -   -   -   -   -
  k20_36_063  n4yf36fyq  278:21:51:05   278.9105 F222M     1152    20      INDEF
INDEF  -39.4957  -17.2074  -175.401  1.0000   y   -   -   -   -   -   -   -
  k25_36_064  n4yf36g2q  278:22:10:26   278.9239 F222M     1472    25      INDEF
INDEF  -39.3956  -17.4086  -175.401  1.0000   y   -   -   -   -   -   -   -
  k20_37_043  n4yf37h6q  279:01:06:44   279.0463 F222M     1152    20      INDEF
INDEF  -32.0838   -8.8665  -175.099  1.0000   y   -   -   -   -   -   -   -
  k25_37_044  n4yf37haq  279:01:26:05   279.0598 F222M     1472    25      INDEF
INDEF  -32.1393   -8.9200  -175.099  1.0000   y   -   -   -   -   -   -   -
  k20_37_063  n4yf37hrq  279:02:38:50   279.1103 F222M     1152    20      INDEF
INDEF  -34.1118   -9.1142  -175.099  1.0000   y   -   -   -   -   -   -   -
  k25_37_064  n4yf37hvq  279:03:03:31   279.1274 F222M     1472    25      INDEF
INDEF  -34.2292   -9.1249  -175.099  1.0000   y   -   -   -   -   -   -   -   CR-22
  k25_38_104  n4yf38ilq  279:06:15:55   279.2610 F222M     1472    25      INDEF
INDEF  -29.7568  -29.8240  -175.400  1.0000   y   -   -   -   -   -   -   -
  k20_40_033  n52f40lcq  279:18:49:08   279.7841 F222M     1152    20      INDEF
INDEF   -0.0692   11.6697  -174.393  1.0000   y   -   -   -   -   -   -   -
  k25_40_034  n52f40lgq  279:19:08:29   279.7975 F222M     1472    25      INDEF
INDEF   -0.9588   11.6609  -174.393  1.0000   y   -   -   -   y   -   -   -   MO-19
  k20_40_053  n52f40luq  279:20:21:08   279.8480 F222M     1152    20      INDEF
INDEF  -14.5096   22.7917  -174.394  1.0000   y   -   -   -   -   -   -   -
  k25_40_054  n52f40lzq  279:20:40:29   279.8615 F222M     1472    25      INDEF
INDEF  -14.4927   22.8235  -174.394  1.0000   y   -   -   -   -   -   -   -
  k25_41_018  n52f41mhq  279:22:19:44   279.9304 F222M     1472    25      INDEF
INDEF    7.0420   18.7053  -173.691  1.0000   y   -   -   -   -   -   -   -
  k15_41_043  n52f41mzq  279:23:41:44   279.9873 F222M      832    15      INDEF
INDEF    4.4186   43.2062  -173.691  1.0000   y   -   -   -   -   -   -   -
  k15_41_044  n52f41n3q  279:23:55:45   279.9970 F222M      832    15      INDEF
INDEF    4.3907   43.1834  -173.691  1.0000   y   -   -   -   -   -   -   -
  k20_41_063  n52f41nkq  280:01:08:12   280.0474 F222M     1152    20      INDEF
INDEF    5.6099   30.9540  -173.691  1.0000   y   -   -   -   -   -   -   -
  k25_41_064  n52f41noq  280:01:27:33   280.0608 F222M     1472    25      INDEF
INDEF    5.5033   30.9134  -173.691  1.0000   y   -   -   -   -   -   -   -
  k20_41_083  n52f41o5q  280:02:45:40   280.1151 F222M     1152    20      INDEF
INDEF    6.9333   18.5841  -173.691  1.0000   y   -   -   -   -   -   -   -
  k25_41_084  n52f41o9q  280:03:05:01   280.1285 F222M     1472    25      INDEF
INDEF    6.9224   18.5931  -173.691  1.0000   y   -   -   -   -   -   -   -
  k25_42_124  n52f42ozq  280:06:28:04   280.2695 F222M     1472    25      INDEF
INDEF  -12.5755   -1.5457  -174.399  1.0000   y   -   -   -   -   -   -   -
  k20_42_143  n52f42pgq  280:08:09:59   280.3403 F222M     1152    20      INDEF
INDEF  -12.6559   -1.4431  -174.398  1.0000   y   -   -   -   -   -   -   -
  k15_42_163  n52f42pyq  280:09:50:22   280.4100 F222M      832    15      INDEF
INDEF  -15.4325   23.0831  -174.399  1.0000   y   -   -   -   -   -   -   -
  k15_43_083  n52f43rhq  280:17:22:29   280.7239 F222M      832    15      INDEF
INDEF    6.9145   18.6727  -173.691  1.0000   y   -   -   -   -   -   -   -
  k20_44_073  n52f44uxq  280:21:50:39   280.9102 F222M     1152    20      INDEF
INDEF   13.5086   38.2194  -173.392  1.0000   y   -   -   -   -   -   -   -
  k25_44_074  n52f44v0q  280:22:10:00   280.9236 F222M     1472    25      INDEF
INDEF   13.3554   38.2446  -173.392  1.0000   y   -   -   -   -   -   -   -
  k25_44_133  n52f44vkq  280:23:51:17   280.9940 F222M     1472    25      INDEF
INDEF    1.2540   36.8471  -173.393  1.0000   y   -   -   -   -   -   -   -
  k15_47_044  n52f47bdq  281:17:34:15   281.7321 F222M      832    15      INDEF
INDEF  -26.9454   -5.4265  -174.892  1.0000   y   -   -   -   y   -   -   -   CR-9
  k15_47_064  n52f47bsq  281:19:08:25   281.7975 F222M      832    15      INDEF
INDEF  -26.9286   -5.4952  -174.893  1.0000   y   -   -   -   -   -   -   -
  k15_47_084  n52f47c7q  281:20:50:01   281.8681 F222M      832    15      INDEF
INDEF  -26.8950   -5.5221  -174.893  1.0000   y   -   -   -   -   -   -   -
  k15_47_104  n52f47clq  281:22:26:58   281.9354 F222M      832    15      INDEF
INDEF  -26.9713   -5.4692  -174.893  1.0000   y   -   -   -   -   -   -   -   CR-11
  k15_47_124  n52f47czq  282:00:03:54   282.0027 F222M      832    15      INDEF
INDEF  -26.9374   -5.4056  -174.893  1.0000   y   -   -   -   -   -   -   -
  k15_47_144  n52f47ddq  282:01:40:49   282.0700 F222M      832    15      INDEF
INDEF  -27.0310   -5.4751  -174.893  1.0000   y   -   -   -   -   -   -   -
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STIS Flanking Fields Observing Log

Notes:

- This table was last updated: Tue Nov 3 14:55:58 EST 1998.
- The proposal **ID link** provides access to the relevant Phase 2 proposal information from the PRESTO website at STScI.
- The source of the **DQSKY** values are an iraf.stsdas.xstis.iterstat mean DN/S after 10 iterations of 5 sigma median clipping of the original HST pipeline products, rootname_crj.fits[100:1000,100:1000].

rootname	id	Linenum	Tdateobs	Ttimeobs	Texptime	Obsmode	Detector	Opt_elem	Aperture	CRsplit	Targname	DQ Sky (dn/s)	DQ Comments
o4y402010	8071	02.002	27/09/98	06:24:33	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.05399	-
o4y402020	8071	02.007	27/09/98	06:50:13	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.04788	-
o4y402030	8071	02.012	27/09/98	07:49:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.08246	-
o4y402040	8071	02.017	27/09/98	08:16:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS1	0.04720	-
o4y404010	8071	04.002	27/09/98	09:37:26	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.05554	-
o4y404020	8071	04.007	27/09/98	10:03:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.04830	-
o4y404030	8071	04.012	27/09/98	11:17:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.05177	-
o4y404040	8071	04.017	27/09/98	12:59:29	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS3	0.04850	-
o4y403010	8071	03.002	09/10/98	23:39:21	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.04885	-
o4y403020	8071	03.007	10/10/98	00:05:01	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.07934	-
o4y403030	8071	03.012	10/10/98	01:10:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.04889	-
o4y403040	8071	03.017	10/10/98	01:37:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS2	0.05935	-
o4y408010	8071	08.002	10/10/98	12:51:38	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.04955	-
o4y408020	8071	08.007	10/10/98	14:05:11	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.04785	-
o4y408030	8071	08.012	10/10/98	14:33:11	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.06275	-
o4y408040	8071	08.017	10/10/98	15:41:58	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS7	0.04790	-
o4y405010	8071	05.002	10/10/98	19:25:47	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.07114	-
o4y405020	8071	05.007	10/10/98	20:32:21	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.04845	-
o4y405030	8071	05.012	10/10/98	21:00:21	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.06345	-
o4y405040	8071	05.017	10/10/98	22:09:09	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS4	0.04809	-
o4y409010	8071	09.002	11/10/98	13:03:52	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.05131	-
o4y409020	8071	09.007	11/10/98	14:17:02	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.04886	-
o4y409030	8071	09.012	11/10/98	14:45:02	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.06957	-
o4y409040	8071	09.017	11/10/98	15:53:47	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS8	0.04901	-
o4y406010	8071	06.002	11/10/98	17:32:57	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.04853	-
o4y406020	8071	06.007	11/10/98	17:58:37	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.07059	-
o4y406030	8071	06.012	11/10/98	19:07:03	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.04864	-
o4y406040	8071	06.017	11/10/98	19:34:03	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS5	0.06171	-
o4y407010	8071	07.002	11/10/98	20:46:26	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.04867	-
o4y407020	8071	07.007	11/10/98	21:12:06	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.06441	-
o4y407030	8071	07.012	11/10/98	22:20:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.04878	-
o4y407040	8071	07.017	11/10/98	22:47:35	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS6	0.05985	-
o4y410010	8071	10.002	12/10/98	14:29:31	1200.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.04952	-
o4y410020	8071	10.007	12/10/98	14:55:11	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.06231	-
o4y410030	8071	10.012	12/10/98	16:04:55	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.04923	-
o4y410040	8071	10.017	12/10/98	16:31:55	1300.0	ACCUM	CCD	MIRVIS	50CCD	2	POS9	0.06199	-
o4y412010	8071	12.001	14/10/98	13:14:21	2800.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05406	-
o4y412020	8071	12.009	14/10/98	14:49:40	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05494	-
o4y412030	8071	12.017	14/10/98	16:26:25	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05459	-
o4y412040	8071	12.025	14/10/98	18:03:08	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05440	-
o4y412050	8071	12.033	14/10/98	19:39:52	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05394	-
o4y411010	8071	11.001	29/10/98	11:07:26	2800.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05343	-
o4y411020	8071	11.009	29/10/98	12:41:07	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05372	-
o4y411030	8071	11.017	29/10/98	14:17:49	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05595	-
o4y411040	8071	11.025	29/10/98	15:54:33	2900.0	ACCUM	CCD	MIRVIS	50CCD	2	STIS_on_NIC	0.05556	-

This page was last updated on November 23, 1998.

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WFPC2 Flanking Fields Observing Logs

Two logs are available:

- Pipeline Log.
- Data Quality Log.

Pipeline Log

Notes:

- This table was last updated: Tue Nov 22, 1998.
- The **proposal ID** is the proposal containing the observation. See the Phase 2 information for details.
- Different fields are separeted by blank lines.

```
# |-----------------------------------Common to all files-----------------------------
-----------------|      |-------------PIPELINE specific----------------|
#image_id  prop  exp_start_UT     instru    mode_1    mode_2    exp_time    nom_RA
nom_DEC   nom_roll      time_pipeline   time_dq_pipeline   comments_pipe
U4Y40201R  8071  09/20/98 06:25:14  WFPC2   F814W   n/a       1200.000  22 33 05.711
-60 31 58.446  230.496   14:28    14:28    none
U4Y40202R  8071  09/20/98 06:51:14  WFPC2   F814W   n/a       1300.000  22 33 05.435
-60 31 58.762  230.497   14:30    14:30    none
U4Y40203R  8071  09/20/98 07:50:14  WFPC2   F814W   n/a       1300.000  22 33 05.975
-60 31 59.125  230.495   14:30    14:30    none
U4Y40204R  8071  09/20/98 08:17:14  WFPC2   F814W   n/a       1300.000  22 33 05.803
-60 31 56.499  230.496   14:31    14:31    none

U4Y40401R  8071  09/20/98 09:38:14  WFPC2   F814W   n/a       1200.000  22 33 13.741
-60 34 30.446  230.496   14:32    14:32    none
U4Y40402R  8071  09/20/98 10:04:14  WFPC2   F814W   n/a       1300.000  22 33 13.465
-60 34 30.762  230.497   14:32    14:32    none
U4Y40403R  8071  09/20/98 11:18:14  WFPC2   F814W   n/a       1300.000  22 33 14.005
-60 34 31.125  230.495   14:33    14:33    none
U4Y40404R  8071  09/27/98 13:00:14  WFPC2   F814W   n/a       1300.000  22 33 13.833
-60 34 28.499  230.496   14:33    14:33    none

U4Y40301R  8071  10/09/98 23:39:14  WFPC2   F814W   n/a       1200.000  22 32 45.154
-60 34 10.446  230.496   11:15    11:15    none
U4Y40302R  8071  10/10/98 00:05:14  WFPC2   F814W   n/a       1300.000  22 32 44.878
-60 34 10.762  230.497   11:16    11:16    none
U4Y40303R  8071  10/10/98 01:11:14  WFPC2   F814W   n/a       1300.000  22 32 45.418
-60 34 11.125  230.495   11:17    11:17    none
U4Y40304R  8071  10/10/98 01:38:14  WFPC2   F814W   n/a       1300.000  22 32 45.246
-60 34 08.499  230.496   11:18    11:18    none

U4Y40501R  8071  10/10/98 19:26:14  WFPC2   F814W   n/a       1200.000  22 33 23.869
-60 33 21.446  230.496   11:19    11:19    none
U4Y40502R  8071  10/10/98 20:33:14  WFPC2   F814W   n/a       1300.000  22 33 23.593
-60 33 21.762  230.497   11:19    11:19    none
U4Y40503R  8071  10/10/98 21:01:14  WFPC2   F814W   n/a       1300.000  22 33 24.133
-60 33 22.125  230.495   11:20    11:20    none
U4Y40504R  8071  10/10/98 22:10:14  WFPC2   F814W   n/a       1300.000  22 33 23.962
-60 33 19.499  230.496   11:20    11:20    none

U4Y40601R  8071  10/11/98 17:33:14  WFPC2   F814W   n/a       1200.000  22 33 03.213
-60 35 35.446  230.496   11:21    11:21    none
U4Y40602R  8071  10/11/98 17:59:14  WFPC2   F814W   n/a       1300.000  22 33 02.936
-60 35 35.762  230.497   11:22    11:22    none
U4Y40603R  8071  10/11/98 19:07:14  WFPC2   F814W   n/a       1300.000  22 33 03.477
-60 35 36.125  230.495   11:22    11:22    none
U4Y40604R  8071  10/11/98 19:34:14  WFPC2   F814W   n/a       1300.000  22 33 03.305
-60 35 33.499  230.496   11:23    11:23    none

U4Y40701R  8071  10/11/98 20:47:14  WFPC2   F814W   n/a       1200.000  22 32 52.684
-60 36 39.446  230.496   11:24    11:24    none
U4Y40702R  8071  10/11/98 21:13:14  WFPC2   F814W   n/a       1300.000  22 32 52.407
-60 36 39.762  230.497   11:24    11:24    none
U4Y40703R  8071  10/11/98 22:21:14  WFPC2   F814W   n/a       1300.000  22 32 52.949
-60 36 40.125  230.495   11:25    11:25    none
U4Y40704R  8071  10/11/98 22:48:14  WFPC2   F814W   n/a       1300.000  22 32 52.776
-60 36 37.499  230.496   11:26    11:26    none

U4Y40801R  8071  10/10/98 12:52:14  WFPC2   F814W   n/a       1200.000  22 33 34.298
-60 32 18.446  230.496   11:26    11:26    none
U4Y40802R  8071  10/10/98 14:06:14  WFPC2   F814W   n/a       1300.000  22 33 34.022
-60 32 18.762  230.497   11:27    11:27    none
U4Y40803M  8071  10/10/98 14:34:14  WFPC2   F814W   n/a       1300.000  22 33 34.562
-60 32 19.125  230.495   11:27    11:27    none
U4Y40804R  8071  10/10/98 15:42:14  WFPC2   F814W   n/a       1300.000  22 33 34.390
-60 32 16.499  230.496   11:27    11:27    none

U4Y40901R  8071  10/11/98 13:04:14  WFPC2   F814W   n/a       1200.000  22 33 42.128
-60 34 16.446  230.496   11:28    11:28    none
U4Y40902R  8071  10/11/98 14:17:14  WFPC2   F814W   n/a       1300.000  22 33 41.852
-60 34 16.762  230.497   11:28    11:28    none
U4Y40903R  8071  10/11/98 14:45:14  WFPC2   F814W   n/a       1300.000  22 33 42.392
-60 34 17.125  230.495   11:29    11:29    none
U4Y40904R  8071  10/11/98 15:54:14  WFPC2   F814W   n/a       1300.000  22 33 42.220
-60 34 14.499  230.496   11:30    11:30    none

U4Y41001R  8071  10/12/98 14:30:14  WFPC2   F814W   n/a       1200.000  22 32 51.685
-60 38 16.446  230.496   11:30    11:30    none
U4Y41002R  8071  10/12/98 14:56:14  WFPC2   F814W   n/a       1300.000  22 32 51.408
-60 38 16.762  230.497   11:31    11:31    none
U4Y41003R  8071  10/12/98 16:05:14  WFPC2   F814W   n/a       1300.000  22 32 51.950
-60 38 17.125  230.495   11:31    11:31    none
U4Y41004R  8071  10/12/98 16:32:14  WFPC2   F814W   n/a       1300.000  22 32 51.777
-60 38 14.499  230.496   11:32    11:32    none

U4Y41201R  8071  10/14/98 13:15:14  WFPC2   F814W   n/a       1100.000  22 32 09.157
-60 38 21.336  230.655   11:53    11:53    none
U4Y41202R  8071  10/14/98 13:36:14  WFPC2   F814W   n/a       1100.000  22 32 09.157
-60 38 21.336  230.655   11:54    11:54    none
U4Y41203R  8071  10/14/98 14:51:14  WFPC2   F814W   n/a       1200.000  22 32 09.401
-60 38 23.524  230.654   11:54    11:54    none
U4Y41204R  8071  10/14/98 15:14:14  WFPC2   F814W   n/a       1200.000  22 32 09.401
-60 38 23.524  230.654   14:21    14:21    none
U4Y41205R  8071  10/14/98 16:28:14  WFPC2   F814W   n/a       1200.000  22 32 09.888
-60 38 27.900  230.652   14:22    14:22    none
U4Y41206R  8071  10/14/98 16:51:14  WFPC2   F814W   n/a       1200.000  22 32 09.888
-60 38 27.900  230.652   14:22    14:22    none
U4Y41207R  8071  10/14/98 18:05:14  WFPC2   F814W   n/a       1200.000  22 32 10.024
-60 38 27.999  230.652   14:24    14:24    none
U4Y41208R  8071  10/14/98 18:28:14  WFPC2   F814W   n/a       1200.000  22 32 10.024
-60 38 27.999  230.652   14:24    14:24    none
U4Y41209R  8071  10/14/98 19:41:14  WFPC2   F814W   n/a       1200.000  22 32 09.266
-60 38 23.426  230.654   14:25    14:25    none
U4Y4120AR  8071  10/14/98 20:04:14  WFPC2   F814W   n/a       1200.000  22 32 09.266
-60 38 23.426  230.654   14:26    14:26    none

U4Y41101R  8071  10/29/98 11:09:14  WFPC2   F606W   n/a       1100.000  22 32 09.645
-60 38 25.712  230.653   16:37    16:37    none
U4Y41102R  8071  10/29/98 11:30:14  WFPC2   F606W   n/a       1100.000  22 32 09.645
-60 38 25.712  230.653   16:39    16:39    none
U4Y41103R  8071  10/29/98 12:43:14  WFPC2   F606W   n/a       1200.000  22 32 08.670
-60 38 16.961  230.656   16:40    16:40    none
U4Y41104R  8071  10/29/98 13:06:14  WFPC2   F606W   n/a       1200.000  22 32 08.670
-60 38 16.961  230.656   16:42    16:42    none
U4Y41105R  8071  10/29/98 14:19:14  WFPC2   F606W   n/a       1200.000  22 32 10.620
-60 38 34.464  230.649   16:44    16:44    none
U4Y41106R  8071  10/29/98 14:42:14  WFPC2   F606W   n/a       1200.000  22 32 10.620
-60 38 34.464  230.649   16:46    16:46    none
U4Y41107R  8071  10/29/98 15:56:14  WFPC2   F606W   n/a       1200.000  22 32 10.132
-60 38 30.088  230.651   16:48    16:48    none
U4Y41108R  8071  10/29/98 16:19:14  WFPC2   F606W   n/a       1200.000  22 32 10.132
-60 38 30.088  230.651   16:49    16:49    none
```

Data Quality Log

Notes:

- This table was last updated: Tue Nov 22, 1998.
- The **proposal ID** is the proposal containing the observation. See the Phase 2 information for details.
- **Charge traps and bad columns** are indicated by the following numbers:
  - [1]: column 527
  - [2]: column 337
  - [3]: columns 251+397
  - [4]: column 441
- **time_dq** is not filled in until DQ has been performed.
- **ds** stands for "diffraction spikes".
- Different fields are separeted by blank lines.

```
# |-   --------------------------------Common to all files-----------------------------
-------------------------|  |----------DQ specific----------------|
# image_id  propid  exp_start_UT     instru    mode_1  mode_2    exp_time  nom_RA
nom_DEC        nom_roll  time_dq       time_mask     comments_dq
 U4Y40201R  8071  09/27/98 06:25:14  WFPC2     F814W   n/a       1200.000  22 33
05.711  -60 31 58.446  230.496   Sep 28 16:33  Sep 28 17:50  [2] 2 ds; [3] 1 ds; [4]
1 ds, ghost=614:319(masked).
 U4Y40202R  8071  09/27/98 06:51:14  WFPC2     F814W   n/a       1300.000  22 33
05.435  -60 31 58.762  230.497   Sep 29 15:35  Sep 28 17:50  [2] 2 ds; [3] 2 ds,
ghost=432:159(masked); [4] 1 ds, ghost=588:327(masked).
 U4Y40203R  8071  09/27/98 07:50:14  WFPC2     F814W   n/a       1300.000  22 33
05.975  -60 31 59.125  230.495   Sep 29 15:41  Sep 28 17:50  [2] 1 ds; [3] 1 ds,
ghost=431:213(masked); [4] 1 ds, ghost=641:325(masked).
 U4Y40204R  8071  09/27/98 08:17:14  WFPC2     F814W   n/a       1300.000  22 33
05.803  -60 31 56.499  230.496   Sep 29 15:53  Sep 28 17:50  [2] 1 ds; [3] 1 ds,
ghost=464:193(masked); [4] 1 ds, ghost=620:293(masked).

 U4Y40301R  8071  10/09/98 23:39:14  WFPC2     F814W   n/a       1200.000  22 32
45.154  -60 34 10.446  230.496   Oct 13 19:20  n/a           nothing
 U4Y40302R  8071  10/10/98 00:05:14  WFPC2     F814W   n/a       1300.000  22 32
44.878  -60 34 10.762  230.497   Oct 13 19:23  n/a           [2,3,4] Earth cross; [4]
moving target (not masked).
 U4Y40303R  8071  10/10/98 01:11:14  WFPC2     F814W   n/a       1300.000  22 32
45.418  -60 34 11.125  230.495   Oct 13 19:25  n/a           nothing
 U4Y40304R  8071  10/10/98 01:38:14  WFPC2     F814W   n/a       1300.000  22 32
45.246  -60 34 08.499  230.496   Oct 13 19:29  Oct 13 19:55  [1] residual trail at
[90:94,1:598] (masked).

 U4Y40401R  8071  09/27/98 09:38:14  WFPC2     F814W   n/a       1200.000  22 33
13.741  -60 34 30.446  230.496   Sep 29 16:13  n/a           [1] moving target(not
masked); [2] moving target(not masked); [4] 1 ds, moving target(not masked).
 U4Y40402R  8071  09/27/98 10:04:14  WFPC2     F814W   n/a       1300.000  22 33
13.465  -60 34 30.762  230.497   Sep 29 16:49  n/a           nothing
 U4Y40403R  8071  09/27/98 11:18:14  WFPC2     F814W   n/a       1300.000  22 33
14.005  -60 34 31.125  230.495   Sep 29 16:58  n/a           nothing
 U4Y40404R  8071  09/27/98 13:00:14  WFPC2     F814W   n/a       1300.000  22 33
13.833  -60 34 28.499  230.496   Sep 30 10:25  n/a           nothing

 U4Y40501R  8071  10/10/98 19:26:14  WFPC2     F814W   n/a       1200.000  22 33
23.869  -60 33 21.446  230.496   Oct 13 15:55  n/a           [3,4] Earth cross.
 U4Y40502R  8071  10/10/98 20:33:14  WFPC2     F814W   n/a       1300.000  22 33
23.593  -60 33 21.762  230.497   Oct 13 16:02  n/a           [4] horizontal smearing
of saturated star (not masked).
 U4Y40503R  8071  10/10/98 21:01:14  WFPC2     F814W   n/a       1300.000  22 33
24.133  -60 33 22.125  230.495   Oct 13 16:09  Oct 13 19:56  [3,4] Earth cross, [4]
horizontal smearing of saturated star (not masked), [4] residual trail at
[700:709,1:500] (masked).
 U4Y40504R  8071  10/10/98 22:10:14  WFPC2     F814W   n/a       1300.000  22 33
23.962  -60 33 19.499  230.496   Oct 13 16:21  n/a           [4] horizontal smearing
of saturated star (not masked).

 U4Y40601R  8071  10/11/98 17:33:14  WFPC2     F814W   n/a       1200.000  22 33
03.213  -60 35 35.446  230.496   Oct 13 16:27  Oct 13 19:57  [2] ghost at
[153:163,219:229] (masked).
 U4Y40602R  8071  10/11/98 17:59:14  WFPC2     F814W   n/a       1300.000  22 33
02.936  -60 35 35.762  230.497   Oct 13 16:28  Oct 13 19:58  [2] moving target (top
to bottom, not masked), ghost at [181:189,213:221] and residual trail at
[399:409,1:800] (both masked); [3,4] Earth cross.
 U4Y40603R  8071  10/11/98 19:07:14  WFPC2     F814W   n/a       1300.000  22 33
03.477  -60 35 36.125  230.495   Oct 13 16:33  Oct 13 20:00  [2] ghost at
[125:136,211:222] (masked).
 U4Y40604R  8071  10/11/98 19:34:14  WFPC2     F814W   n/a       1300.000  22 33
03.305  -60 35 33.499  230.496   Oct 13 17:06  Oct 13 20:02  [2] ghost at
[147:159,245:257] and residual trail at [380:388,1:800] (both masked), [3,4] slight
Earth cross?

 U4Y40701R  8071  10/11/98 20:47:14  WFPC2     F814W   n/a       1200.000  22 32
52.684  -60 36 39.446  230.496   Oct 13 17:14  Oct 13 20:04  [2] ghost at
[271:281,643:653] (masked).
 U4Y40702R  8071  10/11/98 21:13:14  WFPC2     F814W   n/a       1300.000  22 32
52.407  -60 36 39.762  230.497   Oct 13 17:19  Oct 13 20:06  [2] ghost at
[297:307,636:646] (masked); [3,4] Earth cross.
 U4Y40703R  8071  10/11/98 22:21:14  WFPC2     F814W   n/a       1300.000  22 32
52.949  -60 36 40.125  230.495   Oct 13 17:22  Oct 13 20:08  [2] ghost at
```

```
[244:254,636:646] (masked).
 U4Y40704R  8071  10/11/98 22:48:14  WFPC2     F814W   n/a       1300.000  22 32
52.776  -60 36 37.499  230.496   Oct 13 17:25  Oct 13 20:10  [2] ghost at
[263:273,671:681] and residual trail at [279:286,1:600] (both masked); [3,4] slight
Earth cross.

 U4Y40801R  8071  10/10/98 12:52:14  WFPC2     F814W   n/a       1200.000  22 33
34.298  -60 32 18.446  230.496   Oct 13 17:40  n/a           nothing
 U4Y40802R  8071  10/10/98 14:06:14  WFPC2     F814W   n/a       1300.000  22 33
34.022  -60 32 18.762  230.497   Oct 13 17:44  n/a           nothing
 U4Y40803M  8071  10/10/98 14:34:14  WFPC2     F814W   n/a       1300.000  22 33
34.562  -60 32 19.125  230.495   Oct 13 17:46  n/a           [3,4] Earth cross.
 U4Y40804R  8071  10/10/98 15:42:14  WFPC2     F814W   n/a       1300.000  22 33
34.390  -60 32 16.499  230.496   Oct 13 17:48  n/a           nothing

 U4Y40901R  8071  10/11/98 13:04:14  WFPC2     F814W   n/a       1200.000  22 33
42.128  -60 34 16.446  230.496   Oct 13 17:50  n/a           nothing
 U4Y40902R  8071  10/11/98 14:17:14  WFPC2     F814W   n/a       1300.000  22 33
41.852  -60 34 16.762  230.497   Oct 13 17:55  n/a           nothing
 U4Y40903R  8071  10/11/98 14:45:14  WFPC2     F814W   n/a       1300.000  22 33
42.392  -60 34 17.125  230.495   Oct 13 17:59  n/a           [3,4] Earth cross.
 U4Y40904R  8071  10/11/98 15:54:14  WFPC2     F814W   n/a       1300.000  22 33
42.220  -60 34 14.499  230.496   Oct 13 18:02  n/a           nothing

 U4Y41001R  8071  10/12/98 14:30:14  WFPC2     F814W   n/a       1200.000  22 32
51.685  -60 38 16.446  230.496   Oct 13 19:34  n/a           nothing
 U4Y41002R  8071  10/12/98 14:56:14  WFPC2     F814W   n/a       1300.000  22 32
51.408  -60 38 16.762  230.497   Oct 13 19:36  n/a           [3,4] Earth cross.
 U4Y41003R  8071  10/12/98 16:05:14  WFPC2     F814W   n/a       1300.000  22 32
51.950  -60 38 17.125  230.495   Oct 13 19:38  n/a           nothing
 U4Y41004R  8071  10/12/98 16:32:14  WFPC2     F814W   n/a       1300.000  22 32
51.777  -60 38 14.499  230.496   Oct 13 19:40  n/a           [1,2,3] huge double?
moving target; [3,4] Earth cross.

 U4Y41101R  8071  10/29/98 11:09:14  WFPC2     F606W   n/a       1100.000  22 32
09.645  -60 38 25.712  230.653   Nov 02 15:09  n/a           nothing
 U4Y41102R  8071  10/29/98 11:30:14  WFPC2     F606W   n/a       1100.000  22 32
09.645  -60 38 25.712  230.653   Nov 02 15:21  n/a           nothing
 U4Y41103R  8071  10/29/98 12:43:14  WFPC2     F606W   n/a       1200.000  22 32
08.670  -60 38 16.961  230.656   Nov 02 15:33  n/a           nothing
 U4Y41104R  8071  10/29/98 13:06:14  WFPC2     F606W   n/a       1200.000  22 32
08.670  -60 38 16.961  230.656   Nov 02 15:42  n/a           nothing
 U4Y41105R  8071  10/29/98 14:19:14  WFPC2     F606W   n/a       1200.000  22 32
10.620  -60 38 34.464  230.649   Nov 02 15:44  n/a           nothing
 U4Y41106R  8071  10/29/98 14:42:14  WFPC2     F606W   n/a       1200.000  22 32
10.620  -60 38 34.464  230.649   Nov 02 15:46  n/a           nothing
 U4Y41107R  8071  10/29/98 15:56:14  WFPC2     F606W   n/a       1200.000  22 32
10.132  -60 38 30.088  230.651   Nov 02 15:50  n/a           nothing
 U4Y41108R  8071  10/29/98 16:19:14  WFPC2     F606W   n/a       1200.000  22 32
10.132  -60 38 30.088  230.651   Nov 02 15:53  n/a           nothing

 U4Y41201R  8071  10/14/98 13:15:14  WFPC2     F814W   n/a       1100.000  22 32
09.157  -60 38 21.336  230.655   Oct 16 18:08  n/a           nothing
 U4Y41202R  8071  10/14/98 13:36:14  WFPC2     F814W   n/a       1100.000  22 32
09.157  -60 38 21.336  230.655   Oct 16 18:10  n/a           nothing, but 1 RECENTER
 U4Y41203R  8071  10/14/98 14:51:14  WFPC2     F814W   n/a       1200.000  22 32
09.401  -60 38 23.524  230.654   Oct 16 18:12  n/a           nothing
 U4Y41204R  8071  10/14/98 15:14:14  WFPC2     F814W   n/a       1200.000  22 32
09.401  -60 38 23.524  230.654   Oct 20 13:30  n/a           nothing, but 2 RECENTER
 U4Y41205R  8071  10/14/98 16:28:14  WFPC2     F814W   n/a       1200.000  22 32
09.888  -60 38 27.900  230.652   Oct 20 13:32  n/a           nothing
 U4Y41206R  8071  10/14/98 16:51:14  WFPC2     F814W   n/a       1200.000  22 32
09.888  -60 38 27.900  230.652   Oct 20 13:35  n/a           nothing
 U4Y41207R  8071  10/14/98 18:05:14  WFPC2     F814W   n/a       1200.000  22 32
10.024  -60 38 27.999  230.652   Oct 20 13:40  n/a           nothing
 U4Y41208R  8071  10/14/98 18:28:14  WFPC2     F814W   n/a       1200.000  22 32
10.024  -60 38 27.999  230.652   Oct 20 13:43  Oct 20 14:00  [1] residual trails at
[530:534,1:800], [572:573,1:800], [675:676,1:347]; [3] residual trail at
[230:232,1:800] (all masked).
 U4Y41209R  8071  10/14/98 19:41:14  WFPC2     F814W   n/a       1200.000  22 32
09.266  -60 38 23.426  230.654   Oct 20 13:50  n/a           nothing
 U4Y4120AR  8071  10/14/98 20:04:14  WFPC2     F814W   n/a       1200.000  22 32
09.266  -60 38 23.426  230.654   Oct 20 13:53  n/a           nothing, but 1 RECENTER
```

NICMOS Flanking Fields Observing Log

Logfile for the Hubble Deep Field South NICMOS Flanking Field observations. This listing contains basic information about the datasets, as well as a few useful "derived quantities" (e.g. an approximate measure of sky brightness, useful for screening out data with high background levels), and comments based on a preliminary visual inspection.

Note: The images have been named in such a way as to make the names more useful.

Image naming convention: prefixNN_VV_LLL

```
prefix: flnk - flanking field

NN:     flanking field ID (note that ff10 and ff11 are
        the same field)

VV:     not used

LLL:    Exposure logsheet line number
        from the proposal
```

The original suffixes have been retained. For each image there should be 6 files associated with it. They are:

- raw - raw image no calibration
- ima - pipeline calibrated individual reads
- cal - pipeline calibrated and crrej image
- spt - engineering telemetry
- jif - jitter image
- jit - jitter file

```
*********************************************************************************************************
Image = Filename
Oldim = Original dataset name (in the archive)
UT_observed = Obs start time (DDD:HH:MM:SS 1998)
Daynum = Obs start time (UT decimal day)
Filt = Filter
Exp = Exposure time in seconds
Ns  = Number of samples
Sky = Mean "sky" background in DN/s
RMS = Sky rms in DN/s (excluding objects and vignetted region)
Xsh = X shift from reference image in pixels
Ysh = Y shift from reference image in pixels
Ori = rotation angle from reference image in degrees
Wt  = Weight used for final drizzled mosaic
USED = Image was used in final drizzled mosaic
A = Scattered light  -- Determined from plots of the first differences between imsets
B = SAA impacted (CR persistence) -- Flagged if occurred within 90min of SAA exit
(Check image rms for significance)
C = Moving objects
D = Large cosmic ray hits
E = Bars (horizontal)
F = Bands (vertical)
G = Quadrant bias jumps
Comments = Data quality comments (CR=giant cosmic ray, MO=moving object, Number
indicates in which read it occurred)
*********************************************************************************************************
```

```
   Image       Oldim     UT_observed    Daynum   Filt      Exp     Ns   Sky       RMS
Xsh       Ysh       Ori     Wt    USED  A   B   C   D   E   F   G   Comments
-------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------
----------
  flnk1_003   n4y402cyq  270:06:24:24   270.2669 F160W     1344    23 7.10000E-5
0.00545     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-
6,10,17,streaks
  flnk1_008   n4y402d3q  270:06:50:22   270.2850 F160W     1344    23 2.48000E-4
0.00530     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-
5,streaks
  flnk1_013   n4y402dbq  270:07:49:15   270.3259 F160W     1344    23 3.15000E-5
0.00575     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-6
  flnk1_018   n4y402dhq  270:08:16:15   270.3446 F160W     1344    23 4.66000E-5
0.00511     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk3_003   n4y404dpq  270:09:37:17   270.4009 F160W     1344    23 2.13000E-5
0.00528     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk3_008   n4y404duq  270:10:03:15   270.4189 F160W     1344    23 2.26000E-4
0.00519     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk3_013   n4y404e2q  270:11:17:44   270.4706 F160W     1344    23 3.91000E-4
0.00676     INDEF     INDEF     INDEF   INDEF   y   -   y   -   -   -   -   -
  flnk3_018   n4y404e8q  270:12:59:38   270.5414 F160W     1344    23    0.00222
0.01220     INDEF     INDEF     INDEF   INDEF   y   -   y   -   -   -   -   -
  flnk2_003   n4y403glq  282:23:39:12   282.9856 F160W     1344    23 9.19000E-5
0.00520     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-
7,16
  flnk2_008   n4y403gqq  283:00:05:10   283.0036 F160W     1344    23 2.51000E-4
0.00565     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-2
  flnk2_013   n4y403gyq  283:01:10:44   283.0491 F160W     1344    23 3.80000E-5
0.00529     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk2_018   n4y403h4q  283:01:37:44   283.0679 F160W     1344    23 5.36000E-5
0.00528     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-21
  flnk7_003   n4y408jvq  283:12:51:29   283.5357 F160W     1344    23 -2.0200E-4
0.00592     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-11
  flnk7_008   n4y408k0q  283:14:05:20   283.5870 F160W     1344    23 7.17000E-5
0.00651     INDEF     INDEF     INDEF   INDEF   y   -   y   -   -   -   -   -
  flnk7_013   n4y408k8q  283:14:33:20   283.6065 F160W     1344    23 9.96000E-5
0.00576     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk7_018   n4y408keq  283:15:42:07   283.6542 F160W     1344    23 4.50000E-5
0.00561     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk4_003   n4y405lhq  283:19:25:38   283.8095 F160W     1344    23 2.02000E-5
0.00553     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk4_008   n4y405lmq  283:20:32:30   283.8559 F160W     1344    23 5.24000E-5
0.00489     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-8
  flnk4_013   n4y405luq  283:21:00:30   283.8753 F160W     1344    23 1.58000E-4
0.00508     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk4_018   n4y405m0q  283:22:09:18   283.9231 F160W     1344    23 -1.2900E-5
0.00499     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-17
  flnk8_003   n4y409w8q  284:13:03:43   284.5443 F160W     1344    23 2.25000E-4
0.00623     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk8_008   n4y409wdq  284:14:17:11   284.5953 F160W     1344    23 5.45000E-4
0.00656     INDEF     INDEF     INDEF   INDEF   y   -   y   -   -   -   -   -
  flnk8_013   n4y409wlq  284:14:45:11   284.6147 F160W     1344    23 6.09000E-4
0.00635     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-
9,15
  flnk8_018   n4y409wrq  284:15:53:56   284.6624 F160W     1344    23 4.34000E-4
0.00579     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk5_003   n4y406x1q  284:17:32:48   284.7311 F160W     1344    23 5.96000E-5
0.00517     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-18
  flnk5_008   n4y406x6q  284:17:58:46   284.7491 F160W     1344    23 1.45000E-4
0.00553     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-
4,9
  flnk5_013   n4y406xeq  284:19:07:12   284.7967 F160W     1344    23 1.43000E-5
0.00514     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk5_018   n4y406xkq  284:19:34:12   284.8154 F160W     1344    23 1.91000E-4
0.00543     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk6_003   n4y407xsq  284:20:46:17   284.8655 F160W     1344    23 2.64000E-4
0.00520     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk6_008   n4y407xxq  284:21:12:15   284.8835 F160W     1344    23 4.94000E-4
0.00569     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-
7,19
  flnk6_013   n4y407y5q  284:22:20:44   284.9311 F160W     1344    23 3.00000E-5
0.00527     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk6_018   n4y407ybq  284:22:47:44   284.9498 F160W     1344    23 1.46000E-4
0.00544     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk9_003   n4y410e7q  285:14:29:22   285.6037 F160W     1344    23 1.49000E-4
0.00554     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk9_008   n4y410ecq  285:14:55:20   285.6218 F160W     1344    23 1.86000E-4
0.00528     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk9_013   n4y410ekq  285:16:05:04   285.6702 F160W     1344    23 8.26000E-5
0.00511     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk9_018   n4y410eqq  285:16:32:04   285.6889 F160W     1344    23 2.56000E-4
0.00537     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk11_003  n4y412tjq  287:13:14:12   287.5515 F110W     1408    24 4.13708E-4
0.00614     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk11_004  n4y412tmq  287:13:38:03   287.5681 F110W     1408    24 -2.4078E-4
0.00653     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-12
  flnk11_011  n4y412tuq  287:14:49:49   287.6179 F160W     1472    25 3.22453E-4
0.00588     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk11_012  n4y412tzq  287:15:14:44   287.6352 F110W     1472    25 -2.4116E-4
0.00664     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk11_019  n4y412u6q  287:16:26:34   287.6851 F160W     1472    25 3.43939E-4
0.00591     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk11_020  n4y412ubq  287:16:51:29   287.7024 F110W     1472    25 -3.0413E-4
0.00651     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk11_027  n4y412uiq  287:18:03:17   287.7523 F160W     1472    25 3.22894E-4
0.00586     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk11_028  n4y412unq  287:18:28:12   287.7696 F110W     1472    25 -2.8591E-4
0.00655     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk11_035  n4y412uuq  287:19:40:01   287.8195 F160W     1472    25 2.24079E-4
0.00585     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk11_036  n4y412uzq  287:20:04:56   287.8368 F110W     1472    25 -1.2977E-4
0.00672     INDEF     INDEF     INDEF   INDEF   y   y   -   -   y   -   -   -   CR-
2,10
  flnk10_003  n4y411u5q  302:11:07:16   302.4634 F160W     1408    24 2.68843E-4
0.00659     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk10_004  n4y411u8q  302:11:31:07   302.4799 F110W     1408    24 6.71544E-5
0.00621     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk10_011  n4y411ugq  302:12:41:15   302.5287 F160W     1472    25 2.70093E-5
0.00637     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
  flnk10_012  n4y411ulq  302:13:06:10   302.5460 F110W     1472    25 -1.2813E-5
0.00542     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-
4,22,23
  flnk10_019  n4y411usq  302:14:17:57   302.5958 F160W     1472    25 2.54586E-4
0.00672     INDEF     INDEF     INDEF   INDEF   y   -   y   -   -   -   -   -   MO-17
  flnk10_020  n4y411uxq  302:14:42:52   302.6131 F110W     1472    25 1.07635E-4
0.00529     INDEF     INDEF     INDEF   INDEF   y   -   -   -   y   -   -   -   CR-18
  flnk10_027  n4y411v4q  302:15:54:41   302.6630 F160W     1472    25 2.70877E-4
0.00653     INDEF     INDEF     INDEF   INDEF   y   y   -   -   -   -   -   -
  flnk10_028  n4y411v9q  302:16:19:36   302.6803 F110W     1472    25 6.38344E-5
0.00538     INDEF     INDEF     INDEF   INDEF   y   -   -   -   -   -   -   -
```

SAA Crossing Table

The table below contains info on the passage of HST thru the South Atlantic Anomaly (SAA) during the HDF-S Campaign. Some observations may have been adversly affected by this. The table columns are:

- column 1: time of SAA entering
- column 2: time of SAA exit
- column 3: time in the SAA

The times for **enter** and **exit** are given in the format of decimal day number (i.e. day+hour/24+min/(24*60)+sec/(24*3600)); **timein** is given in minutes.

This table was last modified on Thu 13:21:16 08-Oct-98.

enter	exit	timein
269.57767	269.59839	29.833
269.64859	269.66785	27.717
269.72025	269.73727	24.533
269.79190	269.80679	21.433
269.86331	269.87595	18.233
269.93484	269.94351	12.467
270.38031	270.39420	19.983
270.44733	270.46570	26.450
270.51617	270.53647	29.200
270.58603	270.60617	29.017
270.65686	270.67557	26.917
270.72891	270.74503	23.217
270.80042	270.81458	20.367
270.87183	270.88318	16.333
270.94482	270.94870	5.583
271.32797	271.32932	1.950
271.38644	271.40280	23.583
271.45471	271.47400	27.783
271.52368	271.54428	29.667
271.59427	271.61380	28.133
271.66568	271.68323	25.267
271.73746	271.75275	22.000
271.80887	271.82217	19.183
271.88037	271.89035	14.367
272.32712	272.33960	18.000
272.39343	272.41132	25.733
272.46222	272.48230	28.917
272.53168	272.55215	29.500
272.60257	272.62152	27.317
272.67441	272.69098	23.867
272.74597	272.76050	20.900
272.81738	272.82938	17.283
272.88953	272.89603	9.367
273.33322	273.34839	21.817
273.40088	273.41971	27.117
273.46979	273.49023	29.433
273.53998	273.55981	28.567
273.61115	273.62924	26.083
273.68304	273.69873	22.583
273.75449	273.76825	19.833
273.82593	273.83661	15.350
273.89990	273.90073	1.183
274.27719	274.28497	11.217
274.33960	274.35693	24.983
274.40833	274.42801	28.383
274.47739	274.49808	29.833
274.54828	274.56754	27.717
274.61993	274.63696	24.533
274.69159	274.70648	21.417
274.76300	274.77563	18.233
274.83453	274.84320	12.467
275.28000	275.29388	19.983
275.34702	275.36536	26.450
275.41586	275.43613	29.183
275.48569	275.50586	29.033
275.55655	275.57526	26.917
275.62860	275.64471	23.217
275.70010	275.71423	20.367
275.77151	275.78284	16.317
275.84451	275.84836	5.567
276.22766	276.22906	2.000
276.28613	276.30252	23.600
276.35443	276.37372	27.767
276.42340	276.44400	29.667
276.49399	276.51352	28.133
276.56540	276.58295	25.267
276.63718	276.65244	22.000
276.70859	276.72189	19.167
276.78009	276.79004	14.350
277.22681	277.23932	18.017
277.29315	277.31100	25.733
277.36191	277.38199	28.917
277.43137	277.45187	29.517
277.50226	277.52124	27.317
277.57410	277.59067	23.867
277.64569	277.66019	20.900
277.71710	277.72910	17.267
277.78922	277.79572	9.367
278.23288	278.24802	21.800
278.30051	278.31934	27.117
278.36942	278.38986	29.433
278.43961	278.45944	28.567
278.51077	278.52887	26.083
278.58267	278.59836	22.583
278.65411	278.66791	19.850
278.72556	278.73624	15.350
278.79953	278.80035	1.183
279.17682	279.18457	11.200
279.23923	279.25656	24.950
279.30792	279.32764	28.400
279.37698	279.39771	29.850
279.44791	279.46713	27.700
279.51956	279.53659	24.533
279.59122	279.60608	21.433
279.66260	279.67526	18.233
279.73416	279.74280	12.450
280.17960	280.19348	19.983
280.24661	280.26495	26.433
280.31546	280.33575	29.200
280.38528	280.40546	29.033
280.45615	280.47485	26.917
280.52817	280.54431	23.217
280.59970	280.61383	20.367
280.67111	280.68243	16.317
280.74408	280.74799	5.600
281.12729	281.12863	1.933
281.18573	281.20212	23.583
281.25400	281.27328	27.783
281.32300	281.34360	29.667
281.39359	281.41312	28.133
281.46497	281.48251	25.267
281.53674	281.55203	22.000
281.60815	281.62149	19.183
281.67966	281.68964	14.367
282.12640	282.13889	17.983
282.19272	282.21057	25.717
282.26151	282.28159	28.917
282.33093	282.35141	29.500
282.40182	282.42081	27.317
282.47366	282.49026	23.883
282.54526	282.55975	20.900
282.61664	282.62863	17.283
282.68878	282.69531	9.383
283.13248	283.14761	21.800
283.20010	283.21893	27.100
283.26901	283.28946	29.433
283.33923	283.35907	28.567
283.41037	283.42850	26.083
283.48227	283.49796	22.583
283.55371	283.56750	19.850
283.62518	283.63583	15.350
283.69913	283.69995	1.200
284.07642	284.08417	11.167
284.13879	284.15616	24.983
284.20752	284.22723	28.400
284.27658	284.29730	29.850
284.34750	284.36673	27.717
284.41913	284.43616	24.533
284.49078	284.50568	21.417
284.56219	284.57486	18.233
284.63373	284.64240	12.467
285.07938	285.09326	19.983
285.14639	285.16476	26.450
285.21524	285.23553	29.200
285.28506	285.30524	29.033
285.35593	285.37463	26.917
285.42798	285.44409	23.200
285.49948	285.51361	20.383
285.57089	285.58221	16.317
285.64389	285.64774	5.533
286.02701	286.02844	2.067
286.08551	286.10190	23.600
286.15378	286.17307	27.783
286.22278	286.24338	29.683
286.29337	286.31290	28.133
286.36478	286.38232	25.267
286.43655	286.45181	21.983
286.50797	286.52127	19.167
286.57944	286.58942	14.350
287.02612	287.03867	18.050
287.09250	287.11038	25.750
287.16129	287.18137	28.917
287.23074	287.25122	29.500
287.30161	287.32059	27.317

287.37347	287.39005	23.867
287.44504	287.45953	20.883
287.51645	287.52844	17.267
287.58859	287.59509	9.350
288.03226	288.04742	21.833
288.09988	288.11874	27.133
288.16879	288.18924	29.433
288.23901	288.25885	28.550
288.31018	288.32828	26.067
288.38208	288.39774	22.567
288.45352	288.46729	19.833
288.52496	288.53561	15.333
288.59894	288.59973	1.167
288.97617	288.98398	11.233
289.03860	289.05594	24.967
289.10730	289.12704	28.400
289.17639	289.19708	29.833
289.24728	289.26654	27.717
289.31894	289.33597	24.533
289.39059	289.40549	21.417
289.46201	289.47464	18.233
289.53354	289.54218	12.450
289.97900	289.99286	19.983
290.04599	290.06436	26.433
290.11484	290.13510	29.183
290.18466	290.20483	29.017
290.25552	290.27423	26.917
290.32758	290.34369	23.217
290.39905	290.41321	20.383
290.47049	290.48181	16.317
290.54349	290.54733	5.550
290.92664	290.92801	2.000
290.98511	291.00150	23.617
291.05338	291.07266	27.783
291.12238	291.14297	29.667
291.19296	291.21249	28.133
291.26437	291.28189	25.250
291.33612	291.35141	22.000
291.40753	291.42087	19.183
291.47903	291.48901	14.367
291.92572	291.93826	18.033
291.99210	292.00995	25.733
291.99219	292.01007	25.750
292.06097	292.08105	28.917
292.13040	292.15088	29.500
292.20129	292.22028	27.317
292.27313	292.28970	23.867
292.34473	292.35922	20.883
292.41614	292.42810	17.267
292.48825	292.49475	9.333
292.93195	292.94708	21.833
292.99957	293.01840	27.133
293.06848	293.08893	29.433
293.13870	293.15854	28.550
293.20984	293.22797	26.067
293.28174	293.29742	22.583
293.35318	293.36697	19.833
293.42465	293.43530	15.333
293.49860	293.49942	1.150
293.87582	293.88367	11.267
293.93829	293.95563	24.967
294.00699	294.02670	28.400
294.07605	294.09677	29.850
294.14697	294.16620	27.700
294.21860	294.23563	24.517
294.29025	294.30515	21.417
294.36166	294.37433	18.217
294.43323	294.44186	12.433
294.87866	294.89255	19.967
294.94565	294.96402	26.450
295.01453	295.03479	29.200
295.08435	295.10449	29.033
295.15521	295.17389	26.917
295.22723	295.24335	23.200
295.29874	295.31290	20.383
295.37015	295.38147	16.300
295.44315	295.44699	5.550
295.82629	295.82770	2.017
295.88477	295.90118	23.617
295.95303	295.97235	27.783
296.02203	296.04263	29.667
296.09262	296.11215	28.133
296.16403	296.18158	25.267
296.23581	296.25107	21.983
296.30722	296.32053	19.167
296.37869	296.38867	14.350
296.82538	296.83792	18.033
296.89175	296.90961	25.717
296.96051	296.98062	28.933
297.02997	297.05048	29.500
297.10086	297.11984	27.317
297.17270	297.18927	23.867
297.24429	297.25879	20.900
297.31567	297.32767	17.267
297.38782	297.39432	9.367
297.83151	297.84665	21.817
297.89914	297.91797	27.133
297.96805	297.98849	29.433
298.03824	298.05811	28.567
298.10941	298.12750	26.083
298.18130	298.19699	22.567
298.25275	298.26654	19.833
298.32419	298.33484	15.333
298.39816	298.39899	1.167
298.77542	298.78320	11.217
298.83783	298.85516	24.967
298.90652	298.92627	28.400
298.97562	298.99631	29.833

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This page was last updated on November 23, 1998.

STIS Data Reduction / Technical Issues

Check the page with warnings and advisories before making any use of the data.

Information is available about the following topics:

STIS UV echelle spectroscopy

Description of data products

Follow this link for a legend of the file names for the final reprocessed data. The following are the main characteristics of the final data products for the STIS E230M echelle mode data:

```
Total exposure time: 151074 sec
Mean background level: 9.57e-4 cts/s/pixel

Wavelength       Continuum S/N
2300-2600A:      1.5 per pixel
2700-3100A:      4   per pixel
```

Observations

The HDF-S QSO J2233-606 was observed with the STIS E230M echelle mode for a total of 151074 sec (42.6 hours). In this mode, STIS produces a spectrum covering near-UV wavelengths from 2275 to 3118 Anstroms. The spectrum is dispersed across 24 orders at a resolution R = 30000 per two pixels. The QSO was observed through the five separate 0.2x0.2" FP-SPLIT apertures. The five apertures are displaced from each other to allow a displacement of the spectrum on the detector, thus allowing for better flat-fielding accuracy. The telescope was pointed so that the spectrum shifts were largely confined to the wavelength dimension.

In most cases, target acquisitions were done without peaking up on the QSO. The standard CCD target acquisition acquires targets to an accuracy of better than 0.01 arcsec, which is 5% of the slit width. Typical thermal drifts over a typical 45 minute exposure are expected to be less than 0.1 pixels. Frequent calibration lamp observations insure that the wavelength scale is accurately calibrated. Because the observations were pointed near the pole of the HST orbit, the change in velocity of HST during an exposure was no more than 5 km/s. On-board processing corrects for this shift to a precision of 5 km/s in this observing mode.

Data reduction

The data reduction for the STIS E230M echelle data consisted of the following steps:

- 1. Flatfielding.
- 2. Wavelength correction.
- 3. Background fitting.
- 4. One-dimensional spectral extraction.
- 5. Flux calibration.
- 6. Weighted combination.

1. Flatfielding

The spectrum was flatfielded using a preliminary NUV flat derived from internal calibration lamp observations. This flat has been verified on observations of spectrophotometric standards. The flatfielding was carried out by the standard STSDAS "calstis" pipeline. The normal "Doppler smoothing" option was omitted during the pipeline processing. This is not expected to degrade the data, due to the small on-board doppler correction.

2. Wavelength correction

Wavelength correction was carried out via standard procedures in calstis, using contemporaneous observations of the internal calibration lamp. The wavelength accuracy for this observing mode was verified using archival STIS observations of the spectrophotometric standard star BD +28 4211, which was observed with STIS both with the 0.2x0.2" FP-SPLIT aperture and with the more standard 0.2x0.2" single aperture. Wavelengths for narrow interstellar MgII absorption features agreed to within 0.03 Angstroms (3 km/s). The observations of this star were also compared to high-resolution IUE observations. The mean shift relative to three IUE observations was -0.08 +- 0.07 Angstroms.

Comparison with the UCLES optical spectrum of the QSO (Outram et al. 198) shows good agreement. The radial velocities of the higher-order Lyman series lines agree to within 10 km/s with those measured for the Lyman alpha line in the UCLES spectrum.

3. Background fitting

The mean background in the STIS exposures is very low (9.6x10^-4 cts/s), and is almost entirely due to phosphorescent emission from the detector window. The mean background level varies with time, and the time dependence varies with position across the detector. To subtract the background from each exposure, a low-order spline fit was performed using pixels in the inter-order regions. This fit was subtracted from the data prior to extracting the one-dimensional spectra. The smooth fitted background level was used in the computation of the errors.

4. One-dimensional spectral extraction

The spectrum was extracted using a modified version of the STSDAS stis.x1d task. This program finds the position of the orders via cross-correlation. The task was modified to reject orders with low S/N and apply to the whole spectral extraction table a global shift that is determined from the orders with high S/N. Typically about 10 orders were used to find the position of the spectrum, and the rms of the measured shifts of these 10 orders was less than 0.15 pixels. After this centroiding step, the spectrum was extracted along a "trace," determined from observations of standard stars. The spectral extraction box was 3 pixels wide. At each wavelength, pixels within this extraction box were summed together with uniform weights. The S/N of the final spectrum could possibly be improved by extracting with "optimal" weights.

5. Flux calibration

Conversion of counts to flux was also carried out in the x1d task. Fluxes were corrected for the wavelength-dependent throughput of the 0.2x0.2" aperture, and for the light lost outside the extraction box, using the standard values in the APT and PCT reference files.

6. Weighted combination

At the end of one-dimensional extraction, the spectrum consists of 1656 separate pieces, which need to be summed together in a way that maximizes the signal-to-noise ratio of the final spectrum. This "optimal" combination was carried out using a prototype version of the STSDAS routine "splice." This program uses weighting arrays that specify the weight to be used when averaging fluxes from orders that overlap in wavelength. We chose to weight the flux in each order by the (S/N)^2 vs. pixel, as determined from a smooth fit to the continuum; prefering not to have the weights vary sharply around the edges of absorption lines. The first and last 30 pixels of each order were masked during the combination.

This process was iterative. The individual extracted orders were first combined through a simple average in regions of wavelength overlap; the result was an initial estimate of the total echelle spectrum. This estimate was then fit with a cubic spline to produce a continuum estimate. The continuum was then interpolated onto the wavelength array of each order in each exposure, and converted into counts (through multiplication by exposure time and sensitivity). A weighting array for each order was then computed as

```
w = (continuum counts)^2 / (continuum counts + background counts).
```

Arrays of wavelength, flux, statistical errors, and weight for all orders of all frames were then combined by splice into a second iteration of the total echelle spectrum. The process was then iterated once more (continuum estimation --> weight determination --> splice combination) to produce the third and final iteration of the total echelle spectrum.

STIS UV low-resolution spectroscopy

Description of data products G140L

Follow this link for a legend of the file names for the final reprocessed data. The following are the main characteristics of the final data products for the STIS G140L data:

```
Total exposure time   : 18480 sec
Mean background level :   cts/s/pixel (excluding airglow lines)

Wavelength      Continuum S/N
1167-1590A:     >10 per pixel in the continuum, peaking at ~ 18 at 1320A
```

Observations G140L

The HDF-S QSO J2233-606 was observed with the STIS G140L first order mode for a total of 18480 sec (5.1 hours). In this mode, STIS produces a spectrum covering near-UV wavelengths from 1126 to 1721 Angstroms at a resolution of ~1100. The 52x0.2" aperture was used for all observations.

In most cases, target acquisitions were done without peaking up on the QSO. The standard CCD target acquisition acquires targets to an accuracy of better than 0.01 arcsec, which is 5% of the slit width. Typical thermal drifts over a mean 38 minute exposure are expected to be negligible. Frequent calibration lamp observations insure that the wavelength scale is accurately calibrated.

Because the observations were pointed near the pole of the HST orbit, the change in velocity of HST during an exposure was no more than 5 km/s. On-board processing corrects for this shift to a precision of 5 km/s in this observing mode. The final wavelength scale has been reduced to the heliocentric frame.

Note that the final spectrum shows the residual effect of the presence of geocoronal Ly-alpha over the range ~1210-1220 Angstroms and, to a lesser extent, the effect of OI over the range 1301-1310 Angstroms. Airglow emission from the OI] 1356 Angstrom line is weak and almost completely absent in the final spectrum.

Data reduction G140L

The data reduction for the STIS G140L data consisted of the following steps:

- 1. Flatfielding.
- 2. Wavelength correction.
- 3. Background fitting.
- 4. One-dimensional spectral extraction.
- 5. Flux calibration.
- 6. Weighted combination.

1. Flatfielding

The spectrum was flatfielded using a preliminary FUV flat derived from internal calibration lamp observations. This flat has been verified on observations of spectrophotometric standards. The flatfielding was carried out by the standard STSDAS "calstis" pipeline. The normal "Doppler smoothing" option was omitted during the pipeline processing. This is not expected to degrade the data, due to the small on-board doppler correction.

2. Wavelength correction

Wavelength correction was carried out via standard procedures in calstis, using contemporaneous observations of the internal calibration lamp.

3. Background

The mean background in the STIS exposures is extremely low and is almost entirely due to the detector itself. The mean background level varies with time, and shows a temperature dependence. Background counts vary with position across the detector and vary from a mean of ~6x10^-5 ct/s/pixel near the "hot spot" centered close to pixel location (222,615), to ~1x10^5 ct/s/pixel at the long wavelength edge of the detector.

4. One-dimensional spectral extraction

The spectrum was extracted using the standard version of the STSDAS stis.x1d task. After preliminary testing, a spectral extraction box of 11 pixels in cross-dispersion width was found to better S/N that smaller boxes. This is larger than the boxes used in the G230L and E230M cases, but is consistent with the lower background in this detector. As the background is so weak with this detector/grating combination, we were unable to obtain a good two- dimensional fit. We therefore used the standard background measurement of the x1d task in which background regions either side of the spectrum are averaged and subtracted from each spectrum pixel. As the background is weak, we chose large background measurement regions than normal, offset by ten pixels either side of the center of the spectrum, and extending for 280 pixels further away. The background box size was limited to this size by the desire to use a similar background region size for all spectra. For three spectra (root names: o52f41040, o52f41050 and o52f41060) the spectra were offset towards the top of the detector, limiting the maximum region available for background measurement.

The spectral intensity was high enough to permit centring of the extraction box by the x1d task. After this centroiding step, the spectrum was extracted using a standard "trace" from the calibration database (the 1DT file). This trace corrects for instrument-induced distortions of the spectrum and is determined from observations of standard stars. At each wavelength, pixels within this extraction box were summed together with uniform weights. The S/N of the final spectrum could possibly be improved by extracting with "optimal" weights.

5. Flux calibration

Conversion of counts to flux was also carried out in the x1d task. Fluxes were corrected for the wavelength-dependent throughput of the 52x0.2" aperture, and for the light lost outside the extraction box, using the standard values in the APT and PCT reference files.

6. Weighted combination

At the end of one-dimensional extraction, we needed to combine the twelve separate exposures in a way that maximizes the signal-to-noise ratio of the final spectrum. This "optimal" combination was carried out using a prototype version of the STSDAS routine "splice." This program uses weighting arrays that specify the weight to be used when averaging fluxes from spectra that overlap in wavelength. We chose to weight the flux in each spectrum by the (S/N)^2 per pixel, smoothed over five pixels to reduce sharp variations in weighting value from pixel-to-pixel. No other corrections were made to the final weights.

Description of data products G230L

Follow this link for a legend of the file names for the final reprocessed data. The following are the main characteristics of the final data products for the STIS G230L data:

```
Total exposure time   : 18424 sec
Mean background level : 1.08e-3 cts/s/pixel (excluding airglow lines)

Wavelength      Continuum S/N
2200-2640A:     ~20 per pixel in the continuum
2700-2900A:     ~45 per pixel in the continuum
```

Observations G230L

The HDF-S QSO J2233-606 was observed with the STIS G230L first order mode for a total of 18424 sec (5.1 hours). In this mode, STIS produces a spectrum covering near-UV wavelengths from 1585 to 3173 Angstroms at a resolution of ~550. The 52x0.2" aperture was used for all observations.

In most cases, target acquisitions were done without peaking up on the QSO. The standard CCD target acquisition acquires targets to an accuracy of better than 0.01 arcsec, which is 5% of the slit width. Typical thermal drifts over a mean 25 minute exposure are expected to be negligible. Frequent calibration lamp observations insure that the wavelength scale is accurately calibrated.

Because the observations were pointed near the pole of the HST orbit, the change in velocity of HST during an exposure was no more than 5 km/s. On-board processing corrects for this shift to a precision of 5 km/s in this observing mode. The final wavelength scale has been reduced to the heliocentric frame.

Data reduction G230L

The data reduction for the STIS G230L data consisted of the following steps:

- 1. Flatfielding.
- 2. Wavelength correction.
- 3. Background fitting.
- 4. One-dimensional spectral extraction.
- 5. Flux calibration.
- 6. Weighted combination.

1. Flatfielding

The spectrum was flatfielded using a preliminary NUV flat derived from internal calibration lamp observations. This flat has been verified on observations of spectrophotometric standards. The flatfielding was carried out by the standard STSDAS "calstis" pipeline. The normal "Doppler smoothing" option was omitted during the pipeline processing. This is not expected to degrade the data, due to the small on-board doppler correction.

2. Wavelength correction

Wavelength correction was carried out via standard procedures in calstis, using contemporaneous observations of the internal calibration lamp.

3. Background fitting

The mean background in the STIS exposures is very low (~1x10^-3 cts/s/pixel), and is almost entirely due to phosphorescent emission from the detector window. The mean background level varies with time, and the time dependence varies with position across the detector. To subtract the background from each exposure, a low-order two-dimensional polynomial fit was performed to pixels at both sides of the spectrum. Each of the fit regions covered the whole width of the detector, and one hundred pixels perpendicular to the dispersion direction. This fit was subtracted from the data prior to extracting the one-dimensional spectra. As over 2.0x10^5 pixels were used in the fitting process, this is assumed to be a negigible source of error. Hence the error array from the original (gross) counts was carried through this process and used in the computation of the final errors due to the one-dimensional extraction.

4. One-dimensional spectral extraction

The spectrum was extracted using the standard version of the STSDAS stis.x1d task. After preliminary testing, a spectral extraction box of five pixels in the cross-dispersion direction was found to give a good compromise between extracted signal and error, resulting in a peak S/N. The spectrum was strong enough to permit centring of the extraction box by the x1d task. After this centroiding step, the spectrum was extracted using a standard "trace" from the calibration database (the 1DT file). This trace corrects for instrument- induced distortions of the spectrum and is determined from observations of standard stars. At each wavelength, pixels within this extraction box were summed together with uniform weights. The S/N of the final spectrum could possibly be improved by extracting with "optimal" weights, though our choice of a small extraction box probably comes close to an "optimal" result.

5. Flux calibration

Conversion of counts to flux was also carried out in the x1d task. Fluxes were corrected for the wavelength-dependent throughput of the 52x0.2" aperture, and for the light lost outside the extraction box, using the standard values in the APT and PCT reference files.

6. Weighted combination

At the end of one-dimensional extraction, we needed to combine the twelve separate exposures in a way that maximizes the signal-to-noise ratio of the final spectrum. This "optimal" combination was carried out using a prototype version of the STSDAS routine "splice". This program uses weighting arrays that specify the weight to be used when averaging fluxes from spectra that overlap in wavelength. We chose to weight the flux in each spectrum by the (S/N)^2 per pixel, smoothed over five pixels to reduce sharp variations in weighting value from pixel-to-pixel. A test using combined, unweighted, spectra shows that the use of smoothed weights does not affect the line profiles significantly.

As noted above in step 3, the errors carried through to the final one- dimensional extracted spectra are based on the counts prior to the two- dimensional background subtraction. Therefore no other corrections were made to the final weights.

STIS optical spectroscopy

Description of data products

Follow this link for a legend of the file names for the final reprocessed data.

The following are the main characteristics of the final data products for the STIS G430M data:

```
Wavelength coverage: 3025 A to 3565 A.
Total exposure time: 54,892 sec (~15.2 hrs)
                     (29,292 sec for cenwave=3165 A, and
                      25,600 sec for cenwave=3423 A)
Dispersion: 0.28 A/pix
Wavelength resolution: ~0.5 A
S/N ~5 to 15 per pixel.
```

Observations

The HDF-S QSO J2233-606 was observed with the STIS G430M first-order mode for a total of 57092 sec (15.2 hours) in 2 central wavelength settings. The first setting was centered at 3165A, covered the wavelength range 3025 A to 3305 A, and had a total exposure time of 29,292 sec. The second setting was centered at 3423 A, covered the wavelength range 3280 A to 3565 A, and had a total exposure time of 25,600 sec. The dispersion in this mode is 0.28 A/pix; the FWHM of the instrumental line profile is about 2 pixels, corresponding to a spectral resolution of 0.56 A. A 52X0.2 arcsec slit was used for all the observations.

Observations were taken with a CR-split of 2 to aid cosmic-ray rejection. The spectrum was also 'dithered' by about 2.5arcsec (50 pixels) in the cross-dispersion direction in order to be able to correct for the numerous hot-pixels in the data reduction stage. Frequent calibration lamp exposures were taken to ensure proper wavelength calibration. Since the observations were made near the pole of the HST-orbit, the change in the velocity of HST is less than 5 km/sec. Since the velocity resolution of the observations is about 50 km/sec, the smearing to to the change is the velocity of HST is not significant.

Follow this link for a listing of the individual datasets, including exposure times, that were used used to create the final combined spectra.

Data reduction

Data reduction steps:

- 1. Bias and dark subtraction and flagging of hot pixels
- 2. Cosmic ray rejection
- 3. Flatfielding
- 4. Wavelength correction
- 5. Background fitting
- 6. 1-d spectral extraction
- 7. Flux calibration
- 8. Weighted combination

Since the observations are readnoise dominated, special care was taken for the bias and dark subtractions. Weekly darks were specially made for the duration of the HDF-campaign, which were used for the dark subtraction of individual images. STIS CCD develops hot-pixels during the periods of successive 'annealing'. A master 'hot-pixel' mask was made using all the dark exposures taken during the campaign, which was used to 'flag' the hot pixels. A large fraction of the cosmic rays were rejected using the CR-split images.

Wavelength correction was carried out via standard procedures in calstis, using contemporaneous observations of the internal calibration lamp. Comparison with the UCLES optical spectrum of the QSO (Outram et al. 1998) shows agreement to 1/5th of the resolution element of the G430M spectrum.

The spectrum was extracted using a modified version of the STSDAS stis.x1d task. A profile of the spectrum was made in the cross dispersion direction which shows almost all the flux within 5 pixels. Spectra were extracted using different extraction heights, but the best S/N was obtained from an extraction slit height of 5, which was subsequently used for the analysis. The S/N of the final spectrum could possibly be improved by extracting with "optimal" weights.

Conversion of counts to flux was also carried out in the x1d task. Fluxes were corrected for the wavelength-dependent throughput of the 52x0.2" aperture, and for the light lost outside the extraction box, using the standard values in the APT and PCT reference files.

At the end of one-dimensional extraction, the spectrum consists of 59 separate pieces, which need to be summed together in a way that maximizes the signal-to-noise ratio of the final spectrum. We chose to weight the flux by the (S/N)^2 vs. pixel. Since the spectrum is mostly readnoise dominated, the weighting is thus proportional to square of the exposure time. This was done by introducing a separate keyword into the header, exp2. The the weighting in the 'splice' task was set to this 'header keyword' to apply the appropriate weight.

STIS imaging

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WARNING:*Please read the section below on the window reflection before trying to identify or analyze objects close to the quasar!!!*

Abstract

We present the imaging observations made with the Space Telescope Imaging Spectrograph of the Hubble Deep Field -- South. The field was imaged in 4 bands, a clear CCD bandpass for 156 ksec, a long-pass filter for 22-25 ksec per pixel typical exposure, a Near-UV bandpass for 23 ksec and a Far-UV bandpass for 52 ksec. The clear visible image is the deepest observation ever made in the UV-optical-NIR wavelength region. The field contains QSO J2233-606, the target of the STIS spectroscopy, and extends 50 arcsec for the visible images, and 25 arcsec for the ultraviolet images. We present the images and catalogs of objects in the field.

1. Introduction

The images and catalogs presented here were taken with STIS as part of the HDF-S campaign between 1998 September 29 and October 10. For a description of the HDF-S, see Williams et al (1999), and on the web at http://www.stsci.edu/ftp/science/hdf/hdfsouth/hdfs.html. For more information about STIS, see Kimble et al (1998), Woodgate et al (1998), and Walborn & Baum (1998). This README file provides a preliminary description of the observations, the data reduction and the catalog. A more complete description will appear in Gardner et al (1999).

2. Observations

2.1. Description

The images presented here were taken in 4 different modes, FUVQTZ, NUVQTZ, F28X50LP, and 50CCD. The FUVQTZ and NUVQTZ used the MAMA detectors as imagers with the quartz filter. The MAMA field of view is a square, 25 arcseconds on a side, and was dithered so that the observations include data on a field approximately 30 arcseconds square. The 50CCD is filterless imaging with a CCD. The field of view is a square 50 arcseconds on a side, and the dithering extends to a square 60 arcseconds on a side. The F28X50LP is a long-pass filter which vignettes the field of view of the CCD to a rectangle 28 by 50 arcseconds. The observations were dithered to image the entire field of view of the 50CCD observations, although the exposure time "per pixel" is thus approximately half the total exposure time spent in this mode. The original pixel scale is 0.0244 arcsec/pixel for the MAMA images, and 0.05071 arcsec/pixel. All of the images have been drizzled onto a new scale of 0.025 arcsec/pixel. Table 1 describes the observations. The filterless 50ccd observations correspond roughly to V+I, and reach a depth of 29.4 AB magnitudes at 10 sigma in a 0.2 square arcsecond aperture (320 drizzled pixels). This is the deepest exposure ever made in the UV-optical-NIR wavelength region.

Table 1 -- description of the observations

Mode	Cent Wave	FWHM(A)	Det. FOV	Tot FOV	Tot Exp	Exp./pix	Depth
FUVQTZ	1370A	320A	25"x25"	30"	52124 sec	same	27.8
NUVQTZ	2220A	1200A	25"x25"	30"	22616 sec	same	27.5
F28X50LP	7230A	2720A	28"x52"	60"	49768 sec	22494	27.4
50CCD	5850A	4410A	52"x52"	60"	155590 sec	same	29.4

Notes to Table 1: See Walborn & Baum for filter tracings. The detector fields of view has been clipped slightly to remove vignetting. The total fields are approximate. Depths are AB magnitudes at 10 sigma in a 0.2 square arcsecond aperture.

The QSO is at RA=22 33 37.5883, Dec=-60 33 29.128 (J2000). The errors on this position are estimated to be less than 40 milli-arcseconds (Zacharias et al 1999). The position of the QSO on the 50CCD and F28X50LP images is x=1206.61, y=1206.32, and on the MAMA images is x=806.61, y=806.32.

2.2. Test data

Test observations of the field were made on 1997 October 29 through 31. These data are not used in the present analysis.

2.3. Observing plan

The observations were made under the following proposal ID numbers:

```
7633  Test Data           1997-Oct-29 through 1997-Oct-31
8071  PSF observations    1998-Sep-20 and     1998-Oct-19
8071  Flanking Fields     1998-Sep-27 through 1998-Oct-29
8058  Visits 5-15         1998-Sep-28 through 1998-Sep-30
8073  Visits 17-23        1998-Oct-01 through 1998-Oct-02
8074  Visits 24-30        1998-Oct-02 through 1998-Oct-04
8075  Visits 32-39        1998-Oct-04 through 1998-Oct-06
8076  Visits 40-50        1998-Oct-06 through 1998-Oct-09
```

The detailed phase 2 proposal, formatted listing of the observations, and archive information can be obtained from http://presto.stsci.edu/public/propinfo.html. The raw and pipeline processed data are non-proprietary, and are available through the STScI archive.

2.4. Dithering and Rotation

The images were dithered in RA and Dec in order to sample the sky at the sub-pixel level. In addition, variations in rotation of about +/- 1 degree were used to provide additional dithering for the WFPC2 and NICMOS fields during the STIS spectroscopic observations. The STIS imaging observations were interspersed with the STIS spectroscopic observations, therefore all of the images were dithered in rotation as well as RA and Dec. Imaging with the CCD was only done in the dark part of the orbits, while the bright part was typically spent doing G430M spectroscopy. The STIS MAMAs were only used in orbits which did not cross the South Atlantic Anomaly at any point in the orbit.

2.5. CR-SPLIT and pointing strategy

The CCD exposures were split into 2 or 3 "CR-SPLITS" which each have the same RA, Dec and rotation. This facilitates cosmic ray removal, although as discussed below, this was only used in the first iteration of the data reduction. The final 50ccd image is the combination of 193 readouts making up 67 "CR-SPLIT" pointings. The final F28X50LP image is the combination of 66 readouts making up 23 "CR-SPLIT" pointings. The F28X50LP image included 12 pointings at the northern part of the field, 1 pointing at the middle of the field, and 10 pointings at the southern half of the field.

2.6. PSF observations

In order to allow for PSF subtraction of the QSO present in the center of the STIS 50CCD image, two SAO stars of about 10mag were observed in the filterless 50ccd mode before and after the main HDF-S campaign. The stars are SAO 255267, a G2 star, and SAO 255271, a F8 star, respectively. These targets have spectral energy distributions in the STIS CCD sensitivity range similar to that of the QSO. For each star, 32 different CR-SPLIT exposures were taken (PID 8071, visits 1 and 13 respectively). The following strategy was used: (i) four different exposure times between 0.1 s and 5 s for each CR-SPLIT frame, to ensure high signal-to-noise in the wings while not saturating the center; (ii) a four-position dither pattern with quarter-pixel sampling and CR-SPLIT at each pointing with each exposure time; (iii) use of gain=4, to insure no saturation in the A-to-D conversion. During the observations for SAO255267, a failure in the guide star acquisition procedure caused the loss of its long-exposure (5s) images. Gain=4 has a well-documented large scale pattern noise that has to be removed, e.g., by Fourier filtering, before a reliable PSF can be produced. We have not reduced these observations. The raw and pipeline-processed data are available through the archive.

2.7. Flanking Field observations

The flanking field observing program (Lucas et al 1999) was designed to use WFPC2 to image a contiguous region containing the main deep fields of all three instruments. STIS was used in parallel to these observations to obtain 5100sec images in 50CCD mode. In general, there is very little overlap between the STIS flanking field observations and other HDF-S data. The exposures were made up of 4 dither positions, each CR-SPLIT into 2, for a total of 8 readouts. These images were reduced in a manner similar to that of the main field. We have not checked the astrometry on the STIS flanking field data. Therefore, the world coordinate system in the headers is only accurate to the astrometry of the Guide Star Catalog, i.e. of order 0.5-1.0 arcsec. We have not yet cataloged the flanking field observations. Astrometry and catalogs will be made available through this site when they are available.

There were an additional 9 orbits of data in 50CCD mode taken with the STIS centered on the NICMOS deep field. These data are presented with the NICMOS observations (Fruchter et al 1999).

Optical Imaging: Description of data products

Follow this link for a legend of the file names for the final reprocessed data.

Optical Imaging: Data Reduction

1. Bias, Darks, Flats and Masks

Standard processing of CCD images involves bias and dark subtraction, flatfielding, and masking of detector defects. The bias calibration file used for the HDF-S was constructed from 285 individual exposures, combined together with cosmic-ray and hot-pixel trail rejection.

The dark file was constructed from a "superdark" frame and a "delta" dark frame. The superdark is the cosmic-ray rejected combination of over 100 individual 1200 second dark exposures taken over the several months preceeding the HDF-S campaign. The delta dark adds into this high S/N dark frame the pixels that are more than 5-sigma from the mean in the superdark-subtracted combination of 14 dark exposures taken during the HDF-S campaign. Calibration of the images with this dark frame removes most of the hot pixels but still leaves several hundred in each image.

An image mask was constructed to remove the remaining hot pixels and detector features. The individual cosmic-ray rejected HDF-S 50CCD exposures were averaged together without registration. The remaining hot pixels were identified with the iraf "cosmicrays" task. These pixels were included in a mask that was used to reject pixels during the "drizzling" phase. Pixels that were more than 5-sigma below the mean sky background were also masked. The unilluminated portions of the detector around the edges were also masked out. The 30 worst hot pixel trails were also masked. These are features that run along columns caused by high dark current in a single pixel along the column.

Flatfielding was carried out by the STSDAS calstis pipeline using two reference files. The first, the "PFLAT" corrects for small-scale pixel-to-pixel sensitivity variations. This file was created from ground-test data but comparisons to a preliminary version of the on-orbit flat revealed only a few places where the difference was more than 1%. The PFLAT corrects for small-scale variations, but is smooth on large scales. The CCD also shows a 5-10% decrease in sensitivity near the edges due to vignetting. This illumination pattern was corrected by a low-order fit to a sky flat constructed from the flanking field observations.

2. Shifts and rotations

After pipeline processing, the CCD images were reduced using the IRAF/STSDAS package "dither", and test versions called "xdither", and "xditherII". These packages include the "drizzle" software (Fruchter & Hook 1998; Fruchter et al 1998; Fruchter 1998). We used "drizzle" version 1.2, dated 1998 February. The beta versions differ from the previously released version primarily in their ability to remove cosmic rays from each individual readout, and include tasks which have not yet been released.

The rotations used in combining the data were determined from the ROLL_AVG parameter in the jitter files, using the program, "bearing". We did not seek to improve on these rotations via cross-correlation or any other method. However, since we did use cross-correlation to determine the X and Y shifts, small errors in rotation would be removed in this iterative process, to first order.

Determination of the X and Y shifts was done with an iterative procedure. The first iteration was obtained by determining the centroid of the bright point source just east of the QSO, using the pipeline cosmic-ray rejected "crj" files. We could not use cross-correlation in this first iteration, since the very bright star on the southern edge of the field was present on images taken at some, but not all, dither positions, which corrupted the cross-correlation. The source we used for centroiding was clearly visible on all of the 50CCD and F28X50LP frames.

Using these shifts (which were accurate to better than 1 pixel), we drizzled the "crj" files onto individual outputs, which we combined using a median in the task "imcombine". This output image was placed back in the frame (x, y, rotation) of each individual read-out using the xdither task, "blot". After cosmic ray rejection, the blotted image was cross-correlated with the original data, corrected according to the cosmic ray mask, to determine the X & Y shifts used in the final combination.

3. Cosmic ray rejection

Each readout, ("flt" file science extension), was compared to the blotted image, and a cosmic-ray mask was created from all of the pixels which differed (positively or negatively) by more than a given threshold from the blotted image. In the version 1.0 released 50CCD image, this threshold was set to be 5.0 sigma. However, we believe that a small error in the sky level determination, introduced by the amplifier ringing correction discussed below, meant that this level corresponded to a "real" rejection at approximately the 3.0 sigma level. The cosmic ray masks were multiplied by the hot pixel masks discussed above, and resulted in about 8% of the pixels being masked as either cosmic rays or hot pixels. This is, perhaps, overly conservative. A less conservative cut (correcting the error in the sky value) would result in slightly higher exposure time per pixel, and thus an improvement of 1-2% in the signal to noise ratio.

This problem with the sky value was corrected in the F28X50LP image, and a 3.0 sigma level was used in the cosmic ray rejection.

4. Amplifier ringing correction

Horizontal features due to amplifier ringing, varying in pattern from image to image, were present in most of the STIS CCD frames. These were caused by the fact that when a pixel saw a very high signal, the bias level was depressed in the readout for the next few rows. The very high signals causing this ringing came from hot pixels and from the saturated QSO. We removed them with an iterative procedure that subtracted on a row-by-row basis, from each individual image, the weighted average of the background as derived from the innermost 800 columns after masking and rejecting "contaminated" pixels. The masks included all visible sources, hot pixels and cosmic-ray hits. For each readout the mask for the sources was obtained from the "master blot image" derived by combining together all images available in the filter, blotted to the position of the considered frame. A "minmax" rejection criterion was applied to the remaining pixels, which excluded the highest and lowest 6% of the unmasked pixels from the average. The IRAF script implementing this procedure, developed for the HDFS, will be made available to the community.

Heavily smoothing the images reveals very slight horizontal residuals which were not removed by the current choice of smoothing/rejection parameters.

5. Drizzling it all together

The final image combination was done by drizzling the amplifier-ringing corrected pipeline products together onto a single output image. The exposures were weighted by the square of the exposure time, divided by the variance, which is (sky+rn^2+dark). The rotations were corrected so that North is in the +y direction, and the scale used was 0.492999 original CCD pixels per output pixel so that the final pixel scale is exactly 0.025 arcsec/pixel. For the 50CCD data we used a pixfrac=0.1, which is approximately equivalent to interleaving, where each input pixel falls on a single output pixel. For the F28X50LP data we used pixfrac=0.6, as a smaller pixfrac left visible holes in the final image. See Fruchter & Hook (1998) for a discussion of the meaning of the drizzle parameters. The final image is given in counts per second, which can be converted to STMAG using the PHOTFLAM parameter supplied in the header. We also supply the weight image, which is the sum of the weights falling on each pixel. For the F28X50LP image, we supply an exposure-time image, which is the total exposure time contributing to each pixel. We have multiplied this image by the area of the output pixels. The world coordinate system in the headers was corrected so that North is exactly in the +y direction, and the pixel scale is exactly 0.025 arcsec/pixel. However, we have provided the original header information in a separate file.

6. Window reflection

A window in the STIS CCD reflects light from bright objects slightly out-of-focus to the +x, -Y direction (SE on the HDF-S images). The window reflection of the QSO (which is saturated in every 50CCD and F28X50LP exposure) is clearly visible in the F28X50LP image, but has been partially removed from the 50CCD image by the cosmic-ray rejection procedure. We wish to emphasize that it has only been partially removed -- there remain residuals. These residuals should not be mistaken for galaxies near the QSO, nor should they be mistaken for the host galaxy of the QSO. There is additional reflected light from the QSO (and from the bright star at the southern edge) evident in the images. It is the belief of the authors of this document that the version 1.0 released images are not appropriate for searching for objects very close to or underlying the QSO, and that such a search would require re-processing the raw data with particular attention paid to the window reflection, other reflected light, and to the PSF of the QSO. The diffraction spikes of the QSO are smeared in the final images by the rotation of the individual readouts. The QSO is not saturated in the MAMA images.

UV Imaging: Description of data products

Follow this link for a legend of the file names for the final reprocessed data.

UV Imaging: Data Reduction

The near-UV and far-UV images are respectively the weighted averages of 12 and 25 registered frames, with total exposure times of 22616 and 52124 sec. Prior to combination, all frames were processed with CALSTIS, including updated high-resolution pixel-to-pixel flat field files for both UV detectors. Geometric correction and rescaling were applied in the final combinations via the DRIZZLE package. Dark subtraction for the near-UV was done by subtracting a scaled and flat-fielded dark image from each near-UV frame, with scaling determined from the occulted right-hand corners of the detector. For the far-UV images, CALSTIS removes a nearly flat dark frame, but the upper left-hand quadrant of STIS far-UV frames contains a residual ``glow'' in the dark current after nominal calibration. This glow varies from frame to frame and also appears to change shape slightly with time. To remove the residual dark current, the 16 far-UV frames with the highest count rates in the glow region were co-added without object registration but with individual object masks for the only two obvious objects in the far-UV frames (the quasar and bright spiral NNE of the quasar); the result was fit with a cubic spline to produce a glow profile. This profile was then scaled to the residual glow in each frame and subtracted prior to the final drizzle. Note that even during observations with a strong dark glow, the dark is an order of magnitude higher than normal but still quite low, reaching rates as high $6x10^{-5}$ counts sec^{-1} pix^{-1}. The glow thus appears as a higher concentration of ones in a sea of zeros, and the subtraction of a smooth glow profile from such quantized data over-subtracts from the zeros and under-subtracts from the ones. These effects are visible to the eye in the corrected data, even when smoothed out considerably in the final drizzled far-UV image. A low-resolution flat-field correction was applied to the far-UV frames after subtraction of the residual dark glow; the near-UV frames require no low-resolution flat field correction.

Currently, geometrically corrected NUVMAMA/F25QTZ and FUVMAMA/F25QTZ frames do not have the same plate scale; thus, before registration, all near-UV and far-UV frames were geometrically corrected, rescaled to 0.025" pix^{-1}, and rotated to align North with the +y image axis. The roll angle specified in the jitter files was used to determine the relative roll between frames, and the mean difference between the planned roll and the jitter roll determined the absolute rotation. All near-UV and far-UV frames were then cross-correlated against one of the far-UV frames (o52f44uwq) to provide shifts in the output coordinate system. Note that centroiding on the quasar in all far-UV and near-UV frames yields the same shifts as cross-correlation, within 0.1 pixel. The calibrated frames were then drizzled, including the above corrections, rescaling, rotations and shifts, to a 1600x1600 pixel image. The world coordinate system in the image headers has been updated to exactly reflect the plate scale and alignment, and also the NRL position of the quasar.

For both the far-UV and near-UV frames, individual pixels in each frame are weighted by the ratio of the exposure time squared to the dark count variance; this weights the exposures by $(S/N)^2$ for sources that are fainter than the background. Although the far-UV dark profile is smooth, the near-UV dark profile is an actual sum of dark frames, and so we smoothed the near-UV dark profile when determining the drizzle weights. With this weighting algorithm, pixels in the upper left-hand quadrant of a given far-UV image contribute less when the dark glow is high, and contribute more when it is low. The statistical errors (counts sec^{-1}) in the final drizzled image, for objects below the background (e.g., not the quasar), is given by the final drizzled weights file raised to the -1/2 power.

The drizzle "dropsize" (a.k.a. pixfrac) was 0.6, thus improving the resolution over a dropsize of 1.0 (which would be equivalent to simple shift-and-add). The 1600x1600 pixel format is the smallest ``standard'' image size that can contain all dither positions; pixels outside of the dither pattern are at a count rate of zero. The pixel mask for each near-UV input frame included the occulted corners of the detector, a small number of hot pixels, and pixels with relatively low response (those with values <=0.75 in the high-resolution flat field). The pixel mask for each far-UV frame included hot pixels and all pixels flagged in the data quality file for that frame. When every input pixel drizzled onto a given output pixel has been masked, that pixel has been set to zero.

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WFPC2 Data Reduction / Technical Issues

Check the page with warnings and advisories before making any use of the data.

Information is available about the following topics:

WFPC2 imaging

Description of data products

1. General

Follow this link for a legend of the file names for the final reprocessed data.

The version 1 images represent our best shot at a first combination of the WFPC2 data taken in the main portion of the Hubble Deep Field South. Images were taken in the same four filters as for the original Hubble Deep Field: F300W, F450W, F606W, and F814W. For each filter, we have produced a combined data image, named fxxx_comb.fits (xxx stands for 300, 450, 606 or 814), and a weight image, named fxxx_weight.fits. Note that both data and weight images are presented in a single mosaic, with all four WFPC2 detectors combined onto the same image plane.

2. Combined Image

The combined image is the result of combining all individual exposures, optimally weighted for the background signal, and resampled to a pixel scale of 0.0398" using the "Drizzle" package (Fruchter & Hook 1998). The images are expressed in counts per second at a gain of 7. They have been rotated to have North approximately up (about 0.5 degrees from vertical). The coordinates of the images are set in the header WCS parameters, and can be retrieved for example via the IRAF task xy2rd. The absolute astrometry of the field has been derived from a match with four astrometrically measured stars kindly provided by the Naval Observatory, and is likely to be accurate to about 40 mas.

The depth and coverage for each filter varies across the field of view, due to the variety of pointings that were combined together. The image depth wanes when approaching the edges of the area covered, as well as in a near-vertical seam between detectors which received much lower coverage than the central region of each chip. This variable depth is reflected in the image weights, described below.

As a consequence of the decreased image quality, the outer regions of each image are less reliable, especially in terms of cosmic ray rejection. Any oddly-shaped objects appearing in only one filter near the edge of the images presented here has a good probability of being a piece of an unrejected cosmic ray.

Images have been trimmed where the (median) weight per pixel is less than a filter-dependent cutoff value: 7.e7 for F300W, 5.e7 for F450W, 1.e7 for F606W, and 2.e7 for F814W. Images also take the value of 0 where no valid pixels are available, such as at the center of the brightest stars - which saturate in all F606W and F814W images.

3. Exposure time and weight

The total effective exposure time for these images is:

```
F300W   140,185 s
F450W   100,950 s
F606W    81,275 s
F814W   100,300 s
```

Several images need special treatment and have been rejected in this combination; their inclusion in a future version is likely to improve the noise by about 5 to 10%.

The weight images we provide represent the expected (theoretical) inverse variance due to the background sky in each image. However, due to the correlated nature of noise in resampled images, the variance measured on a single-pixel scale will in general differ from the inverse of the weight. The weight image can be used to estimate the expected noise on large scales, where the noise correlation abates. Specifically, the variance of the *total* signal in an area including N pixels scales with sqrt(N / < W >) for N sufficiently large (> 100 or so), where W is the weight reported for each pixel.

4. Photometry

WFPC2 detectors differ slightly in their sensitivity. The individual input images have been scaled to the response of the WF3 detector, thus the zero points determined for WF3 (at gain 7) apply. For reference, the most recent determination of the zero point for infinite aperture in the VEGAMAG system is:

```
F300W     19.43
F450W     22.02
F606W     22.90
F814W     21.66
```

Data reduction

A short description of the steps taken to produce the WFPC2 Version 1 images.

1. Preparation

The WFPC2 group produced a new superbias, superdark, and flat field for each of the filters. The superdark showed a general increase in dark current with respect to the previous version, and a larger number (about 4000 per detector) of permanent hot pixels. Although permanent hot pixels seem to subtract reasonably well, all pixels with dark current greater than 0.02 DN/s (0.14 e/s) were flagged as bad and not used in further combinations.

In addition, daily hot pixel masks were produced to track the newly produced hot pixels. Daily masks were produced by median combination of all F300W images taken in a given day. The median combination excludes objects, which fall on different places in the chip due to the dither and roll changes in the telescope, and brings up hot pixels, which are then flagged. This procedure failed for October 4, 9 and 10, when not enough F300W images were taken; we used the October 5 mask for October 4, and the October 8 mask for October 9 and 10. These masks were used in step 2 and in generating the individual weight files for step 5.

2. Quality verification and pipeline

First, each image was indidually inspected by eye, and any problems - moving objects, charge trails, cosmic ray showers, bias jumps, the characteristic cross due to Earth-scattered light - noted in the master log file. For charge trails, the affected areas were masked out by editging the image quality file. Moving objects and cosmic ray showers generally are rejected automatically in further processing, but the quality of the rejection was checked explicitly later on.

Individual images were processed by the standard CALWP2 pipeline, using the new superbias, superdark and flat field.

Finally, each image had the sky subtracted and the value recorded in the header.

3. Image registration and first combination

A preliminary image registration was obtained with two independent methods. The first was to adopt the position recorded in the jitter file, derived from the average measured position of the guide stars throughout the observation. The second was to cross-correlate the image with an image pair chosen as reference. [The second method could not be used for F300W because of the low signal levels.] Images for which the two methods yielded comparable results were used in the first combination, while images for which they disagreed were excluded from the first combination and included again after their position was redetermined in step 3.

The first combination was done as follows:

- For each input image, use DRIZZLE to produce a mosaic of the four chips (this mosaic will have a small inter-chip gap); each image is shifted and rotated to a common reference position, which has North approximately up.
- Median-combine all images with "good" shifts for each filter, excluding pixels masked in the hot pixel list (step 0) and pixels too close to the pyramid edge; this produced a first reference image (the "median" image) for each filter.

4. Refinement of the pointing measurement

The median image was then used to refine the position measurement for each of the input images. For F450W, F606W and F814W, this was done by cross-correlating each individual mosaic with the median image. In a few cases the quality of the cross-correlation indicated a possible rotation; these cases were excluded from the Version 1 combination.

Again, F300W required a different procedure, since the low signal level causes the full-image cross-correlation to be dominated by cosmic rays. Instead, we cut out two 100-pixel regions around the two brighest stars, and cross-correlated those against the reference image. The shifts were generally in good agreement and their average was adopted; in a few cases, one of the stars was affected by a cosmic ray and the other was used. For one image, both stars were affected by a cosmic ray and unusable; that image, 2704, was excluded from the final combination.

The typical uncertainties in the alignment of individual images are between 5 and 10 mas for F450W, F606W, and F814W, and between 10 and 20 mas for F300W.

5. Cosmic rays and weight image

The identification of cosmic rays, a difficult problem in the absence of cosmic-ray splits, was done by comparing each image to an "expected" image based from the median image. The expected image was produced by BLOT using the updated positions, and the combination of DERIV and DRIZ_CR was used to identify cosmic rays. This process was in general very successful except close to the edges of the median image, where there was not enough information to identify cosmic rays properly. Pixels affected by cosmic rays were identified in the cosmic ray mask.

6. Inter-chip alignment verification

The relative positions of the four detectors in the sky were verified using the following procedure:

- For each filter, a separate image was produced for each of the detectors; these images overlap (by about 10" in the N-S direction, and about 3" in the E-W direction) due to the variety of pointings used
- The positions of objects in the overlap area were compared to determine shift corrections (WF4 was used as reference)

- For the PC, we used the average of the shift determined by comparison with WF2 and WF4.
- In addition, we also determined the (very small) inter-filter shift due to both the so-called filter wedge and the difference in the position of the reference image
- After these updates, we estimate the relative alignment of the images in different filters to be good to better than 5 mas, and between detectors to about 15 mas.

7. Problem cases

Images affected by a bias jump or by the cross pattern due to scattered Earth light were corrected by applying a median filter (width 21 pixels) to the image obtained after subtracting the "expected" image produced by BLOT in step 3. The median filter preserves the edges and produces an adequate subtraction for a sharply varying background, such as that produced by either a bias jump or the scattered Earth light. Direct inspection confirmed the subtraction to be satisfactory.

Cosmic rays were identified properly in the vast majority of cases. A handful of exceptions - usually due to a very large cosmic ray - were identified at this stage and excluded from further processing; such images will be recovered as part of the Version 2 combination.

Similarly, moving targets usually were flagged properly, but in some cases left visible residuals; these were excluded from further Version 1 processing.

Altogether, approximately 7% of the data were excluded from the final combination because of uncertain pointing or uncorrected blemishes; these are identified in the master log file.

8. Final combination

First, the (small) difference in sensitivity between the detectors was corrected by scaling to a common zero point; WF3 was chosen as reference.

Second, the pixel weights of each input file were determined as the inverse variance of the background within each pixel, scaled to the output pixel size.

DRIZZLE was then run on all acceptable images for each filter with the following parameters:

- SCALE = 0.400, PIXFRAC = 0.500 for the Wide Field Cameras
- SCALE = 0.875, PIXFRAC = 0.600 for the Planetary Camera

resulting in a final pixel size of 0.0398" (verified by coalignment with astrometric stars, see below).

The size of the output image is 4096 x 4600 pixels, or 163" x 183" - enough to include all the area with valid data. The final image was set to 0 for low-weight pixels, which suffer from uncorrected cosmic rays and other blemishes and have low scientific value.

As a final step, the image was astrometrically calibrated by using four stars with absolute astrometry determined by the Naval Observatory in the Hipparcos reference frame. The WCS parameters in the header were updated to reflect the best astrometric solution, with an expected error of 40 mas dominated by systematics in the astrometric position of the reference stars.

Appendices

A. The weight images forDRIZZLE

The DRIZZLE program allows each input image to be assigned a pixel-by-pixel weight. We used the inverse variance of the background in each input pixel, scaled by the fourth power of the scale ratio; this produces final weigths that are representative of the inverse variance per pixel on large areas. (The variance measured on small areas is smaller because of the pixel-to-pixel correlation.)

Specifically, we defined the weight image as follows:

```
VARIANCE = [(DARK+BACKGROUND)*FLATFIELD/GAIN + READNOISE^2] /
   (FLATFIELD^2 * EXPTIME^2)

WEIGHT = 1 / (SCALE^4 * VARIANCE)
```

where the dark current DARK and background BACKGROUND were estimated from the image average, rather than on a pixel-by-pixel basis. DARK, BACKGROUND and READNOISE are in DN/pixel; the GAIN and READNOISE were taken from the WFPC2 Instrument Handbook, and are different for each chip; and the FLATFIELD is the inverse of the value in the flat field reference file, which is the INVERSE flat field.

The SCALE parameter is the ratio of output to input pixel size. Since the output size is 0.4 WF pixels, SCALE = 0.400 for WF2, WF3 and Wf4, and SCALE = 0.875 for the PC.

The WEIGHT was set to zero if any of the following conditions applies:

```
dark current > 0.02 DN/s       (hot pixel)
flagged as cosmic ray
inverse flat field > 1.7       (too close to the pyramid edge, vignetted)
x, y < 60 (PC) or < 40 (WF)    (too close to the pyramid edge)
x, y > 795                     (too close to the outer edge)
```

B. Photometric Information

Filter	F300W	F450W	F606W	F814W
Multiplicative factor:				
PC	1.025	1.027	1.008	1.019
WF2	0.984	1.008	0.979	0.994
WF3	1.000	1.000	1.000	1.000
WF4	1.019	1.030	1.015	1.017
Final zero point				
Vegamag	19.43	22.01	22.90	21.66
ABMAG	20.77	21.93	23.02	22.09
STMAG	19.45	21.53	23.21	22.91
Photflam	5.985e-17	8.797e-18	1.888e-18	2.449e-18

These zero points differ very slightly from those used for the original HDF (-0.02 in F300W, -0.01 in F606W). The camera throughput has remained constant through the years, and the slight differences are due to new measurements of the zero points over the last three years.

C. New Superbias reference file

Name I9817383U.R2H

Created by: Shireen Gonzaga, August 25, 1998

The reference bias file ("superbias") was produced from an average of 120 on-orbit bias frames taken between December 4, 1997 and August 13, 1998 (listed in the file header).

The raw images were retrieved from the archive and recalibrated (mask, atod, and bias level corrections) using CALWP2 Version 1.3.5.2, which removes separate bias levels for the even and odd data columns based on values in columns 9-14 of the extracted engineering datafile (x0h).

The STSDAS wfpc "mkdark" task (identical to a version of "crrej" previously used to make reference bias files) was used to combine the calibrated frames and remove cosmic rays. The task was run with four iterations, using sigmas set to 6,5,5,and 4; Pixels are rejected if they are N sigma above or below the initial guess image. The first initial guess image was taken to be the median of the stack; subsequent iterations use the computed average image as the initial guess. In addition, pixels within 1 pixel of a rejected pixel (in a '+' pattern) were discarded if they deviated by more than 2,2,1.5, and 1 sigmas, respectively for each iteration. Pixels using less than 100 input images were marked in the DQF.

D. New Superdark reference file

Name I9T1701QU.R3H

Created by: Michael S. Wiggs and Stefano Casertano, September 25, 1998.

The reference dark file ("superdark") was created from an average of 120 input darks. The input darks were from the date range of 11/05/1998 thru 21/08/1998, and are named in the image header. All datasets were calibrated using CALWP2.1.3.5.2, utilizing the most up-to-date reference files, including the new superbias: i9817383u. The datasets were then run thru the STSDAS task CRREJECT in 8 groups of 15. This was done assuming a total readout, a-to-d conversion, etc. noise of 6 electrons. The cosmic rays were removed iteratively, with 4 sigma rejection, and then additional iterations were made with 3 sigma and 2 sigma rejection levels.

The resulting 8 "crrejected" datasets were averaged together to create the final 120 image superdark. The superdark image was then normalized to a darktime of 1.0 second for each CCD.

The associated DQF file was computed in the following manner:

- If more than 60 input files are valid and the dark current is <= 0.02 DN/s, then the pixel value is 0 (valid data).
- If more than 60 input files are valid and the dark current is > 0.02 DN/s, then the pixel value is 512 (uncorrectable warm pixel).
- If >= 60 input files are valid, set the pixel value to the bitwise OR of all input masks (any flag set in any of the input file is set on the mask).

E. New Inverse Flat Field reference file

```
F300W: I9T1701IU.R4H
F450W: I9T1701KU.R4H
F606W: I9T1701MU.R4H
F814W: I9T1701OU.R4H
```

Created by: John Biretta and Michael S. Wiggs, September 28, 1998.

The flat fields will be described in a forthcoming document.

NICMOS Data Reduction / Technical Issues

Check the page with warnings and advisories before making any use of the data.

Information is available about the following topics:

NICMOS imaging

Description of data products

1. General

The final reprocessed data (version 1.0) can be retrieved from the directory **nicmos/** on this anonymous ftp site. This directory represents our best present combination of the NICMOS images and the STIS images of the NICMOS field as of 23-NOV-1998.

The field was observed with the F110W, F160W and F222M filters of NICMOS Camera 3 (pixel size = 0."2) and in 50CCD (open filter) mode with STIS. The images were processed using a variant of the CALNIC and DIMSUM procedures to remove the electronic pedestal, dark and sky, were registered using new versions of tasks in the STSDAS "dither" and ditherII STSDAS packages (Fruchter, Hook, Busko and Mutchler 1997, Fruchter and Hook 1998), and combined using Drizzle (Fruchter & Hook 1998). Some images which had noise levels substantially larger than predicted (nearly always as a result of persistent cosmic rays in images taken shortly after an SAA passage) were excluded from the combination. The total exposure times in seconds are:

```
F110W   108539
F160W   128441
F222M   103163
50CCD    25900
```

The F222M images were taken during "bright" time, i.e. when the telescope was pointed near the bright limb of the earth. The F110W and F160W were taken in dark time. The 50CCD images, unlike the NICMOS images, were taken outside of CVZ, and thus the telescope was pointed away from the earth limb.

The images have all been combined with North up (the orientation, based on the HST guide stars, has an estimated error of ~0.1 degree) and astrometric zeropoint was set using the position of a star visible in the NICMOS image whose position was determined by the Naval Observatory (with an estimated total error of ~50 mas).

Follow this link for a legend of the file names for the final reprocessed data. In short, the available images are:

```
f110w_v1.fits                   The F110W NICMOS image
f110w_w_v1.fits                 "                " weight image

f160w_v1.fits                   The F160W NICMOS image
f160w_w_v1.fits                 "                " weight image

f222m_v1.fits                   The F222m NICMOS image
f222m_w_v1.fits                 "                " weight image

stis_nic_v1.fits                The STIS on NIMCOS 50CCD image
stis_nic_w_v1.fits              "                       " weight image

stis_nic_psf_v1.fits            The convolved STIS on NICMOS image
stis_nic_psf_w_v1.fits          "                           " weight image
```

In the subdirectory pf1p0/, another version of the F110W, F160W and F222M images can be found. These images were created with a "pixfrac = 1.0" and are primarily of use to those wishing to study sources at the very edges of the images, where the above images begin to "break-up" due to a lack of sufficient input images to cover the output plane at the finer pixfrac scale.

The subdirectory individual/ contains all individual calibrated (un-combined, un-mosaiced) NICMOS exposures as gzipped tar files.

2. Understanding the images

The NICMOS images in this directory were created using the Drizzle parameter values, pixfrac = 0.45, scale = 0.36974. The scale was set to create an output pixel size of 0."075, or exactly three times the scale of the STIS images of 0."025 of both the NICMOS field and the primary quasar field. The pixfrac is a compromise between providing uniform coverage as much of the field as possible and obtaining the highest possible resolution. These goals were, however, fairly well met, as nearly all of the available field has a ratio of r.m.s. to median of the weight image of less than 0.3, and the FWHM of the stars in the J and H band images are about the width of an input (0."2) NIC-3 pixel.

The noise in the images is estimated by the weight map images. The weight maps of individual input images were set equal to the square of the exposure time of the image divided by the expected r.m.s. in counts of the image. This is the inverse of the expected variance of the image. Drizzle divides the input weight up among the output pixels so that the total sum of the pixels in the input image is preserved.

If one measures the r.m.s. in the sky of the drizzled image one will find it does not equal the square root of the inverse of the weight map. There are two factors that must be applied to make these numbers equal:

1) The inverse variance map estimates the noise in a single INPUT pixel, but drizzle divides the flux among scale**2 output pixels. One must therefore divide the estimated r.m.s. by scale**2 (or multiply the weight map by scale**4). This has already been done for the WFPC2 images (as part of creating the PC+WFPC mosaic), but was not done for the STIS or NICMOS images.

2) Drizzling causes adjacent pixels to be correlated. The pixel-to-pixel noise therefore underestimates the true noise of a larger area. This correlation factor is a function of the ratio of (pixfrac/scale). For the NICMOS images this factor is ~1.9, for the STIS image it is ~1.8.

In the case of the NICMOS images then the noise directly estimated from the weight map is about a factor of 14 = 1.9/(0.36*0.36) larger than that measured on small-scales from the images.

In order to obtain the highest signal-to-noise from photometry on a drizzled image one should perform a weighted sum of pixels in the region of interest. The program, weighted block average or wba, found in

http://archive.stsci.edu/pub/hdf/v2/drizzled/

will perform a weighted AVERAGE (note not sum) of a rectangular region of a drizzled image and its weight image. Notes on using the program can also be found on this page.

3. PSF Convolution of the STIS Image

In order to allow a more accurate photometric comparison of the STIS and NICMOS images, the STIS image was convolved to the resolution of the NICMOS image and the 0."025 pixels of the STIS image were block-summed to the 0."075 resolution of the NIMCOS image.

The convolution kernel was created using Tiny Tim and the IRAF task "psfmatch". First a NICMOS F160W PSF was created on the STIS 0."025 drizzled STIS pixel scale. This PSF was then divided in fourier space by a gaussian comparable to the core of the STIS PSF. This step was accomplished using psfmatch. The resulting kernel was then rotated to the average orientation of the NICMOS image, and was applied to the STIS image using the STSDAS task fconvolve. The resulting convolved image was then block-summed 3x3 to the NICMOS pixel scale.

Data Reduction

1. Introduction

The NICMOS HDF-South images were processed using a combination of STScI pipeline procedures and customized tasks designed to remove the basic instrumental signatures from the data. Further processing to remove bad pixels and residual artifacts, and final image combination, were carried out using the Drizzle procedure (Fruchter & Hook 1998) and associated software. A detailed description of the methods used will be presented at a later date both on this web page and in various publications, but here we give a brief outline of the steps taken.

The observations were taken in MULTIACCUM mode using the SPARS64 sample sequence. In this operating mode, the array is first reset and then read out nondestructively at various regular time intervals to sample the accumulating signal throughout the integration. All exposures were obtained using NSAMP = 5, 10, 15, 20 or 25 readouts.

2. Basic Image Processing

1) The images were partially processed through the STSDAS 'calnica' pipeline applying the steps ZOFFCORR, ZSIGCORR, MASKCORR, BIASCORR, NOISCALC, DARKCORR, and NLINCORR. Standard STScI reference files from the calibration database were applied during these steps. This processing accomplishes the subtraction of the nominal bias and dark current from the readouts of the MULTIACCUM image. At this stage, then, no cosmic-ray correction, flat-fielding or conversion to counts per second have been performed. However, some components of NICMOS biases and darks are not temporally stable, and are thus not fully removed by the pipeline processing.

2) In particular, NICMOS data are subject to floating bias levels in each readout quadrant which can change during the course of a MULTIACCUM sequence (sometimes known as "pedestal"). These variable bias levels were dealt with in two stages using a routine we call NBIASFIX. Bias drifts during the course of each individual MULTIACCUM exposure were measured and removed with a customized procedure which also identifies and eliminates the occasional bias jumps or bands (which are particularly common in the last readout of a MULTIACCUM sequence, a.k.a. the "last read anomaly"). The effect of these processing steps is to remove changes in bias levels from readout to readout, leaving data which accumulate in a simple linear fashion with time. However a net (unknown) DC bias level is still present in the data (see step 4 below).

3) The data were then processed through the UNITCORR and CRIDCALC stages of 'calnica.' A slope is fit to the accumulating counts versus time in each pixel. CRIDCALC detects sharp discontinuities in the accumulating counts versus time ramp and identifies these as cosmic ray events. When these occur, the offending readout is eliminated for the pixel in question and the slope is recalculated without it, thus effectively removing the cosmic ray from the image. The output of this processing step is an image representing count rates for each pixel. Note that at this stage in our processing procedure the data have not yet been flatfielded.

4) Step 2 above removes drifts in bias during a readout sequence but not the absolute DC bias level. Sky and bias subtraction were accomplished using the data frames themselves through an iterative procedure. Simple median "sky+bias" images were created from the data taken in each filter grouped by NSAMP (i.e. number of readouts). These were then fit to each image allowing one multiplicative degree of freedom (the DC sky level) and four additive degrees of freedom (the bias levels in each quadrant). The sky and bias subtracted images were flat fielded, coaligned and assembled into mosaics for each bandpass. Objects were identified in the mosaics and masks were created marking their positions in each individual exposure. New sky+bias images were then created in a second iteration, using the scaling information determined in the first pass, and with objects masked during the combination. These second pass sky+bias frames were then scaled again to the individual images following the same procedure as before and subtracted to produce the new sky and bias subtracted exposures, which were then flatfielded. This iterative procedure effectively removes all the additive components (sky plus residual dark and bias) left over after the initial calnica pipeline processing.

5) Error models were created for each image using information about detector characteristics, sky levels, number of readouts and total integration time used for each pixel. The noise level in each image was compared to this model, and the frames were given careful visual inspection. In particular, signs cosmic ray persistence, "monster" cosmic rays, and moving targets (satellite trails, etc.) were noted. A significant number of frames were badly affected by cosmic ray persistence, which occurs in exposures taken after passages through the South Atlantic Anomaly. Frames which were irredeemably ruined by CR persistence were eliminated from the final data set. In general, measured image noise agreed well with the error models. Cases where there was a significant disagreement were tabulated and the relative variance scaling was used to re-weight the images in the final summation (section 12 below).

6) The F222M (K-band) data required special processing. The large background count rate in these data allowed us to identify previously unrecognized shortcomings in the nonlinearity corrections made by the standard pipeline. We constructed a new linearity correction procedure using in-flight calibration data and applied it to the F222M images which significantly improved the quality of the subsequent sky subtraction. Note that this new correction was not applied to the version 1 reductions of the F110W and F160W images; this may be done for a future version 2 release of the HDF-South NICMOS data; however, we expect such a corretion to only affect the brighter stars in these images. Raw F222M images showed a number of ring-like features which we attributed to out-of-focus thermal emission from dust particles lodged on one of the optical surfaces, probably the Field Offset Mirror (FOM). These were found to move several times during the course of the HDF-South observations, evidently at times corresponding to resets of the FOM position. The complete ten-day data stream in F222M was broken into four subsets corresponding to the four intervals where the dust features were found to be stable, and sky subtraction was carried out separately for each of these four intervals.

7) The final sky subtracted images were flatfielded using standard reference files from the calibration pipeline.

3. Image Combination

8) The images were spatially co-registered using cross correlation procedures allowing for rotations between images (necessary because the telescope roll angle changed from exposure to exposure as part of the dithering procedure designed to keep the HDF-S QSO in the STIS spectroscopic apertures); however, the rotation angle used was that provided by the spacecraft telemetry and was not determined independently.

9) Residual bad pixels (including the worst of the cosmic ray persistence features) were identified and masked via an iterative procedure described in the 'dither' and 'ditherII' package tutorial (Fruchter and Mutchler 1998). The resulting bad pixel masks for each image were combined with a custom static mask designed to exclude known and suspected bad pixels in the array, as well as the vignetted region at the bottom edge of the NIC3 field of view and a small unstable region at the upper right.

10) Pixels in the NICMOS detector arrays are not uniformly sensitive across their areas. Therefore undersampled images are subject to intrapixel response effects, wherein the measured counts depend sensitively on the positioning of the source within the pixel. This can have a particularly large effect on point sources observed with Camera 3, causing the measured counts in the peak pixel to vary considerably more than simple shot noise statistics would predict. We found that our procedure designed to identify residual bad pixels and cosmic rays was frequently "zapping" the peaks of bright stars for this reason. The peaks were therefore manually "unzapped" to correct for this effect. The final summed HDF-S NICMOS images should be largely free of photometric uncertainty due to these intrapixel response effects because they are averages over more than one hundred individual exposures with randomly placed sub-pixel centerings.

11) NICMOS images containing relatively bright sources are subject to electronic ghosting artifacts (known as the Mr. Staypuft effect. This phenomenon manifests itself in two ways. First, bright objects can produce "streaks" of elevated signal along image columns. These appear both in the columns where the object lies and also in the corresponding columns in other detector quadrants. Second, faint ghost images of a bright source in one detector quadrant also appear in the other three quadrants at the corresponding pixel positions. Both effects were visible in the HDF-S F110W and F160W images, arising from the small number of brighter stars present in the field. The column ghosts were quite prominent and were handled by fitting and subtracting medians from each column in each exposure. Pixels corresponding to the positions of all known astronomical sources were masked and excluded from the median fitting procedure to ensure that they would not bias the measurement. The fainter ghost images of the four brightest stars were invisible except in the final drizzled image combinations, where they appeared as faint, false "objects." These were eliminated by masking small areas in each exposure around their expected positions in each detector quadrant (i.e. positions 128 pixels away in each axis from the actual location of the responsible stars). These masked regions were set to zero in the weighting maps used to combine the data (see section 10 below). Thanks to the fact that the HDF-S dither pattern involved rotations, the regions which were masked and excluded at one telescope rotation were filled by "good" data from another, ensuring that the ghosts could be eliminated without producing gaps in the final images. However the effective exposure time underneath the regions affected by the Mr. Staypuft ghosts is significantly reduced from the total, and thus the resulting image noise is higher. The output pixel-wise weighting maps from the drizzling process, which are available together with the HDF-S images themselves, show distinctive "holes" which can be used to identify the locations where the ghost masks most severely affect the data.

12) The images were drizzled together using the individual bad pixel masks generated for each exposure combined with the overall static mask (see section 9 above), using spatially dependent weighting maps generated using the known flatfield pattern and noise characteristics of the data (see step 5 above). This procedure ensures optimal weighting by inverse variance during image combination. A new calibration for NICMOS Camera 3 geometric distortion (updating that in Cox et al. 1998) was used during drizzling. NICMOS pixels are slightly rectangular when projected onto the sky, an effect which is also removed during drizzling using the geometric distortion correction. The pixel scale for the final drizzles had a linear extent of 0.36974 original NIC3 pixels, a scale chosen to be exactly 3 times that of the final drizzling scale used for the STIS 50CCD images. The final drizzled pixel scale is therefore 0.075 arcseconds per pixel in the NICMOS images, and 0.025 arcseconds per pixel in the STIS-on-NICMOS image. The "drop size" or "pixfrac" for the NICMOS drizzles was set to 0.45 input pixels. The images in all bandpasses (including the STIS-on-NICMOS data) were drizzled so that they were co-aligned and so that North is up (i.e. in the positive y pixel direction) and East is right (i.e. negative x) to the best of our knowledge of the orientations of the science instrument apertures.

4. STIS image on the Main NICMOS Field

The STIS on NIC image includes 9 orbits of unfiltered STIS images of the NICMOS HDF-S field. Pairs of cosmic-ray split images were obtained at 9 dither positions during two visits. These frames were processed using the same procedures as for the main STIS field. Since the CCD was annealed between the first and second visits, an updated dark frame was created for the version 2 processing. The version 1 processing masked hot pixels from both darks in the post-annealing data. These masks were multiplied by an edge mask to create the final static masks.

The mode of the sky pixels was determined using an iterative rejection algorithm and subtracted from each cosmic-ray split frame. Image shifts were also determined individually via aniterative process of cosmic-ray masking and cross-correlation. The rotation angle was essentially identical for all these frames. The amplifier ringing correction described by Gardner et al. was applied, but the improvement to the sky was negligible for this field. The images were drizzled onto 0.025" pixels, scale = 0.492999, using a drop size of 0.6 pixels. The images were weighted by the variance of the sky, or wt_scl = t ** 2 / (N_sky + R^2 + N_dark). A small rotation of 5.55 degrees was included to rectify the image.

Photometric Zeroponts

There remains some significant uncertainty in the absolute photometric calibration of the NICMOS HDF-South images. The nominal photometric calibration information which is inserted into image headers by the STScI CALNICA data reduction pipeline use the most up-to-date calibration reference files taken from the STScI Data Archive. However, recent information based on revised ground-based photometry of the fundamental NICMOS photometric standards by Persson et al. 1998 (AJ 116, 2475) suggests that calibrations based on these reference files may be incorrect by 5 to 14% for some filters. Moreover some zeropoints also disagree with those used by the NICMOS IDT for their HDF-North observations (Thompson et al. 1998 in press). These discrepancies are presently being investigated

For the purposes of the version 1 data release and catalogs, we have adopted preliminary revised values of the photometric zeropoints for the F110W, F160W and F222M filters kindly provided by D. Calzetti of the STScI NICMOS group. We stress that these are PRELIMINARY values only, but we feel that there is sufficient reason to doubt the nominal pipeline photometric calibration that the use of new values, even preliminary ones, is justified. Here we present these new zeropoint values along with those from the calibration pipeline and those used by Thompson et al. for the HDF-North. In all cases, these are zeropoints in the AB magnitude system, such that

```
AB = zeropoint - 2.5 * log(n)
```

where n is the count rate (ADU per second) measured from the images. All HDF-S images, including those of the NICMOS field have been normalized, to counts per second, i.e. to an effective exposure time of 1 second. Therefore the zeropoints given above may be applied directly to measurements from the images without further rescaling for the exposure times. Actual exposure time varies with position across the image due to the dithering pattern, bad pixel masking, etc. The sum total of the integration times of all images used in the final drizzled mosaics is recorded in the TEXPTIME header keyword in each image.

Bandpass	Preliminary Revised Zeropoint	Pipeline Zeropoint	Thompson et al. HDF-North Zeropoint
F110W	22.75	22.89	22.68
F160W	22.77	22.85	22.80
F222M	21.80	21.89	-----

For the STIS-on-NICMOS image in the 50CCD (clear) bandpass, we adopt the nominal zeropoint from the calibration pipeline, identical to the value used for the primary HDF-South STIS field. We have no reason to question this zeropoint value at this time.

```
50CCD (STIS)    26.386
```

Note that the photometry keywords recorded in the headers of the Version 1 HDF-South NICMOS images (e.g. the PHOTFNU keyword) are those provided by the standard STScI calibration pipeline, and thus correspond to the zeropoints in the middle column above. I.e. they have *not* been revised to account for the new, preliminary calibrations described above.

WE EMPHASIZE THAT ABSOLUTE PHOTOMETRY FROM THE HDF-SOUTH NICMOS IMAGES MAY BE UNCERTAIN AT THE 10% LEVEL DUE TO THESE ZEROPOINT UNCERTAINTIES. We will provide updated information on photometric zeropoints on these web pages as it becomes available.

This page was last updated on March 11, 1999.

Flanking Fields Data Reduction / Technical Issues

Check the page with warnings and advisories before making any use of the data.

Information is available about the following topics:

- STIS 50CCD imaging
- WFPC2 imaging
- NICMOS imaging

STIS 50CCD imaging

Description of data products

Follow this link for a legend of the file names for the final reprocessed data.

General

The analysis and reduction of the STIS flanking fields proceeded in similar fashion as for the imaging of the Main STIS Field. Please read first the description of those observations, with particular emphasis on the description of the Flanking Field observations.

Observations

For Each of nine fields, STIS observation were made in parallel mode operation to the primary instrument WFPC2. After Guide Star Acquisition a "CR-SPLIT" 1200s exposure was followed by a 1300s "CR-SPLIT" exposure at a new dither (shifted) position, but at same roll angle. A second 'orbit' of observations immediately followed with two more dithered "CR-SPLIT" exposures of 1300s apiece.

```
Mode   Cent Wave  FWHM   Det. FOV  Tot FOV  Tot Exp
----   ---------  -----  --------  -------  -------
50CCD  5850A      4410A  52"x52"   60"      5100s

FIELD  RA_TARG       DEC_TARG
-----  -------       --------
POS1  338.448683577  -60.5389133361
POS2  338.363228572  -60.5755798231
POS3  338.482371926  -60.5811353514
POS4  338.524469698  -60.5619687787
POS5  338.438601453  -60.5991908183
POS6  338.394829563  -60.6169685088
POS7  338.56782685   -60.5444688644
POS7  338.600629493  -60.5772464816
POS9  338.390813099  -60.6439128206
```

Data Reduction/Technical Issues

The flanking fields were processed in very closely the same manner as described in the STIS Imaging section. These notes point out the exceptions.

- 1. The DARK calibration reference file used in the CALSTIS data reduction steps was constructed using a 'delta-dark' image appropriate for the epoch of the flanking field observations.
- 2. No cosmic ray rejection masks were used except those constructed within the XDITHERII DRIZ_CR processing.
- 3. There were no differences in the commanded rolls to the spacecraft between the dithered exposures. No significant roll offset was found in the processing. The only rotation applied in the combining process was the +5.4 degree rotation to North.
- 4. DRIZZLE drop-size used for the flanking fields was a "pixfrac" of 0.8.

WFPC2 imaging

Description of data products

The final data products for all of the WFPC2 Flanking Field observations are now available. The current version 1.0 (11/25/98 and 12/21/98) represents our best shot at a first combination of the WFPC2 data taken in the Hubble Deep Field South Flanking Fields.

Follow this link for a legend of the file names for the final reprocessed data.

For positions 1-9, images were taken in the F814W filter. Longer (9 orbit) flanking field observations were also taken when STIS was observing the NICMOS main field. These observations consist of both F606W and F814W images. Note that both data and weight images are presented in a single mosaic, with all four WFPC2 detectors combined onto the same image plane. The weight images represent the inverse of the variance predicted from a noise model at the mean sky level of the observations, taking into account masking of cosmic rays and hot pixels.

General

The analysis and reduction of the WFPC2 flanking fields proceeded in similar fashion as for the imaging of the Main WFPC2 Field. For information on the data reduction, please read first the technical information for the Main WFPC2 Field.

Combined Images

The combined images are the result of combining all individual exposures, optimally weighted for the background signal, and resampled to a pixel scale of 0.0498" using the "Drizzle" package developed by Fruchter and Hook and available in IRAF/STSDAS. The images are expressed in counts per second at a gain of 7. They have been rotated to have North approximately up (about 0.5 degrees from vertical). The coordinates of the images are set in the header WCS parameters, and can be retrieved for example via the IRAF task xy2rd. The absolute astrometry of the fields have not yet been converted to a standard astrometric system more precise than the HST Guide Star Catalog, and hence are uncertain by 1-2 arcsec. Work is underway to tie the fields to astrometrically measured stars kindly provided by the Naval Observatory. This work should be complete by the end of 1998.

The depth and coverage for each filter varies across the field of view, due to the variety of pointings that were combined together. The image depth wanes when approaching the edges of the area covered, as well as in a near-vertical seam between detectors which received much lower coverage than the central region of each chip. This variable depth is reflected in the image weights, described below.

As a consequence of the decreased image quality, the outer regions of each image are less reliable, especially in terms of cosmic ray rejection. Any oddly-shaped objects appearing in only one filter near the edge of the images presented here has a good probability of being a piece of an unrejected cosmic ray.

Images have been trimmed (set to zero) where the weight per pixel was zero. However there are a number of low-weight pixels around the edge that still have residual cosmic rays.

Photometry

WFPC2 detectors differ slightly in their sensitivity. The individual input images have been scaled to the response of the WF3 detector, thus the zero points determined for WF3 (at gain 7) apply. For reference, the most recent determination of the zero point for infinite aperture in the VEGAMAG system is:

```
F814W    21.66
```

Correlated Noise

Those planning to run detection and photometry software on these data should be aware that the noise is strongly correlated between adjacent pixels in the final drizzled images. Consult the main HDF-S web page for more details.

NICMOS imaging

CONSTRUCTION

Check here for information on the status of the NICMOS Flanking Field observations.

The Hubble Deep Field South Clearinghouse

As was the case with the northern HDF, there is likely to be lively interaction and competition among groups interpreting the HDF-S data and carrying out follow-up observations. Indeed, unlike the case for HDF-N, `follow-up' observations of HDF-S from ground- and space-based observatories began long before the primary HST observations were scheduled.

Here we provide a clearinghouse of links to web pages by various groups who are carrying out HDF-S research and observations. We invite anyone contemplating follow-up observations or detailed analysis to share information through this web page. The aim is to establish a forum for publicizing the status of followup work in order to avoid too much duplication, and to provide points of contact for cooperation/collaboration between various investigators. If you are interested in participating, please contact Mark Dickinson, Harry Ferguson, or Massimo Stiavelli.

You may also want to check out our page of HDF-S related publications and our HDF-North Clearinghouse.

General / Miscellaneous

- Informal notes on HDF-S follow-up plans from the December 1997 ESO/Australia Workshop held in Sydney.

UV / Optical / Near-IR

- Hubble Space Telescope
  - Main HST HDF-S page.
  - Data Products.
  - 1997 Preparatory *TEST* observations.
- Anglo-Australian Observatory
  - Main AAO HDF-S page.
  - Prime Focus CCD Imaging.
  - AAT redshifts (including clickable map !).
- ANU 2.3m Telescope
  - Intermediate resolution spectroscopy of the HDF-S QSO, University of New South Wales Group.
- Cerro Tololo Interamerican Observatory
  - CTIO Blanco 4m Big Throughput Camera, Goddard Space Flight Center Group (wide-field UBVRI and narrow-band imaging).
  - CTIO Blanco 4m Big Throughput Camera, NOAO Deep Wide-Field Survey Team (imaging).
  - CTIO Blanco 4m prime focus CCD image, Allistair Walker (R-band 3000s, North is up and East is left) [FITS; 16 MB] , [postscript].
- European Southern Observatory
  - Main ESO HDF-S page.
  - NTT spectroscopy of the HDF-S QSO.
  - VLT Science Verification Data.
  - ESO Imaging Survey.
- European TMR collaboration

Mid-Infrared

- ISO.

Radio

- Australia Telescope National Facility.
- European TMR collaboration

Modeling / Interpretation / Catalogs / Photometric Redshifts

- European TMR collaboration
- HDF-S group at SUNY, Stony Brook
- HDF-S group at UC Berkeley
- Stephen Gwyn's photometric HDF-S redshifts
- The Hubble Deep Fields at the Rome Observatory.

This page was last updated on January 12, 2001.

Listing of .html files on the STScI HDF-S web site

hdfs.html	: main entry page
whatsnew.html	: what's new on the HDF-S Web Site
sitelayout.html	: site layout (this file)
workinggroup.html	: HDF-S Working Group
references.html	: references to HDF-S publications
clearinghouse.html	: links to HDF-S related web sites around the world
sydney.html	: some clearinghouse related notes
testdata.html	: 1997 HST HDF-S *test* data
project.html	: project description
obs_strategy.html	: observational strategy description
phasetwo.html	: links to HDF-S Phase 2 proposals
coordinatesS.html	: HDF-S coordinates
log_stis.html	: observing log STIS
log_wfpc2.html	: observing log WFPC2
log_nicmos.html	: observing log NICMOS
log_flankstis.html	: observing log Flanking Fields STIS
log_flankwfpc2.html	: observing log Flanking Fields WFPC2
log_flanknicmos.html	: observing log Flanking Fields NICMOS
log_saa.html	: SAA Crossings Table
reduc_stis.html	: data reduction description STIS
reduc_wfpc2.html	: data reduction description WFPC2
reduc_nicmos.html	: data reduction description NICMOS
reduc_flanking.html	: data reduction description Flanking Fields
dataprod.html	: links to version 1 data products
filenames.html	: legend of file names version 1 data products
warnings.html	: warnings and advisories
catalogs.html	: source catalogs
linelists.html	: line list
feedback.html	: information for providing feedback/questions
showall.html	: display version image ground-based
showSTIS.html	: display version image STIS
showNIC.html	: display version image NICMOS
showWFPC2.html	: display version image WFPC2
showspec.html	: display version spectrum STIS
press.html	: press reports on the HDF-S

Send us your *feedback or questions*.
Visit the Hubble Deep Field South *main page*.
Visit the Space Telescope Science Institute *home page*.

This page was last updated on November 29, 1998.

Press Reports on the HDF-S

- ABC
- CNN
- MSNBC
- New York Times

Send us your *feedback or questions*.
Visit the Hubble Deep Field South *main page*.
Visit the Space Telescope Science Institute *home page*.

This page was last updated on November 29, 1998.

Feedback and Questions

We welcome your feedback or questions! In general, you should contact one or more of the following people (or other relevant people in the HDF-S Working Group):

Press inquiries : *Office of Public Outreach*

General HDF-S Issues : *Bob Williams* , *Harry Ferguson* , *Mark Dickinson* , *Andy Fruchter*

STIS Specific Issues : *Harry Ferguson* , *Jon Gardner*

WFPC2 Specific Issues : *Stefano Casertano* , *Massimo Stiavelli*

NICMOS Specific Issues : *Andy Fruchter* , *Mark Dickinson*

Catalogs : *Harry Ferguson* , *Mark Dickinson*

QSO Absorption Line List : *Sandra Savaglio*

Web site contents, layout, links : *Roeland van der Marel*

The Medium Deep Survey is an international project that uses the Hubble Space Telescope to study the nature of faint galaxies in the deepest regions of the universe.

Recent Findings:
Read about recent discoveries in the MDS.

Literature & Publications:
Read journal articles and essays that pertain to the MDS and related work.

Research Staff:
Learn about who is working on the project.

MDS WFPC2 Catalog:
Search for images and information about a particular region of the Hubble Deep Field from this MDS database.

Cluster Search:
HST MDS Cluster Sample: Methodology and Data.

Download:
Download MDS software

Feedback:
Give your comments about this web site

index
99-06-04 , Karl Kosack *kosack@astro.phys.cmu.edu*

BIBLIOGRAPHY
For
HST Medium Deep Survey

MDS papers published in refereed Journals

- ( ) Return HTML abstracts (•) View on screen (•) Sort by date (most recent first)
- ( ) Return plain text abstracts ( ) Send to printer ( ) Sort by first author name
- (•) Return Full list sorted ( ) Save to file ( ) Sort by date (oldest first)

[Retrieve MDS Journal references] which have been preselected from ADS.

MDS papers in conference Proceedings

- ( ) Return HTML abstracts (•) View on screen (•) Sort by date (most recent first)
- ( ) Return plain text abstracts ( ) Send to printer ( ) Sort by first author name
- (•) Return Full list sorted ( ) Save to file ( ) Sort by date (oldest first)

[Retrieve MDS conference references] which have been preselected from ADS.

This selected list is also incomplete since all conferences have not as yet been included in ADS.

Search Abstract Query from Astrophysics Data System (ADS)
ADS HELP on Query Results List.

MDS Bibliography updates & corrections please E-mail : kavan@astro.phys.cmu.edu
Last updated as on 1999 June 30th.

DISK+BULGE MORPHOLOGY OF WFPC2 GALAXIES

Index

HUBBLE SPACE TELESCOPE MEDIUM DEEP SURVEY WFPC2 CATALOG Search Help

Explanation of Search Functions.

Define Fields This option links to page which allows user to	Define criteria to select MDS fields which satisfy specified limits in Equatorial(J2000) or Galactic Coordinates, and also Depth of Stack in terms of limiting magnitude, and cosmic-ray split in terms of Minimum number of Exposures in the Red (F814W); Green (F606W); Blue (F450W); and Violet (F300W) wide-band filters used in the Survey.	Next click on Find Fields to list the MDS Fields satisfying the criteria specified in Define Fields.
	Specify a specific MDS field or object ID to directly access a known MDS field or object.	
Define Objects This option links to page which allows user to	Define criteria to select MDS objects which satisfy specified limits in magnitude, Half-light radius, Bulge to Disk Ratio, Signal-to-noise Index, and object classification.	Next click on Find Objects to list MDS objects satisfying the criteria specified in Define Objects in the MDS Fields selected by Define Fields.
	Specify a specific Equatorial coordinate(J2000) and search radius in seconds of arc to locate a specific object of known location.	
Define Image	Select the output image type when a object is selected. Default is gray-scale JPEG images with user definable stretch and quality. Can also select GIF (lossless); or the FITS file on CDROM with optional compression of .Z (UNIX) or .gz (gzip) type	
Clear Form	Reloads current form with default values.	
ReStart	Restarts search erasing all memory of defined fields, objects etc	

Hubble Space Telescope

Medium Deep Survey

The Medium Deep Survey (MDS) is an international project that uses the Hubble Space Telescope (HST) in Pure parallel mode to study the nature of faint galaxies in the deepest regions of the universe.

This is the gateway to get direct and full access to stacks and catalogs on the MDS CDROMS (2nd edition) created by the MDS group at Carnegie Mellon University (CMU) and archived on a Jukebox at the Space telescope Science Institute (STScI). These now non-proprietary post-HST-refurbishment observations cover the period from February 1994 to January 1998. More MDS cdroms will be released when available.

The released MDS database contains model fits for over 210,000 objects in over 450 WFPC2 fields, observed in most cases using the F814W (498 in I), F606W (358 in V), and for few in F450W (55 in B) photometric filters. Some fields overlap each other.

Over 60,000 galaxies have disk-like or bulge-like quantitative morphology classification based on maximum likelihood ratio, and over 9,000 have disk+bulge decomposition (after allowing for about 20% overlap in fields).

When considering using MDS galaxies for cross identification please note that the total survey area is just about one square degree. However when comparing with pointed observations with some other instrument with a field of view larger than about 15 arc min the probability of overlap could be much larger than (survey area in square degrees)/40253 because of coincidence of the interesting targets observed as the primary candidate by the HST and that instrument.

When considering using MDS galaxies for ground based follow up please note that the galaxies have a median half-light radius of 0.3 arc seconds. Only about 3,500 galaxies have an half-light radius larger than one arc-second of which only about 400 exceed two arc seconds.

Please also note that the calibrated stacks on the MDS CDROMS are in STSDAS/GEIS format written from a SUN UNIX machine. For example, VAX users will need to use sun2vax to convert these files. The MDS pipeline was developed on SunOS to use the GEIS format output from the WFPC2 calibration software. Files in a future edition of the MDS CDROMS maybe converted to system independent FITS.

- CMU MDS group Home-page
- Search the WFPC2 MDS Database at STScI (Help).
- Notes on the WFPC2 MDS Catalogs on CDROM

CD	Available Data	Priority	Fields	MB
01	Groth-Westphal Strip Mar-Apr 94	1	28	621.6
02	MDS-GTO Pure Parallel fields 94-97	1	23	628.7
03	MDS-GTO Pure Parallel fields 94-97	1	19	628.7
04	MDS-GTO Pure Parallel fields 94-97	1-2	24	628.7
05	MDS-GTO Pure Parallel fields 94-97	2	24	623.6
06	MDS-GTO Pure Parallel fields 94-97	2	22	614.4
07	MDS-GTO Pure Parallel fields 94-97	2	21	623.6
08	MDS-GTO Pure Parallel fields 94-97	2	21	631.8
09	MDS-GTO Pure Parallel fields 94-97	2-3	48	625.7
10	MDS-GTO Pure Parallel fields 94-97	2-4	49	627.7
11	MDS-GTO Pure Parallel fields 94-97	4-5	25	624.6
12	MDS-GTO Pure Parallel fields 94-97	5	36	619.5
13	MDS-GTO Pure Parallel fields 94-97	5	46	618.5
14	Archival Cluster Fields 94-97	-	23	629.8
15	Archival Cluster Fields 94-97	-	23	622.6
16	Archival HDF substacks 1-9 Dec 95	1	09	651.3
17	Archival HDF + Flank + Primary Fields	1	25	632.8
18	MDS + Archival Primary Fields 97-98	1-2	24	632.8
19	MDS + Archival Primary Fields 97-98	2-7	43	617.5

Please note:
Any use of this data in a publication must reference Ratnatunga, Griffiths and Ostrander 1998 (in preparation) and make the following acknowledgment.

The Medium Deep Survey catalog is based on observations with the NASA/ESA Hubble Space Telescope, obtained at the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555.
The Medium-Deep Survey was funded by STScI grant GO2684 and daughters.
The Hubble Deep Field analysis was funded by STScI grant GO6951.
The Cluster Fields analysis was funded by STScI archival grant GO7036.

The load time for initial access of specific files on a new cdrom can take a minute.

The data is provide on the web via this access for any preliminary study of what is available on the MDS-CDROMS. Any astronomer wishing to make extensive use of this data should request a CDROM copy. Sets of copies of the CDROMS will be made after we roughly know the demand for them and made avaliable at cost of production.

Last modified: 4 October 1998

Please send any questions or comments to:
Kavan U. Ratnatunga

WFPC2 MDS Stack of Hubble Deep Field North

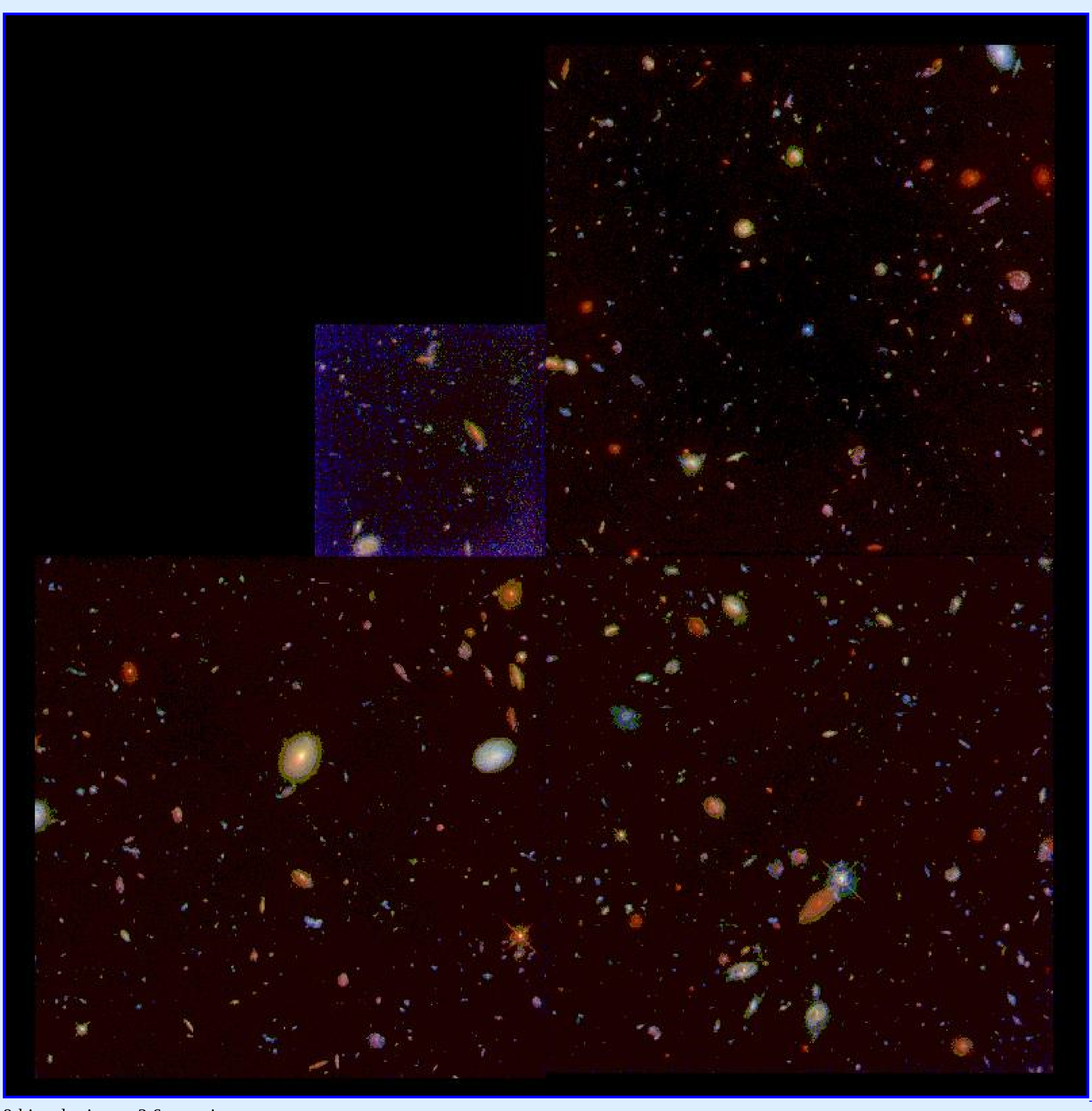
Define Fields	Find Fields	Define Objects	Find Objects	OR	Define Image	Clear Form	ReStart

		Equatorial		Galactic		F814W		F606W		F450W		F300W	
#	Field	R.A.	Dec.	longitude	latitude	mag	ex	mag	ex	mag	ex	mag	ex
1	uhdfk	12:36:49.00	+62:12:58.0	125.89	54.83	26.20	35	27.05	35	26.74	35	24.50	35

Survey Field Enviorenment : HST Primary Target information

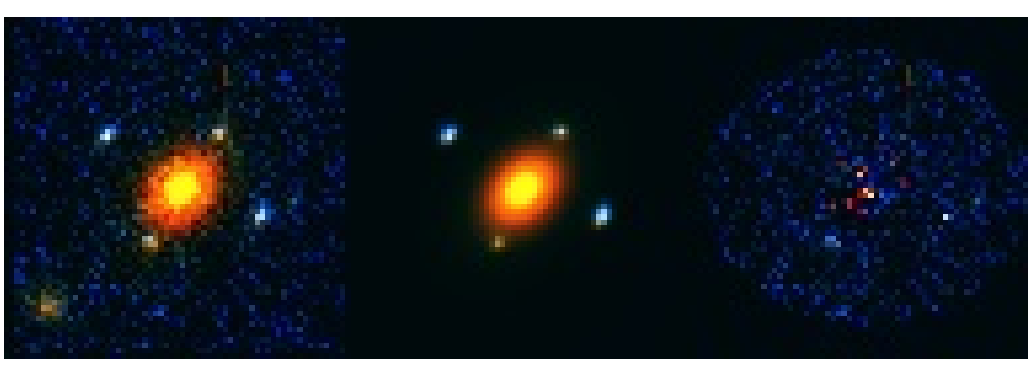
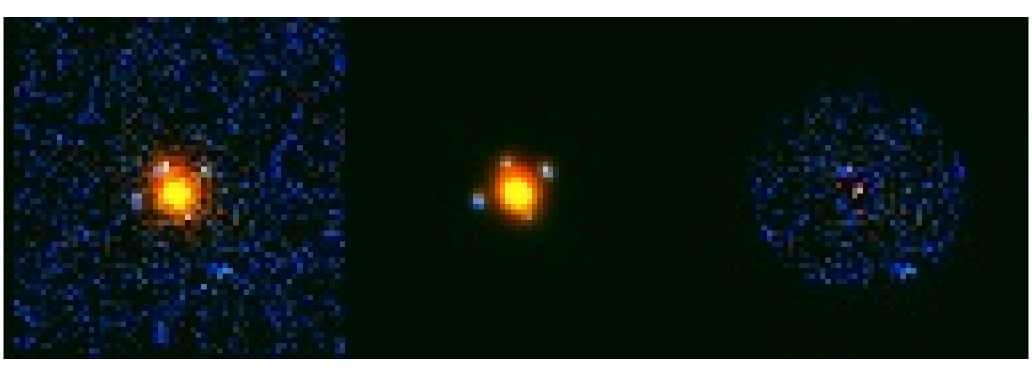
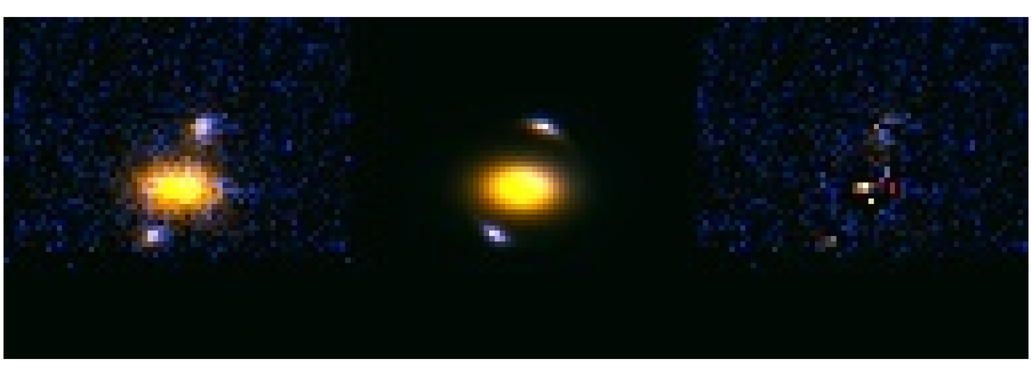
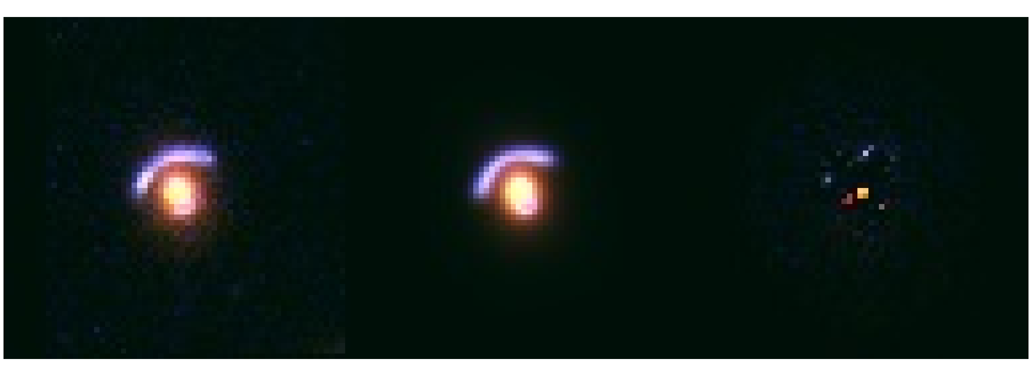
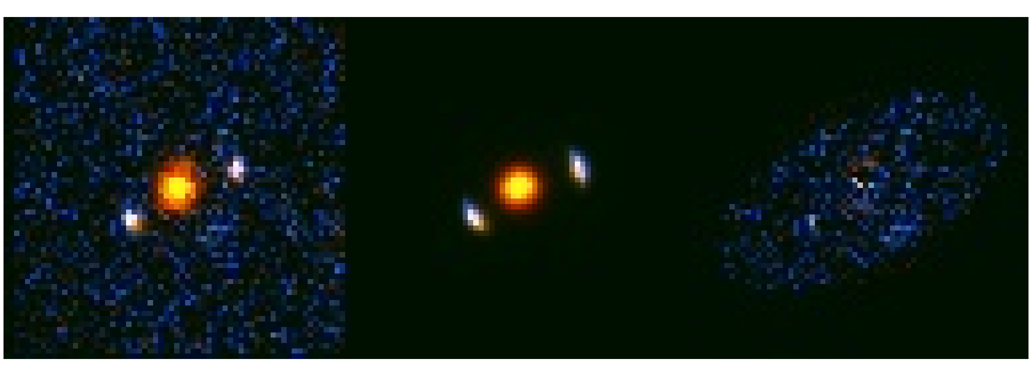
HST Data origin	Archival Primary Data			Primary Abstract	Search
Primary Instrument	WFPC2	Primary Target	HDF-123649+621346	Primary PI	WILLIAMS

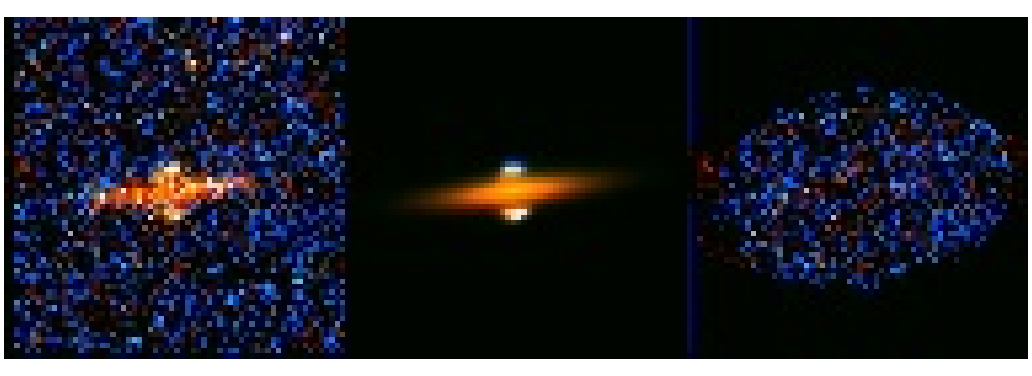
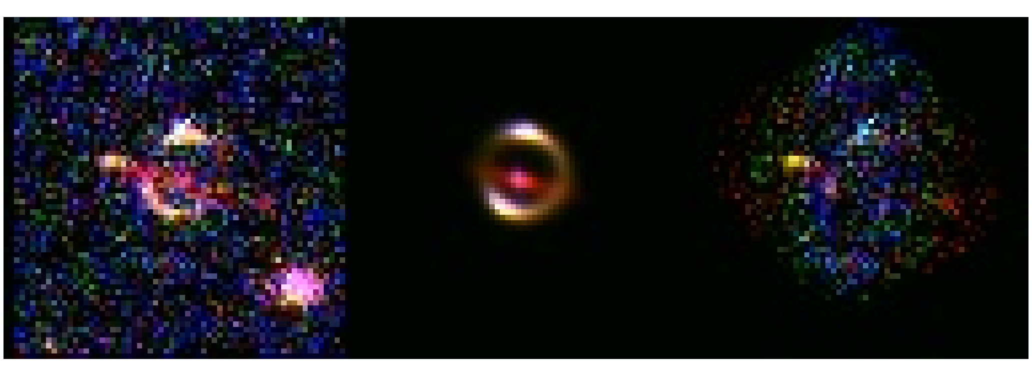
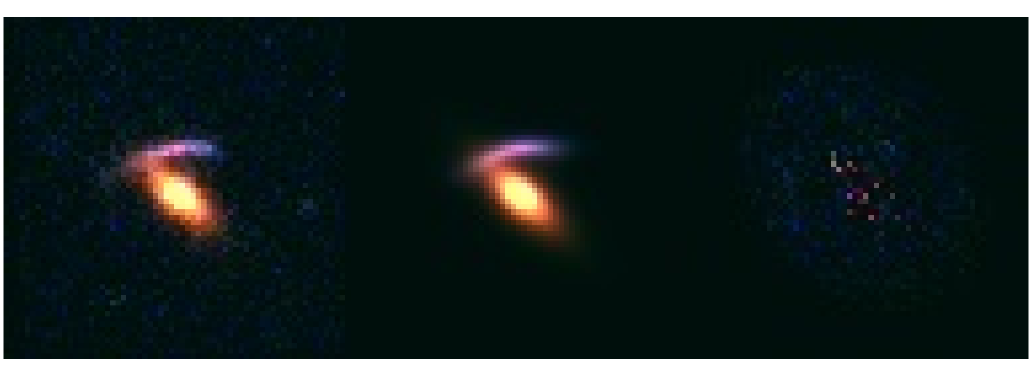
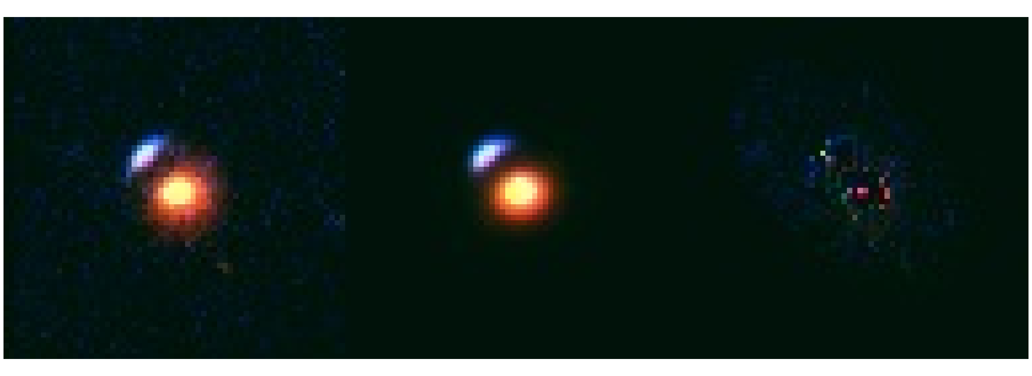
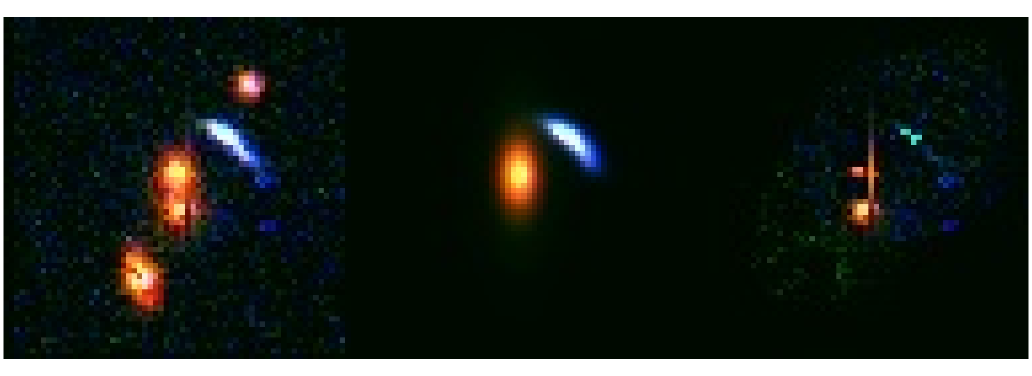
uhdfk.



8-bit color image 2.6 arc-min square

Top Ten Gravitational lens Candidates from Medium Deep Survey and other WFPC2 observations in the Hubble Space Telescope Archive.

MDS id	Observed	Model	Residual
HST 14176+5226 [u26x8:0009](u26x8:0009)			
HST 12531-2914 [urz00:0035](urz00:0035)			
HST 14164+5215 [u26xi:0017](u26xi:0017)			
HST 15433+5352 [uvd01:0014](uvd01:0014)			
HST 01247+0352 [uci10:0034](uci10:0034)			

MDS id	Observed	Model	Residual
HST 01248+0351 [uci10:0050](uci10:0050)			
HST 16302+8230 [urg01:0042](urg01:0042)			
HST 16309+8230 [urg01:0010](urg01:0010)			
HST 12368+6212 uhdfk:0056			
HST 18078+4600 [uqc00:0029](uqc00:0029)			

Click on MDSid link for each object to see a table of parameter estimates of Maximum Likelihood model fitted to images in each observed HST WFPC2 filter

For Press coverage on the WFPC2 HST lens discoveries click.

Ratnatunga, K. U., Griffiths, R. E. & Ostrander, E. J. 1999,
The Top Ten List of Gravitational Lens Candidates from the HST Medium Deep Survey
Astronomical Journal **117** 2010-2023 . astro-ph/9902100

The observed regions cutout from HST WFPC2 images are 64 pixels of of the CCD or 6.4 arc seconds on a side.
All of the color images above were created using a fixed algorithm to transform the observed single filter F814W(R), F606W(G) and when available F450W(B) to color JPG. Although the color balance is probably not as pretty as images that may be created using interactive software procedures, these images can be inter-compared more realistically. Note however that the color of the lensing galaxies are not yellow at the center but a bright red. The yellow produced by color saturation is used to indicate brightness to otherwise flat images.

To visualize gravitational lens configurations try out the interactive online WFPC2 HST lens image creator.

For more information on Gravitational lenses please also look at

- CASTLe Survey
  Harvard-Smithsonian Center for Astrophysics, USA
- Gravitational Lenses Bibliography and Database
  Institut d'Astrophysique et de Geophysique, Liege, Belgium.

Comments: E-mail kavan@astro.phys.cmu.edu - Kavan's Home page.

THE ASTRONOMICAL JOURNAL, 118:86-107, 1999 July

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DISK AND BULGE MORPHOLOGY OF WFPC2 GALAXIES: THE *HUBBLE SPACE TELESCOPE* MEDIUM DEEP SURVEY DATABASE

KAVAN U. RATNATUNGA, RICHARD E. GRIFFITHS, AND ERIC J. OSTRANDER
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Received 1999 February 3; accepted 1999 April 7

ABSTRACT

Quantitative morphological and structural parameters are estimated for galaxies detected in *Hubble Space Telescope* observations of WFPC2 survey fields. A modeling approach based on maximum likelihood has been developed for two-dimensional decomposition of faint undersampled galaxy images into components of disk and bulge morphology. Decomposition can be achieved for images down to F814W (I) ≈ 23.0, F606W (V) ≈ 23.8, and F450W (B) ≈ 23.3 mag in WFPC2 exposures of 1 hr. We discuss details of the fitting procedure and present the observed distributions of magnitude, color, effective half-light radius, disk and bulge axis ratios, bulge-to-(disk+bulge) flux ratio, bulge-to-disk half-light radius ratio, and surface brightness. We also discuss the various selection limits on the measured parameters. The Medium Deep Survey catalogs and images of random pure parallel fields and other similar archival primary WFPC2 fields have been made available via the Internet with a searchable browser interface to the database.

Key words: cosmology: observations—surveys

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Title:	Disk and Bulge Morphology of WFPC2 Galaxies: The HUBBLE SPACE TELESCOPE Medium Deep Survey
Authors:	Ratnatunga, Kavan U.; Griffiths, Richard E.; Ostrander, Eric J.
Affiliation:	AC(Department of Physics, Carnegie Mellon University, Pittsburgh, PA 15213; kavan@astro.phys.cmu.edu, griffith@astro.phys.cmu.edu, ejo@astro.phys.cmu.edu)
Journal:	The Astronomical Journal, Volume 118, Issue 1, pp. 86-107. (AJ Homepage)
Publication Date:	07/1999
Origin:	AJ
AJ Keywords:	COSMOLOGY: OBSERVATIONS, SURVEYS
Abstract Copyright:	(c) 1999: The American Astronomical Society
Bibliographic Code:	1999AJ....118...86R

Abstract

Quantitative morphological and structural parameters are estimated for galaxies detected in Hubble Space Telescope observations of WFPC2 survey fields. A modeling approach based on maximum likelihood has been developed for two-dimensional decomposition of faint undersampled galaxy images into components of disk and bulge morphology. Decomposition can be achieved for images down to F814W(I)~23.0, F606W(V)~23.8, and F450W(B)~23.3 mag in WFPC2 exposures of 1 hr. We discuss details of the fitting procedure and present the observed distributions of magnitude, color, effective half-light radius, disk and bulge axis ratios, bulge-to-(disk+bulge) flux ratio, bulge-to-disk half-light radius ratio, and surface brightness. We also discuss the various selection limits on the measured parameters. The Medium Deep Survey catalogs and images of random pure parallel fields and other similar archival primary WFPC2 fields have been made available via the Internet with a searchable browser interface to the database.

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	☐ Physics/Geophysics
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Sloan Digital Sky Survey

Current Press Releases

- **Researchers say New Star Structures found in the Milky Way Alter Galactic Model**
  (Jan 9, 2002)

SDSS Early Data Release:

SDSS EDR archive pages at STScI
Interactively browse the digital sky at the SDSS SkyServer.
Archive pages in Germany (**www.sdss.mpg.de**) and Japan (**sdss.nao.ac.jp**) coming soon.

Check the status of the SDSS archive servers.

What is the Sloan Digital Sky Survey?

Simply put, the Sloan Digital Sky Survey is the most ambitious astronomical survey project ever undertaken. The survey will map in detail one-quarter of the entire sky, determining the positions and absolute brightnesses of more than 100 million celestial objects. It will also measure the distances to more than a million galaxies and quasars. Apache Point Observatory, site of the SDSS telescopes, is operated by the Astrophysical Research Consortium (ARC).

The SDSS addresses fascinating, fundamental questions about the universe. With the survey, astronomers will be able to see the large-scale patterns of galactic sheets and voids in the universe. Scientists have varying ideas about the evolution of the universe, and different patterns of large-scale structure point to different theories of how the universe evolved. The Sloan Digital Sky Survey will tell us which theories are right -- or whether we have to come up with entirely new ideas.

The Sloan Digital Sky Survey (SDSS) is a joint project of The University of Chicago, Fermilab, the Institute for Advanced Study, the Japan Participation Group, The Johns Hopkins University, the Los Alamos National Laboratory, the Max-Planck-Institute for Astronomy (MPIA), the Max-Planck-Institute for Astrophysics (MPA), New Mexico State University, Princeton University, the United States Naval Observatory, and the University of Washington.

Funding for the project has been provided by the Alfred P. Sloan Foundation, the Participating Institutions, the National Aeronautics and Space Administration, the National Science Foundation, the U.S. Department of Energy, the Japanese Monbukagakusho, and the Max Planck Society.

www.sdss.org is a winner of the Griffith Observatory's Star Award

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This site was last updated on 13 March 2002.
Send Web-related comments and questions to sdss-webmaster@sdss.org.

Credits

Sponsors

Funding for the Sloan Digital Sky Survey (SDSS) has been provided by the Alfred P. Sloan Foundation, the Participating Institutions, the National Aeronautics and Space Administration, the National Science Foundation, the U.S. Department of Energy, the Japanese Monbukagakusho, and the Max Planck Society.

Participating Institutions

The SDSS is a joint project of The University of Chicago, Fermilab, the Institute for Advanced Study, the Japan Participation Group, The Johns Hopkins University, Los Alamos National Laboratory, the Max-Planck-Institute for Astronomy (MPIA), the Max-Planck-Institute for Astrophysics (MPA), New Mexico State University, Princeton University, the United States Naval Observatory, and the University of Washington.

Acknowledging SDSS in Publications

Data from the SDSS public archive may not be used for any commercial publication or other commercial purpose except with explicit approval by the Astrophysical Research Consortium(ARC). Requests for such use should be directed to the ARC Corporate Office via ARC's Business Manager as follows:

Michael L. Evans
ARC Business Manager
c/o University of Washington
Office of Research, Box 351202
Seattle, WA 98195
Phone: 206-685-7857
Email: evans@astro.washington.edu

Non-commercial scientific and technical publications using data from the SDSS public archive should include the following acknowledgment:

> Funding for the creation and distribution of the SDSS Archive has been provided by the Alfred P. Sloan Foundation, the Participating Institutions, the National Aeronautics and Space Administration, the National Science Foundation, the U.S. Department of Energy, the Japanese Monbukagakusho, and the Max Planck Society. The SDSS Web site is http://www.sdss.org/.
>
> The Participating Institutions are The University of Chicago, Fermilab, the Institute for Advanced Study, the Japan Participation Group, The Johns Hopkins University, Los Alamos National Laboratory, the Max-Planck-Institute for Astronomy (MPIA), the Max-Planck-Institute for Astrophysics (MPA), New Mexico State University, Princeton University, the United States Naval Observatory, and the University of Washington.

Please also refer to the appropriate SDSS technical publications.

Sloan Digital Sky Survey

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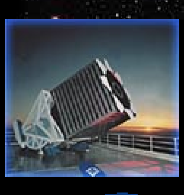

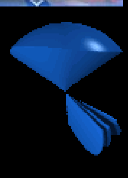

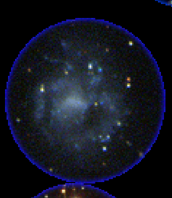

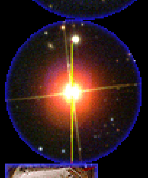

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IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

Project Information

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last updated: **Feb. 29, 2000**

IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

IUE NEWSIPS Atlas

- **Standard Star Atlas : 476 "Normal" Stars**
  - **Standard Stars, sorted by Spectral Type**
  - **Standard Stars, sorted by HD Number**
- **Subluminous Star Atlas : 38 Subdwarfs and White Dwarfs**
  - **Subluminous Stars, sorted by Spectral Type**
  - **Subluminous Stars, sorted by Right Ascension**

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IUE Ultraviolet Spectral Atlas of Standard Stars

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IUESIPS Atlas Addendum I & II

- **Atlas Addendum I (service provided by NASA/GSFC ADF)**
- **Atlas Addendum II (service provided by STScI)**

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IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

UV Atlas Home | Project Info | NEWSIPS Atlas | IUESIPS Atlas | IUE Links

Related Publications & IUE Links

- Related Publications of the UV Standard Star Atlas
- IUE Archive at STScI
- NASA ADF IUE
- ESA IUE

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IUE Ultraviolet Spectral Atlas of Standard Stars

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A Complete UV Atlas of Standard Stars

Chi-Chao Wu, Jinger Mo, D. Michael Crenshaw

* Observations * Data Reduction * Catalogues and Spectra * Acknowledgment *

Digital stellar atlases play an important role in astronomy. They provide the basic data needed for studies such as peculiar stars, composite systems (multiple systems, stellar clusters, and galaxies), automated spectral classification, testing of model stellar atmospheres, and interstellar or circumstellar extinction by dust. There are several atlases containing optical spectra obtained by modern detectors (Jacoby, Hunter & Christian 1984, Pickles 1985, and Silva & Cornell 1992). Together, these atlases contain good quality stellar spectra that cover the range 3500-9000 Å, at resolutions of 4-11 Å.

For many years, the International Ultraviolet Explorer (*IUE*) Observatory had generously granted us telescope time to build such an atlas in the UV. The three installments of the UV stellar spectral atlas are given in Wu et al. (1983,1991,1997). Wu et al. (1992) further provides the archival data for stars, clusters, and galaxies which are not given in the above installments.

This site delivers the final products of the *Complete UV Atlas of Standard Stars Project*. It provides the IUE NEWSIPS (New Spectral Image Processing System) MXLO (Low-Dispersion Merged Extracted Image FITS File) spectra (graphics and wavelength-flux table) of 514 stars, grouped in the following two new atlases.

- Complete Standard Star Atlas : 476 "Normal" Stars.
  - Standard Stars, sorted by Spectral Type
  - Standard Stars, sorted by Star Name (HD Number)
- Subluminous Star Atlas : 38 subdwarfs and white dwarfs.
  - Subluminous Stars, sorted by Spectral Type
  - Subluminous Stars, sorted by Right Ascension

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last updated: **Feb. 29, 2000**

Project Information : Observations

* "Normal" Stars * Star Spatial Distribution * Star Spectral Type Distribution *

* "Normal" Stars

The observations, assembled here, were done mostly by Wu and his collaborators. Only a small number of images were taken from the IUE calibration programs and the other Guest Observers.

All observations were made in the low dispersion mode, with a spectral resolution of about 6 Å. For stars with a spectral type of F2 or earlier, both the short wavelength (1150-1975 Å) and long wavelength (1975-3200 Å) spectral regions were observed, while the short wavelength spectrum was generally not obtained for stars later than F2. In order to maximize the signal-to-noise (S/N) ratio, essentially all the spectra were taken in trail or pseudo-trail mode. Additionally, many observations have a complementary spectrum taken in the small aperture, such that higher exposure levels can be achieved for the spectral regions that tend to be underexposed.

Wu and his collaborators selected the candidate stars according to the following criteria: no known variability or peculiarity; not a member of a multiple system that has a companion that can introduce non-negligible flux to the observed spectrum; reliable MK spectral types and UBV photometry are available; low (or lower) interstellar extinction; and bright enough to give good S/N ratio at reasonable exposure times (generally 30 minutes or less), yet faint enough to give reliable trail rates (about 10 arcsec/sec or less). To provide additional cross checking against peculiarity and variability in the candidate stars, many of the spectral type and luminosity class combinations have two or more stars.

The observations provide a reasonably comprehensive coverage of the HR diagram. Note that many F, G, K dwarfs and giants have an appreciable number of observed stars. This is intended to include a range of metallicity to facilitate the modelling of the important main sequence turn-off components in older stellar populations.

The observations for the pervious atlas (Wu et al. 1983, 1991, 1997) were made during the period from March 1980 to September 1994. And the data presented in the three installments were processed by different versions of the IUESIPS and reduced by the software which was available in the *IUE Data Analysis Center* at the time. Thus, the previous atlas is lacking in internal consistency. Also, the noise characteristics, instrument parameters, and calibration which directly relate to the accuracy of the reported stellar fluxes, are better known now. The *IUE* Project has developed the NEWSIPS pipeline processing system which incorporates these latest improvements in the treatment of the *IUE* data. The Project has essentially reprocessed all the data with the NEWSIPS pipeline, and created the *IUE Final Archive*. Therefore, the time is ripe for the production of a new atlas, based on the data from the Final Archive, which will have the uniformly processed data and significantly improved accuracy for the stellar fluxes. For a detailed discussion of the Final Archive and the recalibration of the *IUE* spectra, see Nichols & Linsky (1996). For the new atlas, selected high quality spectra of a star will be merged to increase the S/N, and to repair spectral regions contaminated by reseaux, cosmic ray hits and other blemishes.

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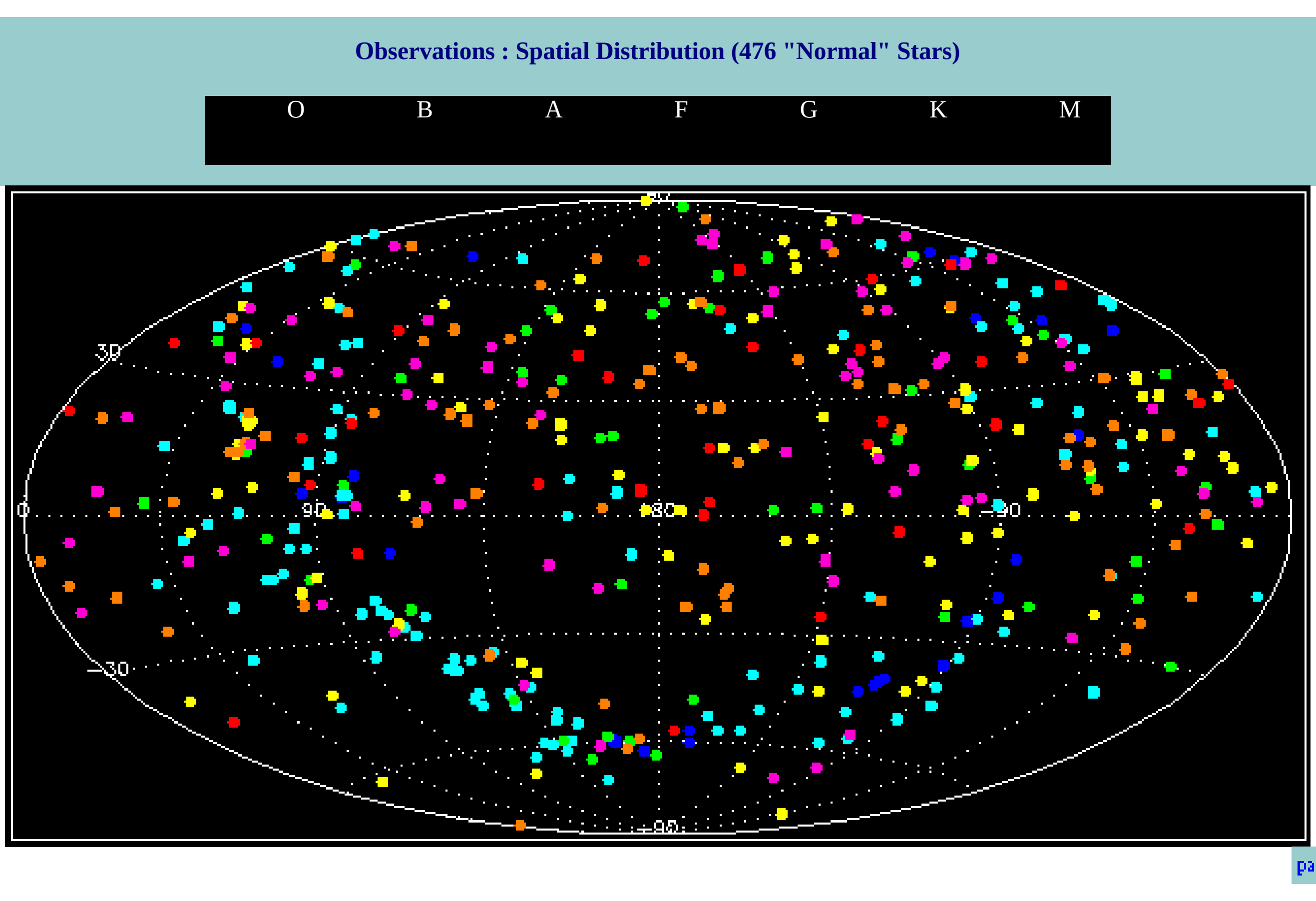
* Spatial Distribution (476 "Normal" Stars)

Observations : Spatial Distribution (476 "Normal" Stars)



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* Star Distribution in Spectral Types

Observations : Star Distribution in Spectral Types

* O * B * A * F * G * K * M *

O Star	VI	V	IV	III	II	Ib	Iab	Ia	If	In	m
3		2									
4		2									
5		1		3							
6				2					1	1	
6.5								1			
7		1		2	2						
7.5				2	1			1			
8		2						2			
8.5		1					1				
9		1	1								
9.5		2		2		1	1	1			
9.7							1				

table top

B Star	VI	V	IV	III	II	Ib	Iab	Ia	If	In	m
0		1		1	1	1					
0.5		1	1	3		1		1			
1		3		2	3	3	2	1			
1.5		2	2	3							
2		2	3	3	1	1		1			
2.5		4	1	2		1					
3		4	2	1	1		1	1			
4		3	2	3							
5		3	2	3	1	2		1			
6		3	2	2		1		1			
7		4		1							
7		1		2	2						
8		2		4	1						
9		2	2	1			2	1			
9.5		5		1							

table top

A Star	VI	V	IV	III	II	Ib	Iab	Ia	If	In	m
0		4	1	2	1	1		1			
1		5	1					1			1
2								1			
3		6		2	1						1
4		1									
5		2	1	1	1	1					
6			1					1			
7		1	4		1						
8		1				1					
9				1							

table top

F Star	VI	V	IV	III	II	Ib	Iab	Ia	If	In	m
0		2	1	2		1					
1				2	2						
2		2	1	3		1		1			
3		2	1	2				2			
4		2	2	2							
5	1	6	2	2		2					
6		7	3	1		1					
7		7	2			2					
8		6	4			2	1	1			
9		7									

table top

G Star	VI	V	IV	III	II	Ib	Iab	Ia	If	In	m
0		10	4	2	1	2					
1		5	1		1	1					
2		8	1			2		1			
3		2			1	1					
4				2	1	1					
5		5	1	2	1	1					
6		2									
7				2							
8		7	3	7	1	1					
9				3	1						

table top

K Star	VI	V	IV	III	II	Ib	Iab	Ia	If	In	m
0		4	1	11		2					
1		3	3	2	1	1					
2		2	1	9	3	1					
3		2		4	2	1					
4				4		1					
5		1		3			1				
7		1		4		1					

table top

M Star	VI	V	IV	III	II	Ib	Iab	Ia	If	In	m
0				4							
0.5		1		1							
1		2									
2				4		1		1			
3		1		4	1						
3.5				1							
4					2						
4.5				2							
5				1							
6				1							
7				1							

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last updated: **Feb. 29, 2000/b>**

IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

Project Information : Data Reductions

* MXLO Data * New Tools * Image Combine *

A new MXLO data reduction tool has been developed to carry out the IUE Standard Star Atlas Project under the IRAF (Image Reduction and Analysis Facility) environment. It facilitates reducing and analyzing data, generating the graphics (gif and ps format) and wavelength_flux (w_f) table for MXLO spectra, retrieving information from various related catologues, and so on.

The NEWSIPS Low-Dispersion Merged Extracted Image (MXLO) were retrieved from the IUE Final Archive, supported by the Multi-Mission Archive at STScI (MAST).

Features of The NEWSIPS MXLO Data

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- **FITS Table**
  The IUE NEWSIPS MXLO file is a 3-D FITS table, a binary table with fixed-length floating point vectors to contain the extracted fluxes and associated flags.
- **Data Points**
  The number of extracted points is always 640. Wavelength are linearly sampled to a uniform step size and measured in vacuum.
- **Aperture**
  Double aperture low-dispersion spectra will contain two rows, with one row for each aperture.
- **Absolute calibration**
  It convers to the absolute fluxes in the range of 1150-1980 Å for short-wavelength spectra and 1850-3350 Å for long-wavelength spectra.
- **Data Quality Flags** ν
  these flages indicate abnormal conditions in the data which can range from fairly minor to quite serious situations. The flags for the MXLO data should be examined carefully in order to ascertain whether or not a particular data point is good or bad. The data points with zero flag value indicate that the data have no know problem condition. In general, flag values of -8 or more negative are indicative of unreliable data. See Data Quality Flag Description for a detailed discussion.
- **Small Aperture Spectra**
  The absolute fluxes for small-aperture data are significantly less reliable than those of large-aperture data. Because centering errors in the small aperture can lead to large variations in the overall observed flux level for individual spectra, it is impossible to determine an absolute S/L ratio. Therefore, the average of S/L over all wavelengths is normalized to unity. *As a result, the small-aperture fluxes are known in a relative sense but not in an absolute one*. See NEWSIPS Aperture Response Corrections for detials.

A New IRAF Tool for the MXLO Data Reduction

page top

We assumed that the IUE MXLO data have been well-calibrated by the IUE NEWSIPS pipline.
And no additional calibration for MXLO data is made by this project.

The run sequence to genaerate the spctra and flux tables is

- **Convert Data Format**
  - convert the **IUE** spectra from the **MXLO** format to the STSDAS Table formats using the IUETOOL, an IRAF subpackage provided by R. Shaw and H. Bushouse at STScI.
  - convert 3D FITS table to 2D STSDAS table, including the following table columns.
    * w : wavelength
    * fL : flux of large aperture image
    * fS : flux of small aperture image
    * qL : data quality flag for large aperture image
    * qS : data quality flag for small aperture image
    * fLSc : averge combined flux of the large aperture and the scaled small aperture
    * qLSc : data quality flag for the averge combined image
- **Make Spectra**
  - wavelength ranges :
    * LWR : 1850 - 3200 Å
    * LWP : 1850 - 3200 Å
    * SWP : 1150 - 1980 Å
  - extract ralated information from image header and transfer it to graphics and tables.
  - make flux table
  - make graphics
  - combine images: utilized the STSDAS gcombine as a basic task to make image combine/merge. See *Image Combine* section for algorithms and parameter specifications.
    * Large Aperture Spectra
    * Double (Large and Small) Aperture Spectra

Image Combine: Algorithms and Parameters

page top

The input images to be combined are specified by a list. A list of input mask images, specified by the `masks' parameter, can be used to mask bad pixels before rejection operations. The mask images should have the same number and size as the input images.

- **For input images**, set
  - Masks
  - Scales and Image Statistics
  - Weights
  - Error Maps
- **For each output image line**,
  - Get input image lines
  - Reject masked pixels
  - Reject pixels using the specified algorithm
  - Combine remaining pixels using the weighted average or median
  - Write the combined image
- **Parameter Specifications**

Masks

The mask images, specified by the parameter, `masks', can be used to mask bad pixels before thresholding and rejection operations. The mask images should have the same number of and size as the input images. A mask image is always treated as of a boolean type. According to the IUE DQF, a zero value indicates a good pixel, while all non-zero mask values indicate a bad pixel.

The procedure for making the masks includes the following steps:

- retrieve the "QUALITY" flag from MXLO.
- make the mask image for each spectra : assumed a zero "QUALITY" value as good pixel.
- make the New Mask (optional).

Image Statistics and Image Scales

In order to combine images with rejection of pixels based on deviations from some average or median they must be scaled to a common level.

- LAp data only: No image scaling is preformed for the LAp absolutely- calibrated net spectra.
- SAp & LAp data: The small-aperture fluxes are known in a relative sense but not in an absolute one, and the absolute fluxes for small-aperture data are significantly less reliable than those of large-aperture data. Therefore, the SAp data scaling stage must perform prior to the image combining step.

The scaling stage includes the following steps:

- select wavelength region for estimating the average fL/fS
- make statistics for fL/fS within selected region
- scale fS and generate fSmed (the median scaled SAp Flux)

Weights

For each data point x(i), its own standard deviation sigma(i) represents its measured precision. The most probable value for the mean is the weighted average of the data points, where each data point is weighted inversely by its own variance sigma(i)**2 in sum.

Two types of weighting scheme are applied to process the MXLO data

- Uniform Weighting :
  - Weights are constant for all pixels of each input image.
  - This uniform weighting scheme is adopted to combine a set of LAp spectra or a set of combined LAp and SAp data. The SAp data. The exposure time is seleted as the only weighting factor.
- Pixel-wise Weighting
  - Weight of a data point is the reciprocal of the variance sigma(i)**2 at that pixel.
  - An input error map, associated with each input image must be specified. The sigma is the scaled error taken from the input *error image*.
  - The "pixel-wise" weighting scheme is adopted to combine the SAp and the LAp data.

Error Maps

The error map applied for our code is consist of two types of uncertainty factor :

- "sigma" spectra : It is known that the MXLO "sigma" spectra indicate the estimated error in the extracted fluxes.
- median scaled factor of fL/fS over a select range, where fL and fS are the flux for LAp and SAp, respectively.

The error maps would then be set as

- For LAp : error map = sqrt (sL)
- For SAp : error map = sqrt (sS * med)

where sL and sS is the "sigma" spectrum for LAp and SAp, respectively. The "med" is the median scaled factor of fL/fS over the selected range. And the "sqrt" here is the square root oprator.

Rejection Algorithms

This stage rejects pixels using sigma clipping about the weighted average. The weighted average (trimmed mean) is used to represent the expected signal level. Values deviating from the expected signal level by more than the specified sigma threshold factors (hsigma and lsigma) are rejected.

- Case 1: input error images are available.
  The noise characteristics of the input images are well represented by the noise values stored in each pixel of the error images.
  This case corresponds to the "errcrrej" rejection in the task "gcombine" .
- Case 2: use robust sigmas compute a sigma, robust against the effects of unidentified outliers on the estimate of the sigma.
  This case corresponds to the "rsigcrrej" rejection in the task "gcombine" .

(see the help file of task "gcombine" for details)

Combining

After all the steps of masking pixels, scaling, and applying a rejection algorithms, the remaining pixels are combined. The pixels may be combined by computing a weighted average. The weighted average, however, is the only adopted option for our project, since the image number for image combine is less than 5. In most cases, it is 2 or 3.

One of the following two weighting scheme must be specified for making the weighted average combine.

- `weight'="exposure":
  The uniform weights are specified in the same way as the scale factors. The "exposure" option in the intensity scaling uses the value of the image header keyword specified by the `expname' keyword. As implied by the parameter name, this is typically the image exposure

time since DN levels are linear with the exposure time in SEC Vidicon.

- `weight'="pixelwise";
  The weight is the reciprocal of the sigma**2, where the sigma is the scaled error taken from the input error image.

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IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

Project Information : Final Products: Catalogues and Spectra

* Catalogues * Spectra and Flux Tables *

Catalogues

page top

This page gives some basic information associated with the 476 standard stars, including the HD number, star name, spectral type and luminous class, reference key number for spectral_type and the luminous_class, RA (Right Ascension) and Dec (Delination), V magnitue, remarks, B-V, and E(B-V).

For each star, an UV spectra page can be accessed through the HD number or the star name in the atlas page. The spectra page provides the informaton of the IUE observations and the outputs of the IUE data processing. The outputs include spectral plots and the w_f tables for each observation. A weighted combined spectrum is made for each camera, if two or more observations are available for the object or the mxlo is a double (large and small) aperture image.

- **Columns Description**

Cloumn	Units	Explanations
HD		HD number
Name		name of the star
Sp_Type		spectral type
Ref		key to data source for spectral type
RA	hh:mm:ss	right ascension (1950.0)
DEC	dd:mm:ss	declination (1950.0)
V	mag	V magnitude
Remarks		remarks on duplicity / variability
B-V	mag	B-V colour index
E(B-V)	mag	color excess on B-V

- **Reference Sources of Spectral Type**

  The spectral type in this page is assembled from various sources. The column Ref indicates the key number to the data source for the spectral type. Those reference sources are listed in Table 2.

Key Number	Peference Source
1	Morgan and Keenan 1973
2	Johnson and Morgan 1953
3	Walborn 1982
4	Walborn 1973
5	Walborn 1972
6	Lesh 1968
7	Lesh 1972
8	Garrison, Hiltner and Schild 1977
9	Morgan, Code and Whitford 1955
10	Cowley, Clwley, Jaschek and Jaschek 1969
11	Keenan and Pitts 1980
12	Keenan and Pitts 1981
13	Jaschek 1980
14	Buscombe 1984
15	Hoffleit 1982
16	O'Connell 1973

- **Star Coordiates: RA & DEC**

  The RA and DEC are retrieved from the *SAO* (Smithsonian Astrophysical Observatory) Star Catalog

- **Photometric Data**

  The source of the photometric data are taken from the *Catalogue of Mean UBV Data on Stars*, an on-line catalog from J.-C. Mermilliod and M. Mermilliod, 1998. In the column Remarks, following the notation of the UBV catalog, an "A" indicates that the star has a close neighbor and that the V magnitude is only for the brighter component. On the other hand, an "AB" indicates that the V magnitude is the combined brightness of the both components. The column E(B-V) is observed B-V (in column 9) minus the intrinsic B-V from FitzGerald (1970). The E(B-V) values assume that the intrinsic B-V's for higher luminosity O stars are the same as main sequence stars of the same spectral type. The computations of E(B-V) for spectral types and luminosity classes, which have no intrinsic B-V in FitzGerald, used interpolated values of B-V.

UV Spectra

page top

This section presents the **Graphics** and **Flux Tables** of the UV spectra of the IUE Standard Stars, the outputs of the data processing from the IUE NEWSIPS MXLO data. The star information, appeared on the page top, is transferred from the Atlas Page.

For each observation, the output of the data processing includes a pair of spectral graphics (a gif file and a ps file) and a w_f (wavelength_flux) text table. Users can access these files by pointing to any of the (gif), (ps) or (w_f) files.

- **Description of the MXLO Image Log**
  - Image : camera(LWR/LWP/SWP) plus image sequence number
    * (gif) - graphics of mxlo spectrum in GIF format
    * (ps) - graphics of mxlo spectrum in PostScript format
    * (ps) - graphics style (color, line style, and marker)

MXLO Data	Large Aperture Spectra	Small Aperture Spectra
Spectra	Black Solid Line	Violet Dashed Line
Bad Data Points	Red Cross	Blue Asterisk

  - (w_f) - mxlo wavelength_flux table in ASCII text format
    * w : wavelength
    * fL : flux of large aperture image
    * qL : DQF for large aperture image
    * fS : flux of small aperture image
  - Ap : aperture (Large/Small)
  - N : number/T
    * number - the number of exposure along the major axis of the large aperture
    * T - trail mode observation
  - Exp : exposure time in seconds
  - E/C/B : DN (Data Number) level of E/C/B, comment by Resident Astronomer of the IUE observatory
    * E - maximum Emission
    * C - maximum Continuum
    * B - mean Background

- **Combined Image**
  - Single Aperture Exprosure & Double Aperture Exprosure
    * Single Aperture Exprosure : A weighted combined spectrum is given for each camera, if two or more Large aperture images are available. The weighting factor is the total exposure time.
    * Double Aperture Exprosure :
  - Description of the Combined Image Log
    * (gif) - combined spectrum in GIF format
    * (ps) - combined spectrum in PostScript format
    * (w_f) - combined wavelength_flux table in ASCII text format

Table Column	Single Aperture Spectra	Double Aperture Spectra
wavelength	w	w
flux (of combined spectra)	fcomb	fLSc
DQF (of combined spectra)	qcomb	qLSc

- **Notes**
  - The ps graphics have the same wavelength range and scale as those in *The IUE Ultraviolet Spectral Atlases*, published in the NASA NEWLETTER No.22, 1983 and No.43, 1993. Users may browse and/or print the ps file from Netscape Navigator directly.
  - Users may use GSview as a PostScript files viewer under
    * OS/2
    * MS-Windows 3.1/Win32s
    * MS-Windows 95/98
    * MS-Windows NT for
    * IBM WebExplorer
    * NCSA Mosaic
    * Netscape Navigator
    * Internet Explorer
  - For the double aperture spectra, a scaled image for small aperture image is overploted onto the large aperture spectrum. Users must keep in mind, the small-aperture fluxes are known in a relative sense but not in an absolute one, and the absolute fluxes for small-aperture data are significantly less reliable than those of large-aperture data.

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IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

Project Information : Acknowledgment

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All NEWSIPS MXLO data are retrieved from the *IUE Final Archive*, supported by the Multi-Mission Archive at STScI (MAST).

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IUE Ultraviolet Spectral Atlas of Standard Stars

Computer Sciences Corporation

IUE NEWSIPS Atlas : 476 "Normal" Stars Atlas, sorted by Spectral Type

* O * B * A * F * G * K * M *

O Stars

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
93250		O3 V((f))	5	10:42:48.3	-59:18:07	7.37		0.17	0.49
303308		O3 V((f))	4	10:43:48.0	-59:24:18	8.16	H	0.13	0.45
46223		O4 V((f))	4	6:29:29.9	4:51:38	7.27		0.22	0.54
164794	9 SGR	O4 V((f))	4	18:00:48.4	-24:21:48	5.97		0.03	0.35
93204		O5 V((f))	4	10:42:31.0	-59:28:36	8.44	B	0.10	0.42
93403		O5 III(f) Var	4	10:43:46.7	-59:08:39	7.27		0.22	0.54
93632		O5 III(f) Var	4	10:45:15.5	-59:49:59	8.36	A	0.30	0.62
93843		O5 III(f) var	4	10:46:40.2	-59:57:33	7.32		-0.04	0.28
93130		O6 III(f)	5	10:42:04.4	-59:36:41	8.06	A	0.23	0.55
93160		O6 III(f)	5	10:42:10.7	-59:18:44	7.82	AB	0.17	0.49
169582		O6 If	4	18:22:57.9	-9:46:57	8.70		0.55	0.87
210839	LAM CEP	O6 I(n) fp	4	22:09:48.6	59:10:02	5.05		0.24	0.56
152723		O6.5 III(f)	5	16:53:26.1	-40:26:03	7.21	AB	0.13	0.45
163758		O6.5 Iaf	4	17:56:06.0	-36:01:06	7.32		0.03	0.35
47839	15 MON	O7 V((f))	5	6:38:13.4	9:56:37	4.65	AB	-0.24	0.08
93222		O7 III((f))	5	10:42:40.4	-59:49:41	8.10		0.05	0.37
101205		O7 IIIn((f))	4	11:35:59.8	-63:05:46	6.46	AB	0.04	0.36
151515		O7 II(f)	5	16:46:17.1	-41:54:57	7.17		0.16	0.48
167659		O7 II(f)	5	18:14:01.9	-18:59:12	7.38		0.21	0.53
24912	XI PER	O7.5 III((f))	5	3:55:42.8	35:38:56	4.04		0.02	0.33
203064	68 CYG	O7.5 III:n((f))	5	21:16:35.1	43:44:05	5.00		-0.03	0.28
162978		O7.5 II((f))	5	17:51:49.2	-24:52:44	6.20		0.04	0.35
188001	9 SGE	O7.5 Iaf	5	19:50:07.8	18:32:31	6.24		0.01	0.33
14633		ON8 V	5	2:19:46.4	41:15:11	7.46	A	-0.20	0.11
46056		O8 Vn	4	6:28:41.5	4:52:14	8.24	A	0.20	0.51
151804		O8 Iaf	5	16:48:04.1	-41:08:47	5.23		0.07	0.36
152408		O8: Iafpe	5	16:51:28.8	-41:04:15	5.79	AB	0.16	0.45
46149		O8.5 V	4	6:29:12.9	5:04:11	7.60		0.17	0.48
112244		O8.5 Iab(f)	4	12:52:59.4	-56:33:54	5.37	A	0.02	0.31
214680	10 LAC	O9 V	1	22:37:00.7	38:47:22	4.88	A	-0.20	0.11
57682		O9 IV	5	7:19:38.1	-8:53:00	6.42		-0.19	0.12
38666	MU COL	O9.5 V	4	5:45:00.5	5:40:45	5.17		-0.28	0.02
93027		O9.5 V	5	10:41:18.3	-59:52:40	8.72		-0.02	0.28
112784		O9.5 III	8	12:57:02.1	-60:19:26	8.26		0.06	0.36
152247		O9.5 II-III	4	16:50:40.9	-41:33:40	7.17		0.19	0.49
209975	19 CEP	O9.5 Ib	5	22:03:36.2	62:02:10	5.10	A	0.09	0.36
188209		O9.5 Iab	5	19:50:28.5	46:53:51	5.63		-0.07	0.20
30614	ALF CAM	O9.5 Ia	5	4:49:03.8	66:15:38	4.29		-0.03	0.30
149038	MU NOR	O9.7 Iab	5	16:30:31.3	-43:56:28	4.90	V	0.09	0.35

B Stars

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
36512	UPS ORI	B0 V	1	5:29:30.6	-7:20:12	4.62		-0.26	0.04
63922		B0 III	7	7:47:42.8	-46:14:47	4.11	A	-0.19	0.11
43818		B0 II	9	6:16:16.6	23:29:27	6.91		0.29	0.58
204172	69 CYG	B0 Ib	6	21:23:44.2	36:27:02	5.93	A	-0.08	0.16
55857		B0.5 V	7	7:11:35.4	-27:16:10	6.11	V	-0.24	0.04
34816	LAM LEP	B0.5 IV	6	5:17:16.1	-13:13:37	4.29		-0.27	0.01
119159		B0.5 III	7	13:39:38.9	-56:30:58	6.00		-0.08	0.20
218376	1 CAS	B0.5 III	6	23:04:29.5	59:08:57	4.85		-0.03	0.25
219188		B0.5 III	9	23:11:27.9	4:43:28	7.05		-0.13	0.15
64760		B0.5 Ib	7	7:51:49.9	-47:58:18	4.24		-0.15	0.07
150898		B0.5 Ia	7	16:43:03.3	-58:15:06	5.57		-0.07	0.15
31726		B1 V	6	4:55:27.3	-14:18:27	6.14		-0.21	0.05
46106		B1 V	13	6:28:58.8	5:03:47	7.93		0.14	0.40
166197		B1 V	7	18:07:36.8	-33:48:39	6.15		-0.15	0.11
46328	XI1 CMA	B1 III	7	6:29:46.2	-23:22:52	4.33	A	-0.24	0.02
50707	15 CMA	B1 III	7	6:51:23.1	-20:09:40	4.82	V	-0.22	0.04
1383		B1 II	9	0:15:34.7	61:26:58	7.63		0.27	0.51
47240		B1 II	6	6:35:13.2	5:00:04	6.15		0.15	0.39
215733		B1 II	9	22:44:35.2	16:58:09	7.33		-0.13	0.11
40111	139 TAU	B1 Ib	6	5:54:53.4	25:56:58	4.82		-0.06	0.13
86606		B1 Ib	7	9:55:17.9	-71:09:02	6.33		-0.06	0.13
157246	GAM ARA	B1 Ib	7	17:21:10.7	-56:19:58	3.33	A	-0.14	0.05
13854		B1 Iab	6	2:13:20.9	56:49:26	6.47	A	0.28	0.47
91316	RHO LEO	B1 Iab	6	10:30:10.7	9:33:52	3.85	AB	-0.14	0.05
150168		B1 Ia	7	16:37:52.6	-49:33:21	5.65		-0.02	0.17
37744		B1.5 V	6	5:38:06.8	-2:51:00	6.21		-0.21	0.04
74273		B1.5 V	7	8:39:30.0	-48:44:36	5.90		-0.21	0.04
69081		B1.5 IV	7	8:12:05.5	-36:10:11	5.08	A	-0.20	0.05
83058		B1.5 IV	7	9:32:24.6	-51:01:56	5.00		-0.19	0.06
44506		B1.5 IIIn	7	6:18:47.6	-34:07:13	5.54		-0.19	0.06
62747		B1.5 III	7	7:42:27.8	-24:33:09	5.61		-0.20	0.05
74375		B1.5 III	7	8:39:30.8	-59:34:55	4.32	A	-0.12	0.13
64802		B2 V	7	7:52:19.7	-35:44:43	5.47		-0.19	0.05
122980	CHI CEN	B2 V	7	14:02:59.0	-40:56:27	4.35		-0.20	0.04
28873	DEL CAE	B2 IV-V	7	4:29:18.1	-45:03:36	5.06		-0.20	0.04
39291	55 ORI	B2 IV-V	6	5:48:57.0	-7:31:48	5.35		-0.20	0.04
3360	ZET CAS	B2 IV	6	0:34:10.3	53:37:19	3.66		-0.20	0.04
51283		B2 III	7	6:53:40.5	-22:52:32	5.30		-0.18	0.06
127381	SIG LUP	B2 III	7	14:29:14.0	-50:14:11	4.41		-0.19	0.05
148703		B2 III	7	16:28:06.5	-34:35:50	4.23		-0.17	0.07
14357		B2 II	9	2:17:38.4	56:38:14	8.52		0.32	0.53
165024	THE ARA	B2 Ib	7	18:02:44.2	-50:05:49	3.67		-0.09	0.07
41117	CHI2 ORI	B2 Ia	1	6:00:56.9	20:08:28	4.63		0.27	0.44
25631		B2.5 V	7	4:01:12.4	-20:16:50	6.46		-0.18	0.04
61831		B2.5 V	7	7:37:41.5	-38:11:32	4.84		-0.19	0.03
64503		B2.5 V	7	7:50:52.3	-38:43:56	4.49		-0.20	0.02
142096	LAM LIB	B2.5 V	6	15:50:25.6	-20:01:08	5.03		-0.02	0.20
32612		B2.5 IV	6	5:01:34.9	-14:26:19	6.40		-0.19	0.03
63465		B2.5 III	7	7:45:38.7	-38:23:11	5.08	AB	-0.11	0.11
166596		B2.5 III	7	18:09:40.1	-41:20:59	5.46		-0.18	0.04
31327		B2.5 Ib	6	4:52:59.4	36:05:25	6.07		0.40	0.55
32630	ETA AUR	B3 V	1	5:03:00.2	41:10:08	3.17		-0.18	0.02
66591		B3 V	7	7:59:42.3	-63:25:42	4.81		-0.17	0.03
120315	ETA UMA	B3 V	1	13:45:34.2	49:33:44	1.86		-0.19	0.01
190993	17 VUL	B3 V	6	20:04:44.3	23:28:08	5.07		-0.18	0.02
42560	XI ORI	B3 IV	6	6:09:05.7	14:13:18	4.47	A	-0.18	0.02
134687		B3 IV	7	15:09:27.3	-44:18:47	4.82		-0.18	0.02
79447		B3 III	7	9:10:08.6	-62:06:40	3.96		-0.19	0.01
24432		B3 II	13	3:51:45.7	48:53:42	6.93		0.58	0.75
225094		B3 Iab	6	0:00:50.7	63:21:46	6.24		0.33	0.46
53138	OMI2 CMA	B3 Ia	1	7:00:56.1	-23:45:32	3.03		-0.09	0.04
65904		B4 V	7	7:57:26.4	-45:04:43	5.98		-0.15	0.03
75112		B4 V	7	8:44:50.0	-34:26:19	6.36		-0.14	0.04
136664	PHI2 LUP	B4 V	7	15:19:57.1	-36:40:50	4.53		-0.15	0.03
48879	42 CAM	B4 IV	6	6:45:44.9	67:37:48	5.14		-0.17	0.01
202654		B4 IV	6	21:13:51.9	47:45:53	6.45		-0.16	0.02
170523	DEL2 TEL	B4 III	7	18:28:20.1	-45:47:37	5.07		-0.13	0.05
183144		B4 III	6	19:25:15.7	14:10:47	6.32		-0.07	0.11
195986		B4 III	6	20:31:07.8	43:01:12	6.59		-0.11	0.07
25340	35 ERI	B5 V	6	3:58:59.8	-1:41:18	5.28		-0.15	0.01
34759	RHO AUR	B5 V	1	5:18:15.8	41:45:24	5.22		-0.15	0.01
188665	23 CYG	B5 V	6	19:52:15.8	57:23:30	5.14		-0.14	0.02
23227	DEL FOR	B5 IV	7	3:40:15.4	-32:05:49	5.00		-0.17	-0.01
147394	TAU HER	B5 IV	1	16:18:14.1	46:25:53	3.90	AB	-0.15	0.01
4180	OMI CAS	B5 III	6	0:41:55.6	48:00:40	4.57	A	-0.07	0.09
76538		B5 III	7	8:52:40.1	-60:09:47	5.78		-0.08	0.08
209419		B5 III	6	22:00:00.4	52:38:26	5.78		-0.11	0.05
83183		B5 II	7	9:32:59.5	-59:00:21	4.08			

HD	Name	Sp_Type		Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
									0.01	0.15
86440	PHI VEL	B5	Ib	7	9:55:06.2	-54:19:44	3.53	A	-0.09	0.00
164353	67 OPH	B5	Ib	6	17:58:08.3	2:55:56	3.96	AB	0.02	0.11
58350	ETA CMA	B5	Ia	1	7:22:06.9	-29:12:16	2.45	A	-0.08	0.01
81848		B6	V	7	9:24:40.2	-53:09:41	5.10		-0.12	0.02
90994	BET SEX	B6	V	6	10:27:44.0	0:22:47	5.07		-0.14	0.00
115823		B6	V	7	13:17:34.6	-52:29:08	5.47		-0.13	0.01
23338	19 TAU	B6	IV	1	3:42:13.5	24:18:42	4.30	A	-0.11	0.03
79694		B6	IV	7	9:12:17.4	-43:56:17	5.85		-0.13	0.01
182255	3 VUL	B6	III	6	19:20:47.9	26:09:54	5.19		-0.12	0.02
195810	EPS DEL	B6	III	6	20:30:49.4	11:07:55	4.03		-0.12	0.02
125288		B6	Ib	7	14:16:48.9	-56:09:26	4.34		0.12	0.19
74371		B6	Ia	7	8:40:14.7	-45:13:50	5.24		0.21	0.28
17081	PI CET	B7	V	6	2:41:44.4	-14:04:10	4.24		-0.14	-0.01
17769	SIG ARI	B7	V	6	2:48:43.6	14:52:38	5.48		-0.09	0.04
29335	49 ERI	B7	V	6	4:34:38.8	0:53:54	5.31		-0.13	0.00
204770	7 CEP	B7	V	6	21:26:48.3	66:35:26	5.43		-0.11	0.02
23630	ETA TAU	B7	III	1	3:44:30.4	23:57:07	2.87	A	-0.09	0.03
23324	18 TAU	B8	V	1	3:42:10.3	24:41:02	5.65		-0.07	0.04
222173	IOT AND	B8	V	13	23:35:40.6	42:59:28	4.28		-0.10	0.01
10205	TAU AND	B8	III	13	1:37:37.0	40:19:28	4.95	A	-0.09	0.01
23850	27 TAU	B8	III	1	3:46:11.0	23:54:07	3.62	AB	-0.09	0.01
173300	PHI SGR	B8	III	13	18:42:32.0	-27:02:38	3.17		-0.11	-0.01
207971	GAM GRU	B8	III	13	21:50:54.4	-37:36:03	3.00		-0.12	-0.02
46769		B8	Ib	6	6:32:41.0	0:55:52	5.80		-0.01	0.01
21790	17 ERI	B9	Vs	10	3:28:08.0	-5:14:43	4.73		-0.09	-0.02
196867	ALP DEL	B9	V	2	20:37:18.8	15:44:04	3.77	A	-0.06	0.01
38899	134 TAU	B9	IV	2	5:46:44.3	12:38:13	4.90	A	-0.07	0.00
222439	KAP AND	B9	IVn	13	23:37:56.2	44:03:25	4.14	A	-0.07	0.00
26571		B9	III	13	4:09:53.1	22:17:11	8.09		0.19	0.27
202850	SIG CYG	B9	Iab	9	21:15:26.9	39:11:03	4.23		0.12	0.12
212593	4 LAC	B9	Iab	13	22:22:29.0	49:13:20	4.57		0.09	0.09
164865		B9	Ia	8	18:01:09.6	-24:11:08	7.66		0.87	0.87
98664	SIG LEO	B9.5	Vs	10	11:18:33.4	6:18:13	4.04		-0.06	-0.02
100889	THE CRT	B9.5	Vn	10	11:34:08.5	-9:31:32	4.70		-0.08	-0.04
166014	OMI HER	B9.5	V	10	18:05:35.4	28:45:15	3.84		-0.03	0.01
193432	NU CAP	B9.5	V	10	20:17:53.4	-12:55:04	4.75	A	-0.05	-0.01
222661	OMG2 AQR	B9.5	V	10	23:40:07.8	-14:49:17	4.48	AB	-0.04	0.00
186882	DEL CYG	B9.5	III	10	19:43:24.6	45:00:28	2.87	AB	-0.03	0.02

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HD	Name	Sp_Type		Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
103287	GAM UMA	A0	V	1	11:51:12.5	53:58:21	2.44		-0.00	0.01
130109	109 VIR	A0	V	2	14:43:43.0	2:06:08	3.74		-0.01	0.00
153808	EPS HER	A0	V	10	16:58:22.4	30:59:55	3.92		-0.02	-0.01
212061	GAM AQR	A0	V	10	22:19:04.4	-1:38:23	3.85	A	-0.06	-0.05
111775		A0	IV	13	12:49:15.5	-47:49:21	6.32		0.03	0.05
123299	ALF DRA	A0	III	2	14:03:01.9	64:36:51	3.66		-0.05	-0.02
149212	15 DRA	A0	III	13	16:28:04.2	68:52:34	4.96		-0.05	-0.02
175687	XI1 SGR	A0	II	10	18:54:22.2	-20:43:24	5.07		0.13	0.13
46300	13 MON	A0	Ib	9	6:30:11.9	7:22:16	4.50		0.01	0.01
92207		A0	Ia	13	10:35:32.3	-58:28:23	5.47	V	0.50	0.48
80081	38 LYN	A1	V	13	9:15:44.3	37:00:55	3.81	AB	0.06	0.04
166205	DEL UMI	A1	Vn	10	17:48:18.3	86:36:34	4.36		0.02	0.00
198001	EPS AQR	A1	V	2	20:44:58.2	-9:40:48	3.77		0.00	-0.02
199629	NU CYG	A1	Vn	10	20:55:18.4	40:58:25	3.93		0.02	0.00
200761	THE CAP	A1	V	10	21:03:08.3	-17:25:57	4.06		-0.01	-0.03
214994	OMI PEG	A1	IV	10	22:39:24.3	29:02:46	4.80		-0.01	-0.01
12953		A1	Ia	9	2:05:09.8	58:11:13	5.69		0.61	0.58
95608	60 LEO	A1m:		10	10:59:39.7	20:26:54	4.42		0.06	-.--
197345	ALP CYG	A2	Ia	1	20:39:43.5	45:06:03	1.25	A	0.09	0.04
16970	GAM CET	A3	V	10	2:40:42.3	3:01:34	3.46	AB	0.09	0.01
38678	ZET LEP	A3	Vn	10	5:44:41.2	-14:50:21	3.54		0.10	0.02
106591	DEL UMA	A3	V	2	12:12:57.5	57:18:36	3.31	A	0.08	0.00
122408	TAU VIR	A3	V	10	13:59:05.9	1:47:08	4.25	A	0.10	0.02
210418	THE PEG	A3	Vn	10	22:07:40.6	5:57:04	3.52		0.09	0.01
216956	ALP PSA	A3	V	1	22:54:53.5	-29:53:15	1.16		0.09	0.01
33111	BET ERI	A3	III	2	5:05:23.3	-5:08:58	2.78	A	0.13	0.04
50019	THE GEM	A3	III	2	6:49:29.6	34:01:24	3.60	A	0.10	0.01
104035		A3	Ib	13	11:56:15.5	-64:03:39	5.61		0.17	0.11
157792	44 OPH	A3m		13	17:23:18.8	-24:07:52	4.17		0.28	-.--
97603	DEL LEO	A4	V	2	11:11:27.0	20:47:52	2.56	A	0.13	0.01
79439	18 UMA	A5	V	10	9:12:36.2	54:13:47	4.83		0.19	0.04
116842	80 UMA	A5	V	2	13:23:13.4	55:14:52	4.01		0.17	0.02
13041	58 AND	A5	IV-V	10	2:05:27.6	37:37:22	4.81		0.12	-0.03
159561	ALP OPH	A5	III	2	17:32:36.6	12:35:41	2.08		0.16	0.01
74272		A5	II	15	8:39:34.6	-47:08:16	4.77		0.12	0.02
59612		A5	Ib	2	7:27:43.9	-22:55:09	4.85	AB	0.23	0.13
28527		A6	IV	10	4:27:41.7	16:05:12	4.78	A	0.17	-0.02
97534		A6	Ia	13	11:10:26.8	-60:02:43	4.60	A	0.54	0.44
87696	21 LMI	A7	V	2	10:04:29.1	35:29:21	4.48		0.18	-0.02
99211	GAM CRT	A7	IV-V	10	11:22:22.8	-17:24:32	4.07	AB	0.21	-0.01
187642	ALF AQL	A7	IV-V	2	19:48:20.5	8:44:05	0.77	A	0.22	0.00
203280	ALP CEP	A7	IV-V	2	21:17:23.2	62:22:23	2.46	CD	0.22	0.00
76644	IOT UMA	A7	IV	1	8:55:47.6	48:14:22	3.14	A	0.20	-0.02
85123	UPS CAR	A7	II Vb	13	9:45:51.8	-64:50:24	2.96	AB	0.27	0.13
28910	RHO TAU	A8	V	10	4:31:00.4	14:44:27	4.65	V	0.25	-0.02
80404	IOT CAR	A8	Ib	13	9:15:45.1	-59:03:53	2.25		0.18	0.04
147547	GAM HER	A9	III	2	16:19:42.7	19:16:09	3.75	A	0.27	-0.01

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HD	Name	Sp_Type		Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
12311	ALP HYI	F0	V	13	1:57:11.7	-61:48:45	2.85		0.28	-0.04
27176	51 TAU	F0	V	10	4:15:25.3	21:27:31	5.65	A	0.28	-0.04
81937	23 UMA	F0	IV-Vb	13	9:27:36.5	63:16:55	3.66	A	0.33	0.03
7312		F0	III	13	1:10:27.3	-38:07:15	5.91		0.29	-0.03
89025	ZET LEO	F0	III	1	10:13:54.7	23:40:01	3.44	A	0.31	-0.01
36673	ALP LEP	F0	Ib	2	5:30:31.3	-17:51:24	2.58	A	0.21	0.06
156897	XI OPH	F1	III-IV	13	17:18:00.2	-21:03:39	4.39	AB	0.38	0.05
40136	ETA LEP	F1	III	13	5:54:07.5	-14:10:31	3.71		0.33	0.00
135153	1 LUP	F1	II	13	15:11:33.1	-31:20:01	4.90		0.38	0.13
159532	THE SCO	F1	II	13	17:33:43.3	-42:58:05	1.86		0.40	0.15
29875	ALF CAE	F2	V	13	4:38:56.9	-41:57:29	4.45	AB	0.34	-0.01
113139	78 UMA	F2	V	2	12:58:35.3	56:38:07	4.93	AB	0.37	0.02
82434	PSI VEL	F2	IV	13	9:28:43.6	-40:14:49	3.58	AB	0.36	-0.01
432	BET CAS	F2	III-IV	1	0:06:29.7	58:52:26	2.27	A	0.34	-0.03
17584	16 PER	F2	III	2	2:47:25.0	38:06:50	4.22	A	0.34	-0.02
129502	MU VIR	F2	III	13	14:40:25.2	-5:26:30	3.88		0.38	0.02
163506	89 HER	F2	Ia	2	17:53:24.0	26:03:24	5.45		0.34	0.16
182835	NU AQL	F2	Ib	13	19:23:57.6	0:14:14	4.66	A	0.59	0.41
157950		F3	V	13	17:23:58.5	-5:02:38	4.53		0.39	-0.02
164259	ZET SER	F3	V	2	17:57:50.4	-3:41:19	4.62		0.38	-0.03
206901	KAP PEG	F3	IV	13	21:42:22.7	25:24:51	4.14	AB	0.42	0.03
214470	31 CEP	F3	III-IV	13	22:34:32.0	73:23:00	5.08		0.39	0.00
61110	OMI GEM	F3	III	13	7:35:54.2	34:42:03	4.90		0.41	0.02
112374		F3	Ia	15	12:53:48.4	-26:11:22	6.62		0.68	0.47
161471	IOT1 SCO	F3	Ia	13	17:44:05.1	-40:06:34	3.02	A	0.51	0.30
26462	45 TAU	F4	V	13	4:08:40.3	5:23:39	5.73	A	0.36	-0.06
185395	THE CYG	F4	V	13	19:35:05.9	50:06:16	4.48	AB	0.38	-0.04
8799	OME AND	F4	IV	13	1:24:39.2	45:08:57	4.83	AB	0.42	0.00
99028	IOT LEO	F4	IV	15	11:21:19.1	10:48:17	3.94	AB	0.41	-0.01
199532	ALF OCT	F4	III	13	20:58:44.0	-77:13:01	5.14		0.49	0.07
209166	20 PEG	F4	III	13	21:58:39.0	12:52:46	5.62	A	0.34	-0.08
108177		F5	VI	13	12:23:01.5	1:34:02	9.66		0.43	-0.02
27524		F5	V	1	4:18:34.3	20:55:22	6.80		0.44	-0.01
27561		F5	V	13	4:18:45.2	14:17:33	6.61		0.41	-0.04
106516		F5	V	13	12:12:36.0	-10:01:14	6.11	A	0.47	0.02
134083	45 BOO	F5	V	13	15:05:06.2	25:03:46	4.93	A	0.43	-0.02
160922	OMG DRA	F5	V	13	17:37:14.3	68:46:52	4.79	A	0.43	-0.02
210027	IOT PEG	F5	V	2	22:04:40.8	25:06:01	3.77	A	0.43	-0.02
61421	ALP CMI	F5	IV-V	2	7:36:41.1	5:21:16	0.37	AB	0.42	0.00

139664		F5	IV-V	13	15:37:44.5	-44:29:50	4.63		0.40	-0.02
43905	45 AUR	F5	III	13	6:17:42.4	53:28:38	5.35		0.43	0.00
79940		F5	III	13	9:13:44.9	-37:12:14	4.62	AB	0.45	0.02
20902	ALP PER	F5	Ib	2	3:20:44.4	49:41:06	1.79	A	0.48	0.22
172052		F5	Ib	13	18:36:00.0	-23:13:38	6.73		0.66	0.40
30652	PI3 ORI	F6	V	1	4:47:07.4	6:52:32	3.19	A	0.45	-0.03
57623	DEL VOL	F6	V	13	7:16:51.6	-67:51:56	3.96		0.77	0.29
43318		F6	V	13	6:13:01.6	-0:29:31	5.64		0.50	0.02
69897	CHI CNC	F6	V	13	8:17:01.8	27:22:52	5.14		0.46	-0.02
142860	GAM SER	F6	V	2	15:54:08.5	15:49:25	3.85	A	0.48	0.00
153597	19 DRA	F6	V	13	16:55:44.8	65:12:39	4.89		0.48	0.00
173667	110 HER	F6	V	2	18:43:30.5	20:29:49	4.20	A	0.46	-0.02
82328	THE UMA	F6	IV	2	9:29:31.4	51:54:23	3.17	AB	0.46	0.00
89449	40 LEO	F6	IV	2	10:17:01.0	19:43:31	4.79		0.45	-0.01
207978	15 PEG	F6	IV	13	21:50:15.8	28:33:31	5.53		0.41	-0.05
160365		F6	III	1	17:36:39.8	13:21:19	6.12		0.56	0.10
120136	TAU BOO	F7	V	2	13:44:53.1	17:42:19	4.50	AB	0.48	-0.02
124850	IOT VIR	F7	V	13	14:13:23.3	-5:45:46	4.08		0.51	0.01
126660	THE BOO	F7	V	2	14:23:29.6	52:04:52	4.05	A	0.50	0.00
165908	99 HER	F7	V	2	18:05:07.5	30:33:13	5.05	AB	0.52	0.02
170153	CHI DRA	F7	V	2	18:21:57.5	72:42:42	3.57	A	0.49	-0.01
215648	XI PEG	F7	V	2	22:44:11.6	11:54:57	4.20	A	0.50	0.00
222368	IOT PSC	F7	V	2	23:37:22.6	5:21:19	4.13	A	0.51	0.01
151769	20 OPH	F7	IV	13	16:47:03.8	-10:41:46	4.65		0.47	-0.03
216385	SIG PEG	F7	IV	13	22:49:51.9	9:34:09	5.16	A	0.48	-0.02
8890	ALF UMI	F7	Ib-II	13	1:48:48.7	89:01:43	2.01	A	0.60	0.12
171635	45 DRA	F7	Ib	13	18:31:42.6	57:00:24	4.79		0.61	0.16
27808		F8	V	1	4:21:16.1	21:37:19	7.14		0.52	-0.01
90839	36 UMA	F8	V	2	10:27:26.4	56:14:15	4.83	A	0.52	-0.01
102870	BET VIR	F8	V	2	11:48:05.3	2:02:47	3.61	AB	0.55	0.02
187691	OMI AQL	F8	V	13	19:48:37.9	10:17:21	5.12	A	0.55	0.02
193901		F8	V	13	20:20:38.8	-21:31:05	8.65		0.55	0.02
217877		F8	V	13	23:01:21.0	-5:03:55	6.68		0.58	0.05
136202	5 SER	F8	IV-V	2	15:16:45.4	1:57:12	5.06	A	0.54	0.03
201891		F8	IV-V	13	21:09:40.0	17:32:04	7.37		0.51	0.00
208906		F8	IV-V	13	21:56:27.8	29:34:43	6.96	A	0.50	-0.01
220657	UPS PEG	F8	IV	2	23:22:52.8	23:07:43	4.41		0.61	0.08
172365		F8	Ib-II	13	18:37:09.2	5:13:03	6.35		0.79	0.22
194093	GAM CYG	F8	Ib	2	20:20:25.9	40:05:44	2.21	A	0.67	0.12
133683		F8	Iab-Ib	13	15:05:01.4	-66:53:36	5.76		0.68	0.13
54605	DEL CMA	F8	Ia	2	7:06:21.4	-26:18:45	1.83		0.68	0.13
27383		F9	V	13	4:17:02.8	16:24:12	6.89	AB	0.56	0.00
22879		F9	V	13	3:37:49.2	-3:22:29	6.69		0.54	-0.02
90508		F9-	V	12	10:24:59.3	49:03:09	6.44	AB	0.60	0.04
114762		F9	V	13	13:09:54.5	17:46:55	7.31		0.53	-0.03
142373	CHI HER	F9	V	2	15:50:56.7	42:35:26	4.62		0.56	0.00
157089		F9	V	13	17:18:35.5	1:29:16	6.97		0.58	0.02
200580		F9	V	13	21:01:36.9	2:48:01	7.32		0.54	-0.02

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HD	Name	Sp_Type		Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
4307	18 CET	G0	V	13	0:42:58.0	-13:09:04	6.14	A	0.60	0.00
4614	ETA CAS	G0	V	2	0:46:03.6	57:33:03	3.44	AB	0.57	-0.03
48682	PSI5 AUR	G0	V	13	6:43:08.2	43:37:46	5.24	A	0.55	-0.05
55575		G0	V	13	7:12:07.6	47:19:51	5.64		0.57	-0.03
109358	BET CVN	G0	V	2	12:31:22.2	41:37:44	4.26		0.59	-0.01
110897	10 CVN	G0	V	13	12:42:37.7	39:33:01	5.96		0.55	-0.05
114710	BET COM	G0	V	2	13:09:32.4	28:07:52	4.26	A	0.57	-0.03
152792		G0	V	13	16:51:57.4	42:54:36	6.83		0.62	0.02
157214	72 HER	G0	V	2	17:18:47.2	32:31:51	5.39	A	0.62	0.02
187923		G0	V	13	19:49:43.0	11:30:13	6.15	A	0.65	0.05
1461		G0	IV	13	0:16:07.4	-8:19:43	6.45		0.68	0.05
73593	34 LYN	G0	IV	13	8:37:34.2	46:00:39	5.38		1.00	0.37
121370	ETA BOO	G0	IV	2	13:52:18.1	18:38:51	2.68	A	0.58	-0.05
205153		G0	IV	13	21:31:13.9	-28:07:24	8.20		0.55	-0.08
6903	PSI3 PSC	G0	III	1	1:07:08.4	19:23:32	5.55		0.69	0.05
111812	31 COM	G0	III	1	12:49:15.8	27:48:44	4.94		0.67	0.03
84441	EPS LEO	G0	II	2	9:43:00.9	24:00:19	2.98		0.81	0.08
26630	MU PER	G0	Ib	1	4:11:13.0	48:17:03	4.15	A	0.96	0.14
204867	BET AQR	G0	Ib	1	21:28:55.6	-5:47:31	2.90	A	0.83	0.01
14802	KAP FOR	G1	V	13	2:20:15.2	-24:02:34	5.19		0.60	-0.02
27836		G1	V	1	4:21:22.4	14:38:38	7.61	V	0.60	-0.02
28068		G1	V	13	4:23:32.0	16:44:29	8.04	V	0.65	0.03
115043		G1	V	2	13:11:34.4	56:58:22	6.83	A	0.60	-0.02
190406	15 SGE	G1	V	13	20:01:51.3	16:56:00	5.79	ABC	0.60	-0.02
150680	ZET HER	G1	IV	1	16:39:23.9	31:41:32	2.81	AB	0.64	0.01
185758	ALF SGE	G1	II	1	19:37:51.6	17:53:51	4.38	A	0.78	-0.02
188650		G1	Ib-II	12	19:52:58.5	36:51:46	5.76		0.75	-0.08
10307		G2	V	2	1:38:43.8	42:21:48	4.95		0.62	-0.01
13043		G2	V	13	2:05:01.8	-0:51:00	6.89	A	0.62	-0.01
28344		G2	V	13	4:25:55.1	17:10:34	7.85	V	0.61	-0.02
30455		G2	V	13	4:45:46.3	18:37:40	6.96		0.62	-0.01
111721		G2	V	13	12:48:49.0	-13:12:54	7.97		0.80	0.17
143761	RHO CRB	G2	V	13	15:59:07.8	33:27:12	5.42	A	0.60	-0.03
186408	16 CYG A	G2	V	2	19:40:29.1	50:24:30	5.96	A	0.64	0.01
224930	85 PEG	G2	V	2	23:59:33.2	26:49:03	5.74	AB	0.67	0.04
2151	BET HYI	G2	IV	13	0:23:09.3	-77:32:08	2.80		0.62	-0.02
159181	BET DRA	G2	Ib-IIa	1	17:29:18.0	52:20:15	2.80	AB	0.97	0.09
209750	ALP AQR	G2	Ib	2	22:03:12.9	0:33:48	2.94	A	0.97	0.09
100261	OMG1 CEN	G2	Ia	1	11:29:26.8	-59:09:57	5.13	A	1.07	0.19
26736		G3	V	17	4:11:32.1	23:27:01	8.08		0.66	0.01
86728	20 LMI	G3	Va H delta 1	12	9:58:08.8	32:10:14	5.37	A	0.65	0.00
144608	OMG2 SCO	G3	II-III	11	16:04:28.0	-20:44:06	4.32		0.84	-0.02
192876	ALP1 CAP	G3	Ib	13	20:14:52.6	-12:39:51	4.25	A	1.07	0.15
82210	24 UMA	G4	III-IV	1	9:30:05.8	70:03:06	4.57		0.77	-0.03
74006	BET PYX	G4	III	13	8:38:08.6	-35:07:47	3.96	A	0.94	0.06
71369	OMI UMA	G4	II-III	13	8:26:07.6	60:53:14	3.37	AB	0.85	-0.02
204075	ZET CAP	G4	Ib	15	21:23:48.9	-22:37:44	3.74	A	1.00	0.04
20630	KAP CET	G5	V	2	3:16:44.1	3:11:17	4.83	A	0.68	0.00
26756		G5	V	17	4:11:36.0	14:30:00	8.46		0.70	0.02
117176	70 VIR	G5	V	2	13:25:59.0	14:02:43	4.97	A	0.71	0.03
186427	16 CYG B	G5	V	2	19:40:32.0	50:24:02	6.22	B	0.66	-0.02
197076		G5	V+	13	20:38:29.4	19:45:09	6.44	A	0.61	-0.07
161797	MU HER	G5	IV	2	17:44:29.9	27:44:55	3.42	A	0.75	0.05
93497	MU VEL	G5	IIIa	17	10:44:36.8	-49:09:19	2.69	AB	0.90	0.00
153751	EPS UMI	G5	III	13	16:51:00.9	82:07:21	4.23	A	0.90	0.00
36079	BET LEP	G5	II	11	5:26:06.0	-20:47:52	2.84	AB	0.82	-0.05
206859	9 PEG	G5	Ib	2	21:42:08.5	17:07:11	4.34		1.16	0.16
114946	55 VIR	G6	V	15	13:11:30.0	-19:40:07	5.32		0.88	0.16
115617	61 VIR	G6	V	2	13:15:47.0	-18:02:01	4.74	A	0.71	-0.01
109379	BET CRV	G7	IIIa Ba 0.3:	11	12:31:45.3	-23:07:13	2.65		0.90	-0.04
148856	BET HER	G7	IIIa	11	16:28:04.1	21:35:50	2.78	A	0.93	-0.01
10700	TAU CET	G8	Vp	2	1:41:44.6	-16:12:00	3.50	A	0.73	-0.01
13783		G8	V	13	2:12:59.0	64:43:32	8.30		0.67	-0.07
64606		G8	V	13	7:52:02.6	-1:16:47	7.44		0.73	-0.01
75732	RHO1 CNC	G8	V	13	8:49:37.4	28:31:23	5.95	A	0.86	0.12
101501	61 UMA	G8	V	2	11:38:25.3	34:29:03	5.32	A	0.72	-0.02
103095		G8	Vp	2	11:50:06.2	38:04:39	6.45		0.75	0.01
211038		G8	V	13	22:11:55.9	-16:03:45	6.55		0.89	0.15
67767	PSI CNC	G8	IV	13	8:07:26.7	25:39:38	5.72	A	0.82	0.00
182572	31 AQL	G8	IV H delta 1	11	19:22:35.2	11:50:09	5.16	A	0.76	-0.06
188512	BET AQL	G8	IV	2	19:52:51.3	6:16:49	3.72	AB	0.85	0.03
37160	PHI2 ORI	G8	IIIb	1	5:34:09.4	9:15:55	4.08		0.96	0.01
96566		G8	III	15	11:04:28.9	-62:09:12	4.61		1.03	0.08
115659	GAM HYA	G8-	IIIa	11	13:16:11.8	-22:54:29	2.99	A	0.92	-0.03
133208	BET BOO	G8-	IIIa: Ba 0.4	11	15:00:03.6	40:35:12	3.51		0.96	0.01
150997	ETA HER	G8	IIIb CN-1	11	16:41:10.8	39:00:58	3.49	A	0.92	-0.03
192947	ALF2 CAP	G8	IIIb	12	20:15:16.8	-12:42:04	3.57	ABC	0.94	-0.01
216131	MU PEG	G8	III+	1	22:47:35.2	24:20:13	3.49		0.94	-0.01
202109	ZET CYG	G8	II CN 1	1	21:10:48.3	30:01:15	3.21	A	0.99	0.00
48329	EPS GEM	G8	Ib	2	6:40:51.3	25:10:56	2.99	A	1.40	0.26
72324	UPS2 CNC	G9	III	13	8:30:02.9	24:15:22	6.35			

HD	Name	Sp_Type	Ref	RA(1950.0)	DEC(1950.0)	V	Remarks	B-V	E(B-V)
								1.03	0.05
96436	65 LEO	G9 III	14	11:04:21.1	2:13:38	5.52	AB	0.97	-0.01
180711	DEL DRA	G9 III	1	19:12:33.8	67:34:25	3.07	A	0.99	0.01
76294	ZET HYA	G9 II-III	1	8:52:45.0	6:08:13	3.10		1.00	0.00

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
10780		K0 V	13	1:44:06.4	63:36:24	5.63	A	0.80	-0.01
134439		K0 V	13	15:07:28.5	-16:08:27	9.07	A	0.77	-0.04
185144	SIG DRA	K0 V	2	19:32:27.5	69:34:34	4.68	A	0.79	-0.02
192310		K0 V	13	20:12:10.4	-27:11:01	5.73		0.88	0.07
198149	ETA CEP	K0 IV	2	20:44:16.4	61:38:38	3.42	AB	0.92	0.01
6203	25 CET	K0 III-IV	13	1:00:30.8	-5:06:13	5.44	A	1.11	0.10
4128	BET CET	K0 III CH-1 H&K-0.5	12	0:41:04.8	-18:15:38	2.04		1.02	0.01
19476	KAP PER	K0 III	13	3:06:06.8	44:40:10	3.80	A	0.98	-0.03
39364	DEL LEP	K0 III CN-2	11	5:49:10.1	-20:52:55	3.78		1.00	-0.01
49293	18 MON	K0 III Ba 0.1	11	6:45:15.2	2:28:06	4.47		1.11	0.10
62509	BET GEM	K0 IIIb	1	7:42:15.5	28:08:55	1.14	AC	1.00	-0.01
88284	LAM HYA	K0 III CN 1	11	10:08:08.9	-12:06:22	3.61	A	1.01	0.00
95272	ALP CRT	K0+ III	11	10:57:20.1	-18:01:56	4.08		1.09	0.08
197989	EPS CYG	K0- III	1	20:44:11.1	33:46:55	2.47	A	1.03	0.02
216228	IOT CEP	K0- III	1	22:47:53.6	65:56:13	3.52		1.05	0.04
219615	GAM PSC	K0- III: CN-1.5	11	23:14:34.3	3:00:31	3.70		0.92	-0.09
207089	12 PEG	K0 Ib	1	21:43:46.1	22:43:03	5.29		1.38	0.20
221861		K0 Ib	11	23:32:48.0	71:21:56	5.84		1.80	0.62
10476	107 PSC	K1 V	2	1:39:46.6	20:01:34	5.24	A	0.84	-0.02
26965	OMI2 ERI	K1- V	12	4:12:58.2	-7:43:46	4.42	A	0.82	-0.04
132142		K1 V	13	14:53:45.6	53:52:30	7.77		0.79	-0.07
142091	KAP CRB	K1 IVa	1	15:49:20.8	35:48:41	4.81	A	1.00	0.01
142980	PHI SER	K1 IV	13	15:54:56.0	14:33:23	5.54		1.14	0.15
145148		K1+ IV	12	16:06:43.3	6:31:12	5.95		0.99	0.00
145328	TAU CRB	K1- III-IV	11	16:07:08.5	36:37:01	4.76	AB	1.01	-0.08
160635	ETA PAV	K1 III	13	17:40:49.2	-64:42:09	3.61		1.19	0.10
163770	THE HER	K1 IIa CN+2	1	17:54:32.1	37:15:21	3.86		1.35	0.21
210745	ZET CEP	K1.5 Ib	1	22:09:06.9	57:57:15	3.35		1.57	0.36
22049	EPS ERI	K2 V	2	3:30:34.3	-9:37:34	3.73		0.88	-0.04
166620		K2 V	2	18:07:58.0	38:27:12	6.40		0.88	-0.04
10486		K2 IV	13	1:40:13.2	45:04:15	6.33		1.02	-0.02
51440	62 AUR	K2 III	13	6:55:38.5	38:07:23	6.00		1.22	0.06
54719	TAU GEM	K2- III	11	7:07:57.5	30:19:45	4.41	AB	1.26	0.10
66141		K2 III	13	7:59:39.9	2:28:24	4.39	A	1.25	0.09
72184		K2 III	13	8:29:40.3	38:11:22	5.90		1.11	-0.05
73471	SIG HYA	K2 III	13	8:36:08.7	3:31:05	4.45		1.21	0.05
85503	MU LEO	K2 IIIb CN 1 Ca 1 Ba -1	11	9:49:55.4	26:14:36	3.88		1.22	0.06
137759	IOT DRA	K2 III	2	15:23:48.7	59:08:26	3.29	A	1.17	0.01
161096	BET OPH	K2 III	1	17:41:00.0	4:35:11	2.77		1.17	0.01
163588	XI DRA	K2 III	1	17:52:39.7	56:52:47	3.75	A	1.18	0.02
20644		K2 II-III	13	3:17:18.4	28:52:07	4.47		1.55	0.42
150798	ALF TRA	K2 IIb-IIIa	13	16:43:21.0	-68:56:19	1.91		1.45	0.32
157999	SIG OPH	K2 II	1	17:24:01.8	4:10:56	4.33		1.50	0.21
206778	EPS PEG	K2 Ib	2	21:41:43.7	9:38:41	2.39	A	1.52	0.29
144872		K3 V	13	16:04:41.9	38:46:22	8.61		0.95	0.00
219134		K3 V	2	23:10:52.0	56:53:30	5.57	A	0.99	0.04
10380	NU PSC	K3- IIIb Ba 0.1	11	1:38:49.6	5:14:07	4.44		1.36	0.10
35620	PHI AUR	K3 III CN+2	11	5:24:19.8	34:26:07	5.08	AD	1.40	0.14
125560	20 BOO	K3 III	13	14:17:23.1	16:32:06	4.84		1.23	-0.03
132345	18 LIB	K3- III CN 2	11	14:56:11.1	-10:56:39	5.84	A	1.26	0.00
31398	IOT AUR	K3 II	1	4:53:43.9	33:05:19	2.68		1.53	0.13
89388		K3 IIa	13	10:15:24.5	-61:04:55	3.36	A	1.54	0.14
157244	BET ARA	K3 Ib-IIa	13	17:21:08.2	-55:29:06	2.84		1.46	0.05
69267	BET CNC	K4 III	1	8:13:48.2	9:20:27	3.53	A	1.48	0.05
127700	5 UMI	K4- III Ba 0.3	12	14:27:36.1	75:55:05	4.27	A	1.43	0.00
131873	BET UMI	K4 III	1	14:50:49.6	74:21:35	2.07	AB	1.47	0.04
209747	NU PEG	K4 III	13	22:03:09.4	4:48:48	4.85		1.45	0.02
78647	LAM VEL	K4 Ib-IIa	13	9:06:09.3	-43:13:47	2.20	A	1.67	0.21
201091	61 CYG A	K5 V	1	21:04:40.0	38:30:00	5.23	A	1.16	0.01
29139	ALP TAU	K5 III	1	4:33:02.8	16:24:37	0.87	A	1.54	0.03
139669	THE UMI	K5 III	13	15:32:51.2	77:30:59	4.96		1.58	0.07
164058	GAM DRA	K5 III	1	17:55:26.5	51:29:38	2.23	A	1.52	0.01
44537	PSI1 AUR	K5-M0 Iab-Ib	1	6:21:02.8	49:18:56	4.87		1.96	0.36
201092	61 CYG B	K7 V	1	21:04:38.0	38:29:30	6.06	B	1.35	0.02
17709	17 PER	K7 III	1	2:48:25.5	34:51:19	4.54		1.56	0.03
70272	31 LYN	K7 III	1	8:19:25.2	43:21:00	4.25		1.55	0.02
80493	ALF LYN	K7 IIIab	1	9:18:00.8	34:36:18	3.14		1.55	0.02
149161	29 HER	K7 III	1	16:30:15.7	11:35:38	4.83		1.49	-0.04
52877	SIG CMA	K7 Ib	1	6:59:43.5	-27:51:43	3.46	A	1.73	0.11

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
6860	BET AND	M0 IIIa	1	1:06:55.5	35:21:21	2.05	A	1.58	0.01
9053	GAM PHE	M0- IIIa	11	1:26:11.7	-43:34:25	3.41		1.57	0.00
89758	MU UMA	M0 III H&Kem	1	10:19:21.4	41:45:06	3.05		1.58	0.01
100029	LAM DRA	M0 III Ca-1	12	11:28:27.5	69:36:26	3.85		1.61	0.04
111631		M0.5 V	2	12:48:09.6	-0:29:26	8.49		1.41	-0.06
146051	DEL OPH	M0.5 III	1	16:11:43.3	-3:34:01	2.73	A	1.58	-0.01
102212	NU VIR	M1 IIIab	1	11:43:17.3	6:48:34	4.03		1.51	-0.09
112769	36 COM	M1- IIIb	1	12:56:27.0	17:40:42	4.77		1.57	-0.03
141477	KAP SER	M1- IIIab	1	15:46:29.2	18:17:41	4.10		1.61	0.01
168720	106 HER	M1 IIIb	1	18:18:10.8	21:56:19	4.94		1.59	-0.01
49331		M1+ Ib-IIa	11	6:45:13.7	-8:56:32	5.05		1.80	0.15
39801	ALP ORI	M1-M2 Ia-Ib	1	5:52:27.8	7:23:57	0.48		1.86	0.21
95735		M2 V	2	11:00:36.5	36:18:20	7.50		1.51	0.04
216399		dM2	16	22:49:52.3	22:37:02	8.65		~1.30	~0.00
1013	CHI PEG	M2+ III	1	0:12:00.6	19:55:43	4.80		1.57	-0.03
86663	PI LEO	M2- IIIab	11	9:57:34.3	8:17:05	4.69		1.60	0.00
119228	83 UMA	M2 IIIab	1	13:38:50.5	54:56:03	4.66		1.63	0.03
219734	8 AND	M2 III	1	23:15:25.1	48:44:30	4.83	AB	1.66	0.06
36389	119 TAU	M2 Iab-Ib	1	5:29:16.7	18:33:31	4.35		2.07	0.42
206936	MU CEP	M2 Ia	1	21:41:58.5	58:33:00	4.10	A	2.33	0.68
173739		M3 V	14	18:42:12.1	59:33:16	8.90	A	1.54	0.07
224427	PSI PEG	M3 III	1	23:55:12.4	24:51:48	4.67		1.58	-0.02
44478	MU GEM	M3 IIIab	1	6:19:56.0	22:32:27	2.87	A	1.64	0.04
112300	DEL VIR	M3 III	1	12:53:04.9	3:40:07	3.38	A	1.57	-0.03
133216	SIG LIB	M3- III	12	15:01:08.2	-25:05:12	3.30		1.68	0.08
40239	PI AUR	M3 II	1	5:56:13.3	45:56:04	4.29		1.70	0.10
108903	GAM CRU	M3.5 III	11	12:28:22.7	-56:50:00	1.62	A	1.60	-0.02
19058	RHO PER	M4 IIb-IIIa	1	3:01:57.7	38:38:52	3.39		1.65	0.02
175588	DEL2 LYR	M4 II	1	18:52:45.2	36:50:02	4.28	A	1.67	0.04
123657		M4.5 III	12	14:05:55.8	44:05:29	5.26		1.58	-0.06
145713	10 HER	M4.5 IIIa	15	16:09:30.1	23:37:22	5.58		1.57	-0.07
132813		M5 III	1	14:56:46.8	66:07:52	4.59		1.59	-0.06
148783	30 HER	M6- III	1	16:26:59.8	41:59:26	5.00		1.54	0.05
207076		M7 III:	1	21:43:56.4	-2:26:40	6.69		1.49	-0.01

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IUE NEWSIPS Atlas : 476 "Normal" Stars Atlas, sorted by HD Number

* [400-50000] * [50001-100000] * [100001-150000] * [150001-200000] * [200001-319000] *

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V)
432	BET CAS	F2 III-IV	1	0:06:29.7	58:52:26	2.27	A	0.34	-0.03
1013	CHI PEG	M2+ III	1	0:12:00.6	19:55:43	4.80		1.57	-0.03
1383		B1 II	9	0:15:34.7	61:26:58	7.63		0.27	0.51
1461		G0 IV	13	0:16:07.4	-8:19:43	6.45		0.68	0.05
2151	BET HYI	G2 IV	13	0:23:09.3	-77:32:08	2.80		0.62	-0.02
3360	ZET CAS	B2 IV	6	0:34:10.3	53:37:19	3.66		-0.20	0.04
4128	BET CET	K0 III CH-1 H&K-0.5	12	0:41:04.8	-18:15:38	2.04		1.02	0.01
4180	OMI CAS	B5 III	6	0:41:55.6	48:00:40	4.57	A	-0.07	0.09
4307	18 CET	G0 V	13	0:42:58.0	-13:09:04	6.14	A	0.60	0.00
4614	ETA CAS	G0 V	2	0:46:03.6	57:33:03	3.44	AB	0.57	-0.03
6203	25 CET	K0 III-IV	13	1:00:30.8	-5:06:13	5.44	A	1.11	0.10
6860	BET AND	M0 IIIa	1	1:06:55.5	35:21:21	2.05	A	1.58	0.01
6903	PSI3 PSC	G0 III	1	1:07:08.4	19:23:32	5.55		0.69	0.05
7312		F0 III	13	1:10:27.3	-38:07:15	5.91		0.29	-0.03
8799	OME AND	F4 IV	13	1:24:39.2	45:08:57	4.83	AB	0.42	0.00
8890	ALF UMI	F7 Ib-II	13	1:48:48.7	89:01:43	2.01	A	0.60	0.12
9053	GAM PHE	M0- IIIa	11	1:26:11.7	-43:34:25	3.41		1.57	0.00
10205	TAU AND	B8 III	13	1:37:37.0	40:19:28	4.95	A	-0.09	0.01
10307		G2 V	2	1:38:43.8	42:21:48	4.95		0.62	-0.01
10380	NU PSC	K3- IIIb Ba 0.1	11	1:38:49.6	5:14:07	4.44		1.36	0.10
10476	107 PSC	K1 V	2	1:39:46.6	20:01:34	5.24	A	0.84	-0.02
10486		K2 IV	13	1:40:13.2	45:04:15	6.33		1.02	-0.02
10700	TAU CET	G8 Vp	2	1:41:44.6	-16:12:00	3.50	A	0.73	-0.01
10780		K0 V	13	1:44:06.4	63:36:24	5.63	A	0.80	-0.01
12311	ALP HYI	F0 V	13	1:57:11.7	-61:48:45	2.85		0.28	-0.04
12953		A1 Ia	9	2:05:09.8	58:11:13	5.69		0.61	0.58
13041	58 AND	A5 IV-V	10	2:05:27.6	37:37:22	4.81		0.12	-0.03
13043		G2 V	13	2:05:01.8	-0:51:00	6.89	A	0.62	-0.01
13783		G8 V	13	2:12:59.0	64:43:32	8.30		0.67	-0.07
13854		B1 Iab	6	2:13:20.9	56:49:26	6.47	A	0.28	0.47
14357		B2 II	9	2:17:38.4	56:38:14	8.52		0.32	0.53
14633		ON8 V	5	2:19:46.4	41:15:11	7.46	A	-0.20	0.11
14802	KAP FOR	G1 V	13	2:20:15.2	-24:02:34	5.19		0.60	-0.02
16970	GAM CET	A3 V	10	2:40:42.3	3:01:34	3.46	AB	0.09	0.01
17081	PI CET	B7 V	6	2:41:44.4	-14:04:10	4.24		-0.14	-0.01
17584	16 PER	F2 III	2	2:47:25.0	38:06:50	4.22	A	0.34	-0.02
17709	17 PER	K7 III	1	2:48:25.5	34:51:19	4.54		1.56	0.03
17769	SIG ARI	B7 V	6	2:48:43.6	14:52:38	5.48		-0.09	0.04
19058	RHO PER	M4 IIb-IIIa	1	3:01:57.7	38:38:52	3.39		1.65	0.02
19476	KAP PER	K0 III	13	3:06:06.8	44:40:10	3.80	A	0.98	-0.03
20630	KAP CET	G5 V	2	3:16:44.1	3:11:17	4.83	A	0.68	0.00
20644		K2 II-III	13	3:17:18.4	28:52:07	4.47		1.55	0.42
20902	ALP PER	F5 Ib	2	3:20:44.4	49:41:06	1.79	A	0.48	0.22
21790	17 ERI	B9 Vs	10	3:28:08.0	-5:14:43	4.73		-0.09	-0.02
22049	EPS ERI	K2 V	2	3:30:34.3	-9:37:34	3.73		0.88	-0.04
22879		F9 V	13	3:37:49.2	-3:22:29	6.69		0.54	-0.02
23227	DEL FOR	B5 IV	7	3:40:15.4	-32:05:49	5.00		-0.17	-0.01
23324	18 TAU	B8 V	1	3:42:10.3	24:41:02	5.65		-0.07	0.04
23338	19 TAU	B6 IV	1	3:42:13.5	24:18:42	4.30	A	-0.11	0.03
23630	ETA TAU	B7 III	1	3:44:30.4	23:57:07	2.87	A	-0.09	0.03
23850	27 TAU	B8 III	1	3:46:11.0	23:54:07	3.62	AB	-0.09	0.01
24432		B3 II	13	3:51:45.7	48:53:42	6.93		0.58	0.75
24912	XI PER	O7.5 III(n)((f))	5	3:55:42.8	35:38:56	4.04		0.02	0.33
25340	35 ERI	B5 V	6	3:58:59.8	-1:41:18	5.28		-0.15	0.01
25631		B2.5 V	7	4:01:12.4	-20:16:50	6.46		-0.18	0.04
26462	45 TAU	F4 V	13	4:08:40.3	5:23:39	5.73	A	0.36	-0.06
26571		B9 III	13	4:09:53.1	22:17:11	8.09		0.19	0.27
26630	MU PER	G0 Ib	1	4:11:13.0	48:17:03	4.15	A	0.96	0.14
26736		G3 V	17	4:11:32.1	23:27:01	8.08		0.66	0.01
26756		G5 V	17	4:11:36.0	14:30:00	8.46		0.70	0.02
26965	OMI2 ERI	K1- V	12	4:12:58.2	-7:43:46	4.42	A	0.82	-0.04
27176	51 TAU	F0 V	10	4:15:25.3	21:27:31	5.65	A	0.28	-0.04
27383		F9 V	13	4:17:02.8	16:24:12	6.89	AB	0.56	0.00
27524		F5 V	1	4:18:34.3	20:55:22	6.80		0.44	-0.01
27561		F5 V	13	4:18:45.2	14:17:33	6.61		0.41	-0.04
27808		F8 V	1	4:21:16.1	21:37:19	7.14		0.52	-0.01
27836		G1 V	1	4:21:22.4	14:38:38	7.61	V	0.60	-0.02
28068		G1 V	13	4:23:32.0	16:44:29	8.04	V	0.65	0.03
28344		G2 V	13	4:25:55.1	17:10:34	7.85	V	0.61	-0.02
28527		A6 IV	10	4:27:41.7	16:05:12	4.78	A	0.17	-0.02
28873	DEL CAE	B2 IV-V	7	4:29:18.1	-45:03:36	5.06		-0.20	0.04
28910	RHO TAU	A8 V	10	4:31:00.4	14:44:27	4.65	V	0.25	-0.02
29139	ALP TAU	K5 III	1	4:33:02.8	16:24:37	0.87	A	1.54	0.03
29335	49 ERI	B7 V	6	4:34:38.8	0:53:54	5.31		-0.13	0.00
29875	ALF CAE	F2 V	13	4:38:56.9	-41:57:29	4.45	AB	0.34	-0.01
30455		G2 V	13	4:45:46.3	18:37:40	6.96		0.62	-0.01
30614	ALF CAM	O9.5 Ia	5	4:49:03.8	66:15:38	4.29		0.03	0.30
30652	PI3 ORI	F6 V	1	4:47:07.4	6:52:32	3.19	A	0.45	-0.03
31327		B2.5 Ib	6	4:52:59.4	36:05:25	6.07		0.40	0.55
31398	IOT AUR	K3 II	1	4:53:43.9	33:05:19	2.68		1.53	0.13
31726		B1 V	6	4:55:27.3	-14:18:27	6.14		-0.21	0.05
32612		B2.5 IV	6	5:01:34.9	-14:26:19	6.40		-0.19	0.03
32630	ETA AUR	B3 V	1	5:03:00.2	41:10:08	3.17		-0.18	0.02
33111	BET ERI	A3 III	2	5:05:23.3	-5:08:58	2.78	A	0.13	0.04
34759	RHO AUR	B5 V	1	5:18:15.8	41:45:24	5.22		-0.15	0.01
34816	LAM LEP	B0.5 IV	6	5:17:16.1	-13:13:37	4.29		-0.27	0.01
35620	PHI AUR	K3 III CN+2	11	5:24:19.8	34:26:07	5.08	AD	1.40	0.14
36079	BET LEP	G5 II	11	5:26:06.0	-20:47:52	2.84	AB	0.82	-0.05
36389	119 TAU	M2 Iab-Ib	1	5:29:16.7	18:33:31	4.35		2.07	0.42
36512	UPS ORI	B0 V	1	5:29:30.6	-7:20:12	4.62		-0.26	0.04
36673	ALP LEP	F0 Ib	2	5:30:31.3	-17:51:24	2.58	A	0.21	0.06
37160	PHI2 ORI	G8 IIIb	1	5:34:09.4	9:15:55	4.08		0.96	0.01
37744		B1.5 V	6	5:38:06.8	-2:51:00	6.21		-0.21	0.04
38666	MU COL	O9.5 V	4	5:45:00.5	5:40:45	5.17		-0.28	0.02
38678	ZET LEP	A3 Vn	10	5:44:41.2	-14:50:21	3.54		0.10	0.02
38899	134 TAU	B9 IV	2	5:46:44.3	12:38:13	4.90	A	-0.07	0.00
39291	55 ORI	B2 IV-V	6	5:48:57.0	-7:31:48	5.35		-0.20	0.04<
39364	DEL LEP	K0 III CN-2	11	5:49:10.1	-20:52:55	3.78		1.00	-0.01
39801	ALP ORI	M1-M2 Ia-Ib	1	5:52:27.8	7:23:57	0.48		1.86	0.21
40111	139 TAU	B1 Ib	6	5:54:53.4	25:56:58	4.82		-0.06	0.13
40136	ETA LEP	F1 III	13	5:54:07.5	-14:10:31	3.71		0.33	0.00
40239	PI AUR	M3 II	1	5:56:13.3	45:56:04	4.29		1.70	0.10
41117	CHI2 ORI	B2 Ia	1	6:00:56.9	20:08:28	4.63		0.27	0.44
42560	XI ORI	B3 IV	6	6:09:05.7	14:13:18	4.47	A	-0.18	0.02
43318		F6 V	13	6:13:01.6	-0:29:31	5.64		0.50	0.02
43818		B0 II	9	6:16:16.6	23:29:27	6.91		0.29	0.58
43905	45 AUR	F5 III	13	6:17:42.4	53:28:38	5.35		0.43	0.00
44478	MU GEM	M3 IIIab	1	6:19:56.0	22:32:27	2.87	A	1.64	0.04
44506		B1.5 IIIn	7	6:18:47.6	-34:07:13	5.54		-0.19	0.06
44537	PSI1 AUR	K5-M0 Iab-Ib	1	6:21:02.8	49:18:56	4.87		1.96	0.36
46056		O8 Vn	4	6:28:41.5	4:52:14	8.24	A	0.20	0.51
46106		B1 V	13	6:28:58.8	5:03:47	7.93		0.14	0.40
46149		O8.5 V	4	6:29:12.9	5:04:11	7.60		0.17	0.48
46223		O4 V((f))	5	6:29:29.9	4:51:38	7.27		0.22	0.54
46300	13 MON	A0 Ib	9	6:30:11.9	7:22:16	4.50		0.01	0.01
46328	XI1 CMA	B1 III	7	6:29:46.2	-23:22:52	4.33	A	-0.24	0.02
46769		B8 Ib	6	6:32:41.0	0:55:52	5.80		-0.01	0.01
47240		B1 II	6	6:35:13.2	5:00:04	6.15		0.15	0.39
47839	15 MON	O7 V((f))	5	6:38:13.4	9:56:37	4.65	AB	-0.24	0.08
48329	EPS GEM	G8 Ib	2	6:40:51.3	25:10:56	2.99	A	1.40	0.26
48682	PSI5 AUR	G0 V	13	6:43:08.2	43:37:46	5.24	A	0.55	-0.05

HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
48879	42 CAM	B4 IV	6	6:45:44.9	67:37:48	5.14		-0.17	0.01
49293	18 MON	K0 III Ba 0.1	11	6:45:15.2	2:28:06	4.47		1.11	0.10
49331		M1+ Ib-IIa	11	6:45:13.7	-8:56:32	5.05		1.80	0.15

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
50019	THE GEM	A3 III	2	6:49:29.6	34:01:24	3.60	A	0.10	0.01
50707	15 CMA	B1 III	7	6:51:23.1	-20:09:40	4.82	V	-0.22	0.04
51283		B2 III	7	6:53:40.5	-22:52:32	5.30		-0.18	0.06
51440	62 AUR	K2 III	13	6:55:38.5	38:07:23	6.00		1.22	0.06
52877	SIG CMA	K7 Ib	1	6:59:43.5	-27:51:43	3.46	A	1.73	0.11
53138	OMI2 CMA	B3 Ia	1	7:00:56.1	-23:45:32	3.03		-0.09	0.04
54605	DEL CMA	F8 Ia	2	7:06:21.4	-26:18:45	1.83		0.68	0.13
54719	TAU GEM	K2- III	11	7:07:57.5	30:19:45	4.41	AB	1.26	0.10
55575		G0 V	13	7:12:07.6	47:19:51	5.64		0.57	-0.03
55857		B0.5 V	7	7:11:35.4	-27:16:10	6.11	V	-0.24	0.04
57623	DEL VOL	F6 V	13	7:16:51.6	-67:51:56	3.96		0.77	0.29
57682		O9 IV	5	7:19:38.1	-8:53:00	6.42		-0.19	0.12
58350	ETA CMA	B5 Ia	1	7:22:06.9	-29:12:16	2.45	A	-0.08	0.01
59612		A5 Ib	2	7:27:43.9	-22:55:09	4.85	AB	0.23	0.13
61110	OMI GEM	F3 III	13	7:35:54.2	34:42:03	4.90		0.41	0.02
61421	ALP CMI	F5 IV-V	2	7:36:41.1	5:21:16	0.37	AB	0.42	0.00
61831		B2.5 V	7	7:37:41.5	-38:11:32	4.84		-0.19	0.03
62509	BET GEM	K0 IIIb	1	7:42:15.5	28:08:55	1.14	AC	1.00	-0.01
62747		B1.5 III	7	7:42:27.8	-24:33:09	5.61		-0.20	0.05
63465		B2.5 III	7	7:45:38.7	-38:23:11	5.08	AB	-0.11	0.11
63922		B0 III	7	7:47:42.8	-46:14:47	4.11	A	-0.19	0.11
64503		B2.5 V	7	7:50:52.3	-38:43:56	4.49		-0.20	0.02
64606		G8 V	13	7:52:02.6	-1:16:47	7.44		0.73	-0.01
64760		B0.5 Ib	7	7:51:49.9	-47:58:18	4.24		-0.15	0.07
64802		B2 V	7	7:52:19.7	-35:44:43	5.47		-0.19	0.05
65904		B4 V	7	7:57:26.4	-45:04:43	5.98		-0.15	0.03
66141		K2 III	13	7:59:39.9	2:28:24	4.39	A	1.25	0.09
66591		B3 V	7	7:59:42.3	-63:25:42	4.81		-0.17	0.03
67767	PSI CNC	G8 IV	13	8:07:26.7	25:39:38	5.72	A	0.82	0.00
69081		B1.5 IV	7	8:12:05.5	-36:10:11	5.08	A	-0.20	0.05
69267	BET CNC	K4 III	1	8:13:48.2	9:20:27	3.53	A	1.48	0.05
69897	CHI CNC	F6 V	13	8:17:01.8	27:22:52	5.14		0.46	-0.02
70272	31 LYN	K7 III	1	8:19:25.2	43:21:00	4.25		1.55	0.02
71369	OMI UMA	G4 II-III	13	8:26:07.6	60:53:14	3.37	AB	0.85	-0.02
72184		K2 III	13	8:29:40.3	38:11:22	5.90		1.11	-0.05
72324	UPS2 CNC	G9 III	13	8:30:02.9	24:15:22	6.35		1.03	0.05
73471	SIG HYA	K2 III	13	8:36:08.7	3:31:05	4.45		1.21	0.05
73593	34 LYN	G0 IV	13	8:37:34.2	46:00:39	5.38		1.00	0.37
74006	BET PYX	G4 III	13	8:38:08.6	-35:07:47	3.96	A	0.94	0.06
74272		A5 II	15	8:39:34.6	-47:08:16	4.77		0.12	0.02
74273		B1.5 V	7	8:39:30.0	-48:44:36	5.90		-0.21	0.04
74371		B6 Ia	7	8:40:14.7	-45:13:50	5.24		0.21	0.28
74375		B1.5 III	7	8:39:30.8	-59:34:55	4.32	A	-0.12	0.13
75112		B4 V	7	8:44:50.0	-34:26:19	6.36		-0.14	0.04
75732	RHO1 CNC	G8 V	13	8:49:37.4	28:31:23	5.95	A	0.86	0.12
76294	ZET HYA	G9 II-III	1	8:52:45.0	6:08:13	3.10		1.00	0.00
76538		B5 III	7	8:52:40.1	-60:09:47	5.78		-0.08	0.08
76644	IOT UMA	A7 IV	1	8:55:47.6	48:14:22	3.14	A	0.20	-0.02
78647	LAM VEL	K4 Ib-IIa	13	9:06:09.3	-43:13:47	2.20	A	1.67	0.21
79439	18 UMA	A5 V	10	9:12:36.2	54:13:47	4.83		0.19	0.04
79447		B3 III	7	9:10:08.6	-62:06:40	3.96		-0.19	0.01
79694		B6 IV	7	9:12:17.4	-43:56:17	5.85		-0.13	0.01
79940		F5 III	13	9:13:44.9	-37:12:14	4.62	AB	0.45	0.02
80081	38 LYN	A1 V	13	9:15:44.3	37:00:55	3.81	AB	0.06	0.04
80404	IOT CAR	A8 Ib	13	9:15:45.1	-59:03:53	2.25		0.18	0.04
80493	ALF LYN	K7 IIIab	1	9:18:00.8	34:36:18	3.14		1.55	0.02
81848		B6 V	7	9:24:40.2	-53:09:41	5.10		-0.12	0.02
81937	23 UMA	F0 IV-Vb	13	9:27:36.5	63:16:55	3.66	A	0.33	0.03
82210	24 UMA	G4 III-IV	1	9:30:05.8	70:03:06	4.57		0.77	-0.03
82328	THE UMA	F6 IV	2	9:29:31.4	51:54:23	3.17	AB	0.46	0.00
82434	PSI VEL	F2 IV	13	9:28:43.6	-40:14:49	3.58	AB	0.36	-0.01
83058		B1.5 IV	7	9:32:24.6	-51:01:56	5.00		-0.19	0.06
83183		B5 II	7	9:32:59.5	-59:00:21	4.08		0.01	0.15
84441	EPS LEO	G0 II	2	9:43:00.9	24:00:19	2.98		0.81	0.08
85123	UPS CAR	A7 II Vb	13	9:45:51.8	-64:50:24	2.96	AB	0.27	0.13
85503	MU LEO	K2 IIIb CN 1 Ca 1 Ba -1	11	9:49:55.4	26:14:36	3.88		1.22	0.06
86440	PHI VEL	B5 Ib	7	9:55:06.2	-54:19:44	3.53	A	-0.09	0.00
86606		B1 Ib	7	9:55:17.9	-71:09:02	6.33		-0.06	0.13
86663	PI LEO	M2- IIIab	11	9:57:34.3	8:17:05	4.69		1.60	0.00
86728	20 LMI	G3 Va H delta 1	12	9:58:08.8	32:10:14	5.37	A	0.65	0.00
87696	21 LMI	A7 V	2	10:04:29.1	35:29:21	4.48		0.18	-0.02
88284	LAM HYA	K0 III CN 1	11	10:08:08.9	-12:06:22	3.61	A	1.01	0.00
89025	ZET LEO	F0 III	1	10:13:54.7	23:40:01	3.44	A	0.31	-0.01
89388		K3 IIa	13	10:15:24.5	-61:04:55	3.36	A	1.54	0.14
89449	40 LEO	F6 IV	2	10:17:01.0	19:43:31	4.79		0.45	-0.01
89758	MU UMA	M0 III H&Kem	1	10:19:21.4	41:45:06	3.05		1.58	0.01
90508		F9- V	12	10:24:59.3	49:03:09	6.44	AB	0.60	0.04
90839	36 UMA	F8 V	2	10:27:26.4	56:14:15	4.83	A	0.52	-0.01
90994	BET SEX	B6 V	6	10:27:44.0	0:22:47	5.07		-0.14	0.00
91316	RHO LEO	B1 Iab	6	10:30:10.7	9:33:52	3.85	AB	-0.14	0.05
92207		A0 Ia	13	10:35:32.3	-58:28:23	5.47	V	0.50	0.48
93027		O9.5 V	5	10:41:18.3	-59:52:40	8.72		-0.02	0.28
93130		O6 III(f)	5	10:42:04.4	-59:36:41	8.06	A	0.23	0.55
93160		O6 III(f)	5	10:42:10.7	-59:18:44	7.82	AB	0.17	0.49
93204		O5 V((f))	4	10:42:31.0	-59:28:36	8.44	B	0.10	0.42
93222		O7 III((f)	5	10:42:40.4	-59:49:41	8.10		0.05	0.37
93250		O3 V((f))	5	10:42:48.3	-59:18:07	7.37		0.17	0.49
93403		O5 III(f) Var	4	10:43:46.7	-59:08:39	7.27		0.22	0.54
93497	MU VEL	G5 IIIa	17	10:44:36.8	-49:09:19	2.69	AB	0.90	0.00
93632		O5 III(f) Var	4	10:45:15.5	-59:49:59	8.36	A	0.30	0.62
93843		O5 III(f) var	4	10:46:40.2	-59:57:33	7.32		-0.04	0.28
95272	ALP CRT	K0+ III	11	10:57:20.1	-18:01:56	4.08		1.09	0.08
95608	60 LEO	A1m:	10	10:59:39.7	20:26:54	4.42		0.06	-.--
95735		M2 V	2	11:00:36.5	36:18:20	7.50		1.51	0.04
96436	65 LEO	G9 III	14	11:04:21.1	2:13:38	5.52	AB	0.97	-0.01
96566		G8 III	15	11:04:28.9	-62:09:12	4.61		1.03	0.08
97534		A6 Ia	13	11:10:26.8	-60:02:43	4.60	A	0.54	0.44
97603	DEL LEO	A4 V	2	11:11:27.0	20:47:52	2.56	A	0.13	0.01
98664	SIG LEO	B9.5 Vs	10	11:18:33.4	6:18:13	4.04		-0.06	-0.02
99028	IOT LEO	F4 IV	15	11:21:19.1	10:48:17	3.94	AB	0.41	-0.01
99211	GAM CRT	A7 IV-V	10	11:22:22.8	-17:24:32	4.07	AB	0.21	-0.01

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
100029	LAM DRA	M0 III Ca-1	12	11:28:27.5	69:36:26	3.85		1.61	0.04
100261	OMG1 CEN	G2 Ia	1	11:29:26.8	-59:09:57	5.13	A	1.07	0.19
100889	THE CRT	B9.5 Vn	10	11:34:08.5	-9:31:32	4.70		-0.08	-0.04
101205		O7 IIIn((f))	4	11:35:59.8	-63:05:45	6.46	AB	0.04	0.36
101501	61 UMA	G8 V	2	11:38:25.3	34:29:03	5.32	A	0.72	-0.02
102212	NU VIR	M1 IIIab	1	11:43:17.3	6:48:34	4.03		1.51	-0.09
102870	BET VIR	F8 V	2	11:48:05.3	2:02:47	3.61	AB	0.55	0.02
103095		G8 Vp	2	11:50:06.2	38:04:39	6.45		0.75	0.01
103287	GAM UMA	A0 V	1	11:51:12.5	53:58:21	2.44		0.00	0.01
104035		A3 Ib	13	11:56:15.5	-64:03:39	5.61		0.17	0.11
106516		F5 V	13	12:12:36.0	-10:01:14	6.11	A	0.47	0.02
106591	DEL UMA	A3 V	2	12:12:57.5	57:18:36	3.31	A	0.08	0.00
108177		F5 VI	13	12:23:01.5	1:34:02	9.66		0.43	-0.02
108903	GAM CRU	M3.5 III	11	12:28:22.7	-56:50:00	1.62	A	1.60	-0.02
109358	BET CVN	G0 V	2	12:31:22.2	41:37:44	4.26		0.59	-0.01
109379	BET CRV	G7 IIIa Ba 0.3:	11	12:31:45.3	-23:07:13	2.65		0.90	-0.04
110897	10 CVN	G0 V	13	12:42:37.7	39:33:01	5.96		0.55	-0.05
111631		M0.5 V	2	12:48:09.6	-0:29:26	8.49		1.41	-0.06
111721		G2 V	13	12:48:49.0	-13:12:54	7.97		0.80	0.17
111775		A0 IV	13	12:49:15.5	-47:49:21	6.32		0.03	0.05
111812	31 COM	G0 III	1	12:49:15.8	27:48:44	4.94		0.67	0.03

112244		O8.5 Iab(f)	4	12:52:59.4	-56:33:54	5.37	A	0.02	0.31
112300	DEL VIR	M3 III	1	12:53:04.9	3:40:07	3.38	A	1.57	-0.03
112374		F3 Ia	15	12:53:48.4	-26:11:22	6.62		0.68	0.47
112769	36 COM	M1- IIIb	1	12:56:27.0	17:40:42	4.77		1.57	-0.03
112784		O9.5 III	8	12:57:02.1	-60:19:26	8.26		0.06	0.36
113139	78 UMA	F2 V	2	12:58:35.3	56:38:07	4.93	AB	0.37	0.02
114710	BET COM	G0 V	2	13:09:32.4	28:07:52	4.26	A	0.57	-0.03
114762		F9 V	13	13:09:54.5	17:46:55	7.31		0.53	-0.03
114946	55 VIR	G6 V	15	13:11:30.0	-19:40:07	5.32		0.88	0.16
115043		G1 V	2	13:11:34.4	56:58:22	6.83	A	0.60	-0.02
115617	61 VIR	G6 V	2	13:15:47.0	-18:02:01	4.74	A	0.71	-0.01
115659	GAM HYA	G8- IIIa	11	13:16:11.8	-22:54:29	2.99	A	0.92	-0.03
115823		B6 V	7	13:17:34.6	-52:29:08	5.47		-0.13	0.01
116842	80 UMA	A5 V	2	13:23:13.4	55:14:52	4.01		0.17	0.02
117176	70 VIR	G5 V	2	13:25:59.0	14:02:43	4.97	A	0.71	0.03
119159		B0.5 III	7	13:39:38.9	-56:30:58	6.00		-0.08	0.20
119228	83 UMA	M2 IIIab	1	13:38:50.5	54:56:03	4.66		1.63	0.03
120136	TAU BOO	F7 V	2	13:44:53.1	17:42:19	4.50	AB	0.48	-0.02
120315	ETA UMA	B3 V	1	13:45:34.2	49:33:44	1.86		-0.19	0.01
121370	ETA BOO	G0 IV	2	13:52:18.1	18:38:51	2.68	A	0.58	-0.05
122408	TAU VIR	A3 V	10	13:59:05.9	1:47:08	4.25	A	0.10	0.02
122980	CHI CEN	B2 V	7	14:02:59.0	-40:56:27	4.35		-0.20	0.04
123299	ALF DRA	A0 III	2	14:03:01.9	64:36:51	3.66		-0.05	-0.02
123657		M4.5 III	12	14:05:55.8	44:05:29	5.26		1.58	-0.06
124850	IOT VIR	F7 V	13	14:13:23.3	-5:45:46	4.08		0.51	0.01
125288		B6 Ib	7	14:16:48.9	-56:09:26	4.34		0.12	0.19
125560	20 BOO	K3 III	13	14:17:23.1	16:32:06	4.84		1.23	-0.03
126660	THE BOO	F7 V	2	14:23:29.6	52:04:52	4.05	A	0.50	0.00
127381	SIG LUP	B2 III	7	14:29:14.0	-50:14:11	4.41		-0.19	0.05
127700	5 UMI	K4- III Ba 0.3	12	14:27:36.1	75:55:05	4.27	A	1.43	0.00
129502	MU VIR	F2 III	13	14:40:25.2	-5:26:30	3.88		0.38	0.02
130109	109 VIR	A0 V	2	14:43:43.0	2:06:08	3.74		-0.01	0.00
131873	BET UMI	K4 III	1	14:50:49.6	74:21:35	2.07	AB	1.47	0.04
132142		K1 V	13	14:53:45.6	53:52:30	7.77		0.79	-0.07
132345	18 LIB	K3- III CN 2	11	14:56:11.1	-10:56:39	5.84	A	1.26	0.00
132813		M5 III	1	14:56:46.8	66:07:52	4.59		1.59	-0.06
133208	BET BOO	G8- IIIa: Ba 0.4	11	15:00:03.6	40:35:12	3.51		0.96	0.01
133216	SIG LIB	M3- III	12	15:01:08.2	-25:05:12	3.30		1.68	0.08
133683		F8 Iab-Ib	13	15:05:01.4	-66:53:36	5.76		0.68	0.13
134083	45 BOO	F5 V	13	15:05:06.2	25:03:46	4.93	A	0.43	-0.02
134439		K0 V	13	15:07:28.5	-16:08:27	9.07	A	0.77	-0.04
134687		B3 IV	7	15:09:27.3	-44:18:47	4.82		-0.18	0.02
135153	1 LUP	F1 II	13	15:11:33.1	-31:20:01	4.90		0.38	0.13
136202	5 SER	F8 IV-V	2	15:16:45.4	1:57:12	5.06	A	0.54	0.03
136664	PHI2 LUP	B4 V	7	15:19:57.1	-36:40:50	4.53		-0.15	0.03
137759	IOT DRA	K2 III	2	15:23:48.7	59:08:26	3.29	A	1.17	0.01
139664		F5 IV-V	13	15:37:44.5	-44:29:50	4.63		0.40	-0.02
139669	THE UMI	K5 III	13	15:32:51.2	77:30:59	4.96		1.58	0.07
141477	KAP SER	M1- IIIab	1	15:46:29.2	18:17:41	4.10		1.61	0.01
142091	KAP CRB	K1 IVa	1	15:49:20.8	35:48:41	4.81	A	1.00	0.01
142096	LAM LIB	B2.5 V	6	15:50:25.6	-20:01:08	5.03		-0.02	0.20
142373	CHI HER	F9 V	2	15:50:56.7	42:35:26	4.62		0.56	0.00
142860	GAM SER	F6 V	2	15:54:08.5	15:49:25	3.85	A	0.48	0.00
142980	PHI SER	K1 IV	13	15:54:56.0	14:33:23	5.54		1.14	0.15
143761	RHO CRB	G2 V	13	15:59:07.8	33:27:12	5.42	A	0.60	-0.03
144608	OMG2 SCO	G3 II-III	11	16:04:28.0	-20:44:06	4.32		0.84	-0.02
144872		K3 V	13	16:04:41.9	38:46:22	8.61		0.95	0.00
145148		K1+ IV	12	16:06:43.3	6:31:12	5.95		0.99	0.00
145328	TAU CRB	K1- III-IV	11	16:07:08.5	36:37:01	4.76	AB	1.01	-0.08
145713	10 HER	M4.5 IIIa	15	16:09:30.1	23:37:22	5.58		1.57	-0.07
146051	DEL OPH	M0.5 III	1	16:11:43.3	-3:34:01	2.73	A	1.58	-0.01
147394	TAU HER	B5 IV	1	16:18:14.1	46:25:53	3.90	AB	-0.15	0.01
147547	GAM HER	A9 III	2	16:19:42.7	19:16:09	3.75	A	0.27	-0.01
148703		B2 III	7	16:28:06.5	-34:35:50	4.23		-0.17	0.07
148783	30 HER	M6- III	1	16:26:59.8	41:59:26	5.00		1.54	0.05
148856	BET HER	G7 IIIa	11	16:28:04.1	21:35:50	2.78	A	0.93	-0.01
149038	MU NOR	O9.7 Iab	5	16:30:31.3	-43:56:28	4.90	V	0.09	0.35
149161	29 HER	K7 III	1	16:30:15.7	11:35:38	4.83		1.49	-0.04
149212	15 DRA	A0 III	13	16:28:04.2	68:52:34	4.96		-0.05	-0.02

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
150168		B1 Ia	7	16:37:52.6	-49:33:21	5.65		-0.02	0.17
150680	ZET HER	G1 IV	1	16:39:23.9	31:41:32	2.81	AB	0.64	0.01
150798	ALF TRA	K2 IIb-IIIa	13	16:43:21.0	-68:56:19	1.91		1.45	0.32
150898		B0.5 Ia	7	16:43:03.3	-58:15:06	5.57		-0.07	0.15
150997	ETA HER	G8 IIIb CN-1	11	16:41:10.8	39:00:58	3.49	A	0.92	-0.03
151515		O7 II(f)	5	16:46:17.1	-41:54:57	7.17		0.16	0.48
151769	20 OPH	F7 IV	13	16:47:03.8	-10:41:46	4.65		0.47	-0.03
151804		O8 Iaf	5	16:48:04.1	-41:08:47	5.23		0.07	0.36
152247		O9.5 II-III	4	16:50:40.9	-41:33:40	7.17		0.19	0.49
152408		O8: Iafpe	5	16:51:28.8	-41:04:15	5.79	AB	0.16	0.45
152723		O6.5 III(f)	5	16:53:26.1	-40:26:03	7.21	AB	0.13	0.45
152792		G0 V	13	16:51:57.4	42:54:36	6.83		0.62	0.02
153597	19 DRA	F6 V	13	16:55:44.8	65:12:39	4.89		0.48	0.00
153751	EPS UMI	G5 III	13	16:51:00.9	82:07:21	4.23	A	0.90	0.00
153808	EPS HER	A0 V	10	16:58:22.4	30:59:55	3.92		-0.02	-0.01
156897	XI OPH	F1 III-IV	13	17:18:00.2	-21:03:39	4.39	AB	0.38	0.05
157089		F9 V	13	17:18:35.5	1:29:16	6.97		0.58	0.02
157214	72 HER	G0 V	2	17:18:47.2	32:31:51	5.39	A	0.62	0.02
157244	BET ARA	K3 Ib-IIa	13	17:21:08.2	-55:29:06	2.84		1.46	0.05
157246	GAM ARA	B1 Ib	7	17:21:10.7	-56:19:58	3.33	A	-0.14	0.05
157792	44 OPH	A3m	13	17:23:18.8	-24:07:52	4.17		0.28	-.--
157950		F3 V	13	17:23:58.5	-5:02:38	4.53		0.39	-0.02
157999	SIG OPH	K2 II	1	17:24:01.8	4:10:56	4.33		1.50	0.21
159181	BET DRA	G2 Ib-IIa	1	17:29:18.0	52:20:15	2.80	AB	0.97	0.09
159532	THE SCO	F1 II	13	17:33:43.3	-42:58:05	1.86		0.40	0.15
159561	ALP OPH	A5 III	2	17:32:36.6	12:35:41	2.08		0.16	0.01
160365		F6 III	1	17:36:39.8	13:21:19	6.12		0.56	0.10
160635	ETA PAV	K1 III	13	17:40:49.2	-64:42:09	3.61		1.19	0.10
160922	OMG DRA	F5 V	13	17:37:14.3	68:46:52	4.79	A	0.43	-0.02
161096	BET OPH	K2 III	1	17:41:00.0	4:35:11	2.77		1.17	0.01
161471	IOT1 SCO	F3 Ia	13	17:44:05.1	-40:06:34	3.02	A	0.51	0.30
161797	MU HER	G5 IV	2	17:44:29.9	27:44:55	3.42	A	0.75	0.05
162978		O7.5 II((f))	5	17:51:49.2	-24:52:44	6.20		0.04	0.35
163506	89 HER	F2 Ia	2	17:53:24.0	26:03:24	5.45		0.34	0.16
163588	XI DRA	K2 III	1	17:52:39.7	56:52:47	3.75	A	1.18	0.02
163758		O6.5 Iaf	4	17:56:06.0	-36:01:06	7.32		0.03	0.35
163770	THE HER	K1 IIa CN+2	1	17:54:32.1	37:15:21	3.86		1.35	0.21
164058	GAM DRA	K5 III	1	17:55:26.5	51:29:38	2.23	A	1.52	0.01
164259	ZET SER	F3 V	2	17:57:50.4	-3:41:19	4.62		0.38	-0.03
164353	67 OPH	B5 Ib	6	17:58:08.3	2:55:56	3.96	AB	0.02	0.11
164794	9 SGR	O4 V((f))	4	18:00:48.4	-24:21:48	5.97		0.03	0.35
164865		B9 Ia	8	18:01:09.6	-24:11:08	7.66		0.87	0.87
165024	THE ARA	B2 Ib	7	18:02:44.2	-50:05:49	3.67		-0.09	0.07
165908	99 HER	F7 V	2	18:05:07.5	30:33:13	5.05	AB	0.52	0.02
166014	OMI HER	B9.5 V	10	18:05:35.4	28:45:15	3.84		-0.03	0.01
166197		B1 V	7	18:07:36.8	-33:48:39	6.15		-0.15	0.11
166205	DEL UMI	A1 Vn	10	17:48:18.3	86:36:34	4.36		0.02	0.00
166596		B2.5 III	7	18:09:40.1	-41:20:59	5.46		-0.18	0.04
166620		K2 V	2	18:07:58.0	38:27:12	6.40		0.88	-0.04
167659		O7 II(f)	4	18:14:01.9	-18:59:12	7.38		0.21	0.53
168720	106 HER	M1 IIIb	1	18:18:10.8	21:56:19	4.94		1.59	-0.01
169582		O6 If	4	18:22:57.9	-9:46:57	8.70		0.55	0.87
170153	CHI DRA	F7 V	2	18:21:57.5	72:42:42	3.57	A	0.49	-0.01
170523	DEL2 TEL	B4 III	7	18:28:20.1	-45:47:37	5.07		-0.13	0.05
171635	45 DRA	F7 Ib	13	18:31:42.6	57:00:24	4.79		0.61	0.16
172052		F5 Ib	13	18:36:00.0	-23:13:38	6.73		0.66	0.40
172365		F8 Ib-II	13	18:37:09.2	5:13:03	6.35		0.79	0.22
173300	PHI SGR	B8 III	13	18:42:32.0	-27:02:38	3.17		-0.11	-0.01
173667	110 HER	F6 V	2	18:43:30.5	20:29:49	4.20	A	0.46	-0.02
173739		M3 V	14	18:42:12.1	59:33:16	8.90	A	1.54	0.07
175588	DEL2 LYR	M4 II	1	18:52:45.2	36:50:02	4.28	A		

HD	Name	Sp_Type	Ref	RA(1950.0)	DEC(1950.0)	V	Remarks	B-V	E(B-V)
								1.67	0.04
175687	XI1 SGR	A0 II	10	18:54:22.2	-20:43:24	5.07		0.13	0.13
180711	DEL DRA	G9 III	1	19:12:33.8	67:34:25	3.07	A	0.99	0.01
182255	3 VUL	B6 III	6	19:20:47.9	26:09:54	5.19		-0.12	0.02
182572	31 AQL	G8 IV H delta 1	11	19:22:35.2	11:50:09	5.16	A	0.76	-0.06
182835	NU AQL	F2 Ib	13	19:23:57.6	0:14:14	4.66	A	0.59	0.41
183144		B4 III	6	19:25:15.7	14:10:47	6.32		-0.07	0.11
185144	SIG DRA	K0 V	2	19:32:27.5	69:34:34	4.68	A	0.79	-0.02
185395	THE CYG	F4 V	13	19:35:05.9	50:06:16	4.48	AB	0.38	-0.04
185758	ALF SGE	G1 II	1	19:37:51.6	17:53:51	4.38	A	0.78	-0.02
186408	16 CYG A	G2 V	2	19:40:29.1	50:24:30	5.96	A	0.64	0.01
186427	16 CYG B	G5 V	2	19:40:32.0	50:24:02	6.22	B	0.66	-0.02
186882	DEL CYG	B9.5 III	10	19:43:24.6	45:00:28	2.87	AB	-0.03	0.02
187642	ALF AQL	A7 IV-V	2	19:48:20.5	8:44:05	0.77	A	0.22	0.00
187691	OMI AQL	F8 V	13	19:48:37.9	10:17:21	5.12	A	0.55	0.02
187923		G0 V	13	19:49:43.0	11:30:13	6.15	A	0.65	0.05
188001	9 SGE	O7.5 Iaf	5	19:50:07.8	18:32:31	6.24		0.01	0.33
188209		O9.5 Iab	5	19:50:28.5	46:53:51	5.63		-0.07	0.20
188512	BET AQL	G8 IV	2	19:52:51.3	6:16:49	3.72	AB	0.85	0.03
188650		G1 Ib-II	12	19:52:58.5	36:51:46	5.76		0.75	-0.08
188665	23 CYG	B5 V	6	19:52:15.8	57:23:30	5.14		-0.14	0.02
190406	15 SGE	G1 V	13	20:01:51.3	16:56:00	5.79	ABC	0.60	-0.02
190993	17 VUL	B3 V	6	20:04:44.3	23:28:08	5.07		-0.18	0.02
192310		K0 V	13	20:12:10.4	-27:11:01	5.73		0.88	0.07
192876	ALP1 CAP	G3 Ib	13	20:14:52.6	-12:39:51	4.25	A	1.07	0.15
192947	ALF2 CAP	G8 IIIb	12	20:15:16.8	-12:42:04	3.57	ABC	0.94	-0.01
193432	NU CAP	B9.5 V	10	20:17:53.4	-12:55:04	4.75	A	-0.05	-0.01
193901		F8 V	13	20:20:38.8	-21:31:05	8.65		0.55	0.02
194093	GAM CYG	F8 Ib	2	20:20:25.9	40:05:44	2.21	A	0.67	0.12
195810	EPS DEL	B6 III	6	20:30:49.4	11:07:55	4.03		-0.12	0.02
195986		B4 III	6	20:31:07.8	43:01:12	6.59		-0.11	0.07
196867	ALP DEL	B9 V	2	20:37:18.8	15:44:04	3.77	A	-0.06	0.01
197076		G5 V+	13	20:38:29.4	19:45:09	6.44	A	0.61	-0.07
197345	ALP CYG	A2 Ia	1	20:39:43.5	45:06:03	1.25	A	0.09	0.04
197989	EPS CYG	K0- III	1	20:44:11.1	33:46:55	2.47	A	1.03	0.02
198001	EPS AQR	A1 V	2	20:44:58.2	-9:40:48	3.77		0.00	-0.02
198149	ETA CEP	K0 IV	2	20:44:16.4	61:38:38	3.42	AB	0.92	0.01
199532	ALF OCT	F4 III	13	20:58:44.0	-77:13:01	5.14		0.49	0.07
199629	NU CYG	A1 Vn	10	20:55:18.4	40:58:25	3.93		0.02	0.00

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
200580		F9 V	13	21:01:36.9	2:48:01	7.32		0.54	-0.02
200761	THE CAP	A1 V	10	21:03:08.3	-17:25:57	4.06		-0.01	-0.03
201091	61 CYG A	K5 V	1	21:04:40.0	38:30:00	5.23	A	1.16	0.01
201092	61 CYG B	K7 V	1	21:04:38.0	38:29:30	6.06	B	1.35	0.02
201891		F8 IV-V	13	21:09:40.0	17:32:04	7.37		0.51	0.00
202109	ZET CYG	G8 II CN 1	1	21:10:48.3	30:01:15	3.21	A	0.99	0.00
202654		B4 IV	6	21:13:51.9	47:45:53	6.45		-0.16	0.02
202850	SIG CYG	B9 Iab	9	21:15:26.9	39:11:03	4.23		0.12	0.12
203064	68 CYG	O7.5 III:n((f))	5	21:16:35.1	43:44:05	5.00		-0.03	0.28
203280	ALP CEP	A7 IV-V	2	21:17:23.2	62:22:23	2.46	CD	0.22	0.00
204075	ZET CAP	G4 Ib	15	21:23:48.9	-22:37:44	3.74	A	1.00	0.04
204172	69 CYG	B0 Ib	6	21:23:44.2	36:27:02	5.93	A	-0.08	0.16
204770	7 CEP	B7 V	6	21:26:48.3	66:35:26	5.43		-0.11	0.02
204867	BET AQR	G0 Ib	1	21:28:55.6	-5:47:31	2.90	A	0.83	0.01
205153		G0 IV	13	21:31:13.9	-28:07:24	8.20		0.55	-0.08
206778	EPS PEG	K2 Ib	2	21:41:43.7	9:38:41	2.39	A	1.52	0.29
206859	9 PEG	G5 Ib	2	21:42:08.5	17:07:11	4.34		1.16	0.16
206901	KAP PEG	F3 IV	13	21:42:22.7	25:24:51	4.14	AB	0.42	0.03
206936	MU CEP	M2 Ia	1	21:41:58.5	58:33:00	4.10	A	2.33	0.68
207076		M7 III:	1	21:43:56.4	-2:26:40	6.69		1.49	-0.01
207089	12 PEG	K0 Ib	1	21:43:46.1	22:43:03	5.29		1.38	0.20
207971	GAM GRU	B8 III	13	21:50:54.4	-37:36:03	3.00		-0.12	-0.02
207978	15 PEG	F6 IV	13	21:50:15.8	28:33:31	5.53		0.41	-0.05
208906		F8 IV-V	13	21:56:27.8	29:34:43	6.96	A	0.50	-0.01
209166	20 PEG	F4 III	13	21:58:39.0	12:52:46	5.62	A	0.34	-0.08
209419		B5 III	6	22:00:00.4	52:38:26	5.78		-0.11	0.05
209747	NU PEG	K4 III	13	22:03:09.4	4:48:48	4.85		1.45	0.02
209750	ALP AQR	G2 Ib	2	22:03:12.9	0:33:48	2.94	A	0.97	0.09
209975	19 CEP	O9.5 Ib	5	22:03:36.2	62:02:10	5.10	A	0.09	0.36
210027	IOT PEG	F5 V	2	22:04:40.8	25:06:01	3.77	A	0.43	-0.02
210418	THE PEG	A3 Vn	10	22:07:40.6	5:57:04	3.52		0.09	0.01
210745	ZET CEP	K1.5 Ib	1	22:09:06.9	57:57:15	3.35		1.57	0.36
210839	LAM CEP	O6 I(n) fp	4	22:09:48.6	59:10:02	5.05		0.24	0.56
211038		G8 V	13	22:11:55.9	-16:03:45	6.55		0.89	0.15
212061	GAM AQR	A0 V	10	22:19:04.4	-1:38:23	3.85	A	-0.06	-0.05
212593	4 LAC	B9 Iab	13	22:22:29.0	49:13:20	4.57		0.09	0.09
214470	31 CEP	F3 III-IV	13	22:34:32.0	73:23:00	5.08		0.39	0.00
214680	10 LAC	O9 V	1	22:37:00.7	38:47:22	4.88	A	-0.20	0.11
214994	OMI PEG	A1 IV	10	22:39:24.3	29:02:46	4.80		-0.01	-0.01
215648	XI PEG	F7 V	2	22:44:11.6	11:54:57	4.20	A	0.50	0.00
215733		B1 II	9	22:44:35.2	16:58:09	7.33		-0.13	0.11
216131	MU PEG	G8 III+	1	22:47:35.2	24:20:13	3.49		0.94	-0.01
216228	IOT CEP	K0- III	1	22:47:53.6	65:56:13	3.52		1.05	0.04
216385	SIG PEG	F7 IV	13	22:49:51.9	9:34:09	5.16	A	0.48	-0.02
216399		dM2	16	22:49:52.3	22:37:02	8.65		~1.30	~0.00
216956	ALP PSA	A3 V	1	22:54:53.5	-29:53:15	1.16		0.09	0.01
217877		F8 V	13	23:01:21.0	-5:03:55	6.68		0.58	0.05
218376	1 CAS	B0.5 III	6	23:04:29.5	59:08:57	4.85		-0.03	0.25
219134		K3 V	2	23:10:52.0	56:53:30	5.57	A	0.99	0.04
219188		B0.5 III	9	23:11:27.9	4:43:28	7.05		-0.13	0.15
219615	GAM PSC	K0- III: CN-1.5	11	23:14:34.3	3:00:31	3.70		0.92	-0.09
219734	8 AND	M2 III	1	23:15:25.1	48:44:30	4.83	AB	1.66	0.06
220657	UPS PEG	F8 IV	2	23:22:52.8	23:07:43	4.41		0.61	0.08
221861		K0 Ib	11	23:32:48.0	71:21:56	5.84		1.80	0.62
222173	IOT AND	B8 V	13	23:35:40.6	42:59:28	4.28		-0.10	0.01
222368	IOT PSC	F7 V	2	23:37:22.6	5:21:19	4.13	A	0.51	0.01
222439	KAP AND	B9 IVn	10	23:37:56.2	44:03:25	4.14	A	-0.07	0.00
222661	OMG2 AQR	B9.5 V	10	23:40:07.8	-14:49:17	4.48	AB	-0.04	0.00
224427	PSI PEG	M3 III	1	23:55:12.4	24:51:48	4.67		1.58	-0.02
224930	85 PEG	G2 V	2	23:59:33.2	26:49:03	5.74	AB	0.67	0.04
225094		B3 Iab	6	0:00:50.7	63:21:46	6.24		0.33	0.46
303308		O3 V((f))	4	10:43:48.0	-59:24:18	8.16	H	0.13	0.45

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IUE NEWSIPS Atlas : Subluminous Star Atlas, sorted by Spectral Type

Star Name	Sp_Type	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	B-V mag
HD 49798	sdO	06:46:34.85	-44:15:33.5	8.27	-0.30
BD +75 325	sdO	08:04:43.44	75:06:47.7	9.54	-0.37
AGK +81-266	sdO	09:13:42.53	81:56:11.29	11.85	-0.34
HZ 44	sdO	13:21:19.10	36:23:38.00	11.71	-0.27
BD +28 4211	sdO	21:48:57.30	28:37:44	10.52	-0.34
GD 108	sdB	10:00:47.33	-07:33:31.2	13.56	-0.23
FEIGE 65	sdB	12:33.24	42:39	12.01	-0.24
FEIGE 66	sdB	12:34:54.69	25:20:30.4	10.51	-0.26
G 191-B2 B	DA1	05:01:31.3	52:45:50	11.78	-0.29
GD 71	DA1	05:49:34	15:52.7	13.04	-0.24
BPM 16274	DA2	00:50:03.18	-52:08:17.4	14.20	-0.02
GD 50	DA2	03:48:50.06	-00:58:30.4	14.05	-0.28
G 87-7	DA2	06:44:15	37:34.9	12.04	-0.07
GD 394	DA2	21:11:03.1	49:53:53	13.10	-0.23
HZ 2	DA3	04:09:57.00	11:44:13.92	13.86	-0.05
GRW +70 5824	DA3	13:38:51.77	70:17:08.5	12.79	-0.09
G 93-48	DA3	21:52:25.33	02:23:24.3	12.74	-0.01
FEIGE 108	DAS	23:13:36	-02:07	12.90	-0.28
40 ERI B	DA4	04:13:03.66	-07:44:08.9	9.50	0.11
HZ 4	DA4	03:52:37.90	09:38:34.08	14.47	0.08
LB 227	DA4	04:06:36.89	17:00:03.96	15.35	0.05
G 226-29	DAV	16:47:38	59:08:42	12.19	0.04
LDS 532-81	DA6	08:39:35.9	-32:46:55	12.0	0.16
ROSS 627	DA7	11:21:37.9	21:38:05	14.17	0.37
FEIGE 7	DABP3	00:41:15	-10:16.6	14.52	0.01
GD 323	DAB	13:02:27	59:42:54	14.52	-0.13
GD 303	DB4	10:11:17	57:03.5	14.62	-0.14
L 1573-31	DB4	19:40.24	37:24	14.57	-0.10
LDS 749 B	DB4	21:29:36.60	00:00:00.00	14.73	-0.04
LDS 678 B	DBQ	19:17:52.9	-07:45:34	12.33	0.05
G 175-34 B	DC7	04:26:50	58:53.3	12.44	0.31
HZ 21	DO1	12:11:24	33:12	14.63	-0.28
PG 1159-03	DO2	11:59:12.3	-03:28:57	14.87	-0.37
FEIGE 34	DO	10:36:40.00	43:21:52.00	11.12	-0.30
FEIGE 110	DOp	23:19:58.39	-05:09:55.8	11.50	-0.30
VAN MAANEN 2	DZ8	00:46:28.8	05:10:21	12.46	0.52
L 145-141	DQ6	11:42:58.0	-64:33:34	11.44	0.16
GRW +70 8247	DXP	19:00:40	70:35.6	13.14	0.08

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IUE NEWSIPS Atlas : Subluminous Star Atlas, sorted by Right Ascension

Star Name	Sp_Type	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	B-V mag
FEIGE 7	DABP3	00:41:15	-10:16.6	14.52	0.01
VAN MAANEN 2	DZ8	00:46:28.8	05:10:21	12.46	0.52
BPM 16274	DA2	00:50:03.18	-52:08:17.4	14.20	-0.02
GD 50	DA2	03:48:50.06	-00:58:30.4	14.05	-0.28
HZ 4	DA4	03:52:37.90	09:38:34.08	14.47	0.08
LB 227	DA4	04:06:36.89	17:00:03.96	15.35	0.05
HZ 2	DA3	04:09:57.00	11:44:13.92	13.86	-0.05
40 ERI B	DA4	04:13:03.66	-07:44:08.9	9.50	0.11
G 175-34 B	DC7	04:26:50	58:53.3	12.44	0.31
G 191-B2 B	DA1	05:01:31.3	52:45:50	11.78	-0.29
GD 71	DA1	05:49:34	15:52.7	13.04	-0.24
G 87-7	DA2	06:44:15	37:34.9	12.04	-0.07
HD 49798	sdO	06:46:34.85	-44:15:33.5	8.27	-0.30
BD +75 325	sdO	08:04:43.44	75:06:47.7	9.54	-0.37
LDS 532-81	DA6	08:39:35.9	-32:46:55	12.0	0.16
AGK +81-266	sdO	09:13:42.53	81:56:11.29	11.85	-0.34
GD 108	sdB	10:00:47.33	-07:33:31.2	13.56	-0.23
GD 303	DB4	10:11:17	57:03.5	14.62	-0.14
FEIGE 34	DO	10:36:40.00	43:21:52.00	11.12	-0.30
ROSS 627	DA7	11:21:37.9	21:38:05	14.17	0.37
L 145-141	DQ6	11:42:58.0	-64:33:34	11.44	0.16
PG 1159-03	DO2	11:59:12.3	-03:28:57	14.87	-0.37
HZ 21	DO1	12:11:24	33:12	14.63	-0.28
FEIGE 65	sdB	12:33.24	42:39	12.01	-0.24
FEIGE 66	sdB	12:34:54.69	25:20:30.4	10.51	-0.26
GD 323	DAB	13:02:27	59:42:54	14.52	-0.13
HZ 44	sdO	13:21:19.10	36:23:38.00	11.71	-0.27
GRW +70 5824	DA3	13:38:51.77	70:17:08.5	12.79	-0.09
G 226-29	DAV	16:47:38	59:08:42	12.19	0.04
GRW +70 8247	DXP	19:00:40	70:35.6	13.14	0.08
LDS 678 B	DBQ	19:17:52.9	-07:45:34	12.33	0.05
L 1573-31	DB4	19:40.24	37:24	14.57	-0.10
GD 394	DA2	21:11:03.1	49:53:53	13.10	-0.23
LDS 749 B	DB4	21:29:36.60	00:00:00.00	14.73	-0.04
BD +28 4211	sdO	21:48:57.30	28:37:44	10.52	-0.34
G 93-48	DA3	21:52:25.33	02:23:24.3	12.74	-0.01
FEIGE 108	DAS	23:13:36	-02:07	12.90	-0.28
FEIGE 110	DOp	23:19:58.39	-05:09:55.8	11.50	-0.30

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IUE Standard Stars

From:

Wu, C.-C. et al. 1983, *IUE* Newsletter No. 22
Wu, C.-C. et al. 1991, *IUE* Newsletter No. 43

HD	object name	spec type	luminosity class	vis mag	E(B-V)	IUE Entry ID (EID)	a p t	exposure length seconds
HD 93250		O3	V	7.37	0.48	SWP11224	L	115.56
HD 93250		O3	V	7.37	0.48	LWR09840	L	71.75
HD 303308		O3	V	8.17	0.44	SWP11225	L	192.60
HD 303308		O3	V	8.17	0.44	LWR09841	L	117.88
HD 46223		O4		7.26	0.22	SWP14776	L	166.86
HD 46223		O4		7.26	0.22	LWR11362	L	72.57
HD 46223		O4		7.26	0.22	LWR11363	L	290.27
HD 93632		O4		8.34	0.32	SWP14482	L	428.00
HD 93632		O4		8.34	0.32	SWP14483	L	267.50
HD 93632		O4		8.34	0.32	LWR11067	L	288.73
HD 93632		O4		8.34	0.32	LWR11068	L	205.00
HD 164794	9 SGR	O5		5.97	0.32	SWP14163	L	18.20
HD 164794	9 SGR	O5		5.97	0.32	SWP14194	L	16.05
HD 164794	9 SGR	O5		5.97	0.32	LWR10768	L	3.28
HD 164794	9 SGR	O5		5.97	0.32	LWR10787	L	12.30
HD 93403		O5	III	7.26	0.53	SWP14305	L	128.37
HD 93403		O5	III	7.26	0.53	LWR10936	L	82.00
HD 93843		O5	III F VAR	7.33	0.27	SWP33672	L	48.15
HD 93843		O5	III F VAR	7.33	0.27	LWP13334	L	30.75
HD 210839	LAM CEP	O6	I N FP	5.04	0.57	SWP31259	L	21.40
HD 210839	LAM CEP	O6	I N FP	5.04	0.57	LWP11101	L	10.25
CPD -59 2600		O6	V	8.61	0.55	SWP11137	L	353.14
CPD -59 2600		O6	V	8.61	0.55	LWR09806	L	322.83
CPD -59 2600		O6	V	8.61	0.55	LWR09842	L	261.38
HD 93130		O6	III	8.06	0.54	SWP14306	L	278.21
HD 93130		O6	III	8.06	0.54	LWR10937	L	179.35
HD 163758		O6	IAF	7.31	0.35	SWP01638	L	15.97
HD 152723		O6.5	III F	7.31	0.42	SWP31626	L	80.25
HD 152723		O6.5		7.31	0.42	LWP11466	L	46.13
HD 47839	15 MON*	O7		4.65	0.07	SWP08146	L	1.47
HD 47839	15 MON*	O7		4.65	0.07	LWR07077	L	1.98
HD 151515		O7	IIF	7.16	0.48	SWP31625	L	123.05
HD 151515		O7	IIF	7.16	0.48	LWP11465	L	82.00
HD 151515		O7	IIF	7.16	0.48	LWP11467	L	41.00
HD 167659		O7	IIF	7.39	0.53	SWP31623	L	128.40
HD 167659		O7	IIF	7.39	0.53	LWP11463	L	107.62
HD 203064	68 CYG	O7.5	IIINF	5.00	0.30	SWP36315	L	5.08
HD 203064	68 CYG	O7.5	IIINF	5.00	0.30	LWP15564	L	4.77
HD 14633		O8	V	7.46	0.09	SWP08149	L	15.18
HD 14633		O8	V	7.46	0.09	SWP08150	L	23.01
HD 14633		O8	V	7.46	0.09	LWR07080	L	28.47
HD 151804		O8	IF	5.22	0.36	SWP01627	L	1.64
HD 151804		O8	IF	5.22	0.36	SWP02858	S	4.00
HD 151804		O8	IF	5.22	0.36	SWP02858	L	3.69
HD 152408		O8	IF	5.77	0.44	SWP01625	L	6.96
HD 152408		O8	IF	5.77	0.44	SWP01625	S	7.00
HD 152408		O8	IF	5.77	0.44	LWR11110	S	5.73
HD 152408		O8	IF	5.77	0.44	LWR11182	L	21.52
HD 152408		O8	IF	5.77	0.44	LWR11182	S	30.00
HD 188001	9 SGE	O8	IF	6.23	0.30	SWP01602	L	5.73
HD 188001	9 SGE	O8	IF	6.23	0.30	SWP01602	S	6.00
HD 188001	9 SGE	O8	IF	6.23	0.30	SWP03466	S	4.92
HD 188001	9 SGE	O8	IF	6.23	0.30	LWR01682	L	5.75
HD 188001	9 SGE	O8	IF	6.23	0.30	LWR01682	S	12.00
HD 188001	9 SGE	O8	IF	6.23	0.30	LWR01683	L	3.69
HD 188001	9 SGE	O8	IF	6.23	0.30	LWR01683	S	7.00
HD 188001	9 SGE	O8	IF	6.23	0.30	LWR03044	S	4.92
HD 214680	10 LAC	O9	V	4.88	0.11	SWP01764	L	1.86
HD 214680	10 LAC	O9	V	4.88	0.11	LWR01655	L	2.56
HD 38666	MU COL	O9.5	IV	5.17	0.02	SWP34340	L	1.93
HD 38666	MU COL	O9.5	IV	5.17	0.02	LWR10954	L	2.48
HD 188209		O9.5	IA	5.65	0.20	SWP08195	L	11.76
HD 188209		O9.5	IA	5.65	0.20	LWR07123	L	7.48
HD 209975	19 CEP	O9.5	IB	5.11	0.35	SWP32916	L	13.38
HD 209975	19 CEP	O9.5	IB	5.11	0.35	LWP12661	L	6.15
HD 149038	MU NOR	O9.7	IAB	4.98	0.29	SWP31624	L	8.02
HD 149038	MU NOR	O9.7	IAB	4.98	0.29	LWP11464	L	6.15
HD 36512	UPS ORI*	B0	V	4.62	0.04	SWP08164	L	1.18
HD 36512	UPS ORI*	B0	V	4.62	0.04	LWR07097	L	1.83
HD 63922		B0	III	4.11	0.12	SWP09511	L	1.22
HD 63922		B0	III	4.11	0.12	LWR08237	L	1.44
HD 204172	69 CYG	B0	IB	5.94	0.16	SWP19249	L	16.05
HD 204172	69 CYG	B0	IB	5.94	0.16	LWR15285	L	10.25
HD 55857	GY CMA	B0.5	V	6.11	0.02	SWP14339	L	5.67
HD 55857	GY CMA	B0.5	V	6.11	0.02	LWR10953	L	6.97
HD 34816	LAM LEP	B0.5	IV	4.29	0.03	SWP08166	L	1.04
HD 34816	LAM LEP	B0.5	IV	4.29	0.03	LWR07099	L	1.51
HD 34816	LAM LEP	B0.5	IV	4.29	0.03	LWR07100	L	1.51
HD 119159		B0.5	III	6.00	0.20	SWP19245	L	16.05
HD 119159		B0.5	III	6.00	0.20	LWR15281	L	11.27
HD 64760		B0.5	IB	4.24	0.08	SWP07719	L	0.70
HD 64760		B0.5	IB	4.24	0.08	LWR06706	L	0.70
HD 64760		B0.5	IB	4.24	0.08	SWP19056	L	1.96
HD 64760		B0.5	IB	4.24	0.08	LWR15100	L	1.86
HD 150898		B0.5	IA	5.57	0.15	SWP10173	L	8.42
HD 150898		B0.5	IA	5.57	0.15	LWR08837	L	10.40
HD 218376	1 CAS	B0.5	III	4.85	0.25	SWP31260	L	6.42
HD 218376	1 CAS	B0.5	III	4.85	0.25	LWP11102	L	5.13
HD 31726		B1	V	6.15	0.05	SWP08165	L	8.42
HD 31726		B1	V	6.15	0.05	LWR07098	L	10.40
HD 46328	XI 1CMA	B1	III	4.34	0.01	SWP19244	L	7.23
HD 46328	XI 1CMA	B1	II	4.34	0.01	LWR15280	L	1.76
HD 40111	139 TAU	B1	IB	4.82	0.13	SWP08151	L	5.72
HD 40111	139 TAU	B1	IB	4.82	0.13	LWR07081	L	4.04
HD 91316	RHO LEO	B1	IAB	3.85	0.05	SWP19501	L	3.08
HD 91316	RHO LEO	B1	IAB	3.85	0.05	SWP19520	L	1.97
HD 91316	RHO LEO	B1	IAB	3.85	0.05	LWR15529	L	1.48
HD 150168		B1	IA	5.65	0.16	SWP19246	L	18.19
HD 150168		B1	IA	5.65	0.16	LWR15282	L	9.74
HD 166197		B1	V	6.16	0.12	SWP33202	L	12.84
HD 166197		B1	V	6.16	0.12	LWP12981	L	12.30
HD 215733		B1	II	7.34	0.11	SWP34697	L	58.85
HD 215733		B1	II	7.34	0.11	LWP15560	L	32.80
HD 13854		B1	IAB	6.49	0.47	SWP34867	L	112.69
HD 13854		B1	IAB	6.49	0.47	LWP14595	L	37.73
HD 13854		B1	IAB	6.49	0.47	LWP14597	L	25.44
HD 13854		B1	IAB	6.49	0.47	LWP14597	S	100.00
HD 74273		B1.5	V	5.90	0.04	SWP14307	L	6.75
HD 74273		B1.5	V	5.90	0.04	LWR10938	L	6.51
HD 62747		B1.5	II I	5.62	0.06	SWP19295	L	9.16
HD 62747		B1.5	II I	5.62	0.06	SWP19297	L	6.42
HD 62747		B1.5	II I	5.62	0.06	LWR15328	L	6.95
HD 64802		B2	V	5.49	0.05	SWP14308	L	6.85
HD 64802		B2	V	5.49	0.05	LWR10939	L	6.51
HD 3302	ZET CAS	B2	IV	3.66	0.04	SWP04316	L	1.03
HD 3302	ZET CAS	B2	IV	3.66	0.04	SWP04316	S	1.00
HD 3302	ZET CAS	B2	IV	3.66	0.04	LWR03812	L	0.82
HD 3302	ZET CAS	B2	IV	3.66	0.04	LWR03812	S	1.00
HD 52183		B2	III	5.28	0.05	SWP08167	L	9.11
HD 52183		B2	III	5.28	0.05	LWR07101	L	6.34
HD 165024	THE ARA	B2	IB	3.66	0.08	SWP10174	L	2.21
HD 165024	THE ARA	B2	IB	3.66	0.08	LWR08838	L	1.45
HD 61831		B2.5	V	4.84	0.02	SWP14309	L	4.28
HD 61831		B2.5	V	4.84	0.02	LWR10940	L	4.03
HD 3265		B2.5	IV	6.41	0.04	SWP19500	L	23.54
HD 3265		B2.5	IV	6.41	0.04	LWR15528	L	20.50
HD 63465		B2.5	III	5.08	0.12	SWP19296	L	10.91
HD 63465		B2.5	III	5.08	0.12	LWR15329	L	71.55
HD 32630	ETA AUR	B3	V *	3.17	0.02	SWP08197	L	1.06
HD 32630	ETA AUR	B3	V *	3.17	0.02	LWR07125	L	1.01
HD 32630	ETA AUR	B3	V *	3.17	0.02	LWR07126	L	1.01
HD 120315	ETA UMA	B3	V	1.86	0.01	SWP02341	L	0.29
HD 120315	ETA UMA	B3	V	1.86	0.01	SWP04410	L	0.33
HD 120315	ETA UMA	B3	V	1.86	0.01	LWR02127	L	0.29
HD 120315	ETA UMA	B3	V	1.86	0.01	LWR02127	S	0.12
HD 120315	ETA UMA	B3	V	1.86	0.01	LWR03640	L	0.33
HD 142096	LAM LIB	B3	V	5.03	0.19	LWR10778	L	6.87
HD 190993	17 VUL	B3	V*	5.07	0.02	SWP09961	L	5.47
HD 190993	17 VUL	B3	V*	5.07	0.02	LWR12024	L	5.74
HD 42560	XI ORI	B3	IV	4.48	0.02	SWP19365	L	4.82
HD 42560	XI ORI	B3	IV	4.48	0.02	SWP19365	S	0.68
HD 42560	XI ORI	B3	IV	4.48	0.02	LWR15403	L	3.49
HD 79447		B3	III	3.97	0.02	SWP14338	L	2.35
HD 79447		B3	III	3.97	0.02	LWR10952	L	1.81
HD 53138	OMI2CMA	B3	IA*	3.04	0.05	SWP08168	L	2.17
HD 53138	OMI2CMA	B3	IA*	3.04	0.05	LWR07102	L	1.05
HD 53138	OMI2CMA	B3	IA*	3.04	0.05	LWR07103	L	1.06
HD 225094		B3	IAB	6.24	0.46	SWP31262	L	224.70
HD 225094		B3	IAB	6.24	0.46	LWP11103	L	51.25
HD 65904		B4	V*	5.99	0.04	SWP15557	L	16.26
HD 65904		B4	V*	5.99	0.04	LWR12042	L	16.91
HD 202654		B4	IV	6.46	0.03	SWP19363	L	33.17
HD 202654		B4	IV	6.46	0.03	LWR15401	L	22.55
HD 195986		B4	III	6.60	0.07	SWP19248	L	28.89
HD 195986		B4	III	6.60	0.07	SWP19292	L	41.73
HD 195986		B4	III	6.60	0.07	LWR15284	L	32.90
HD 75112		B4	V	6.37	0.05	SWP36317	L	37.45
HD 75112		B4	V	6.37	0.05	LWP15566	L	21.53
HD 48879	42 CAM	B4	IV	5.14	0.01	SWP32997	L	8.56
HD 48879	42 CAM	B4	IV	5.14	0.01	LWP12755	L	6.87
HD 34759	RHO AUR	B5	V	5.23	0.01	SWP15537	L	8.60
HD 34759	RHO AUR	B5	V	5.23	0.01	LWR09868	L	7.69
HD 188665	23 CYG	B5	V*	5.14	0.03	SWP15338	L	5.35
HD 188665	23 CYG	B5	V*	5.14	0.03	SWP15339	L	8.02
HD 188665	23 CYG	B5	V*	5.14	0.03	LWR11856	L	8.20
HD 188665	23 CYG	B5	V*	5.14	0.03	LWR12008	L	9.22
HD 147394	TAU HER	B5	IV*	3.89	0.01	SWP08194	L	3.17
HD 147394	TAU HER	B5	IV*	3.89	0.01	LWR07122	L	2.63
HD 4180	OMI CAS	B5	III	4.54	0.09	SWP19293	L	9.63
HD 4180	OMI CAS	B5	III	4.54	0.09	LWR15326	L	6.50
HD 83183		B5	II	4.08	0.13	SWP09512	L	11.44
HD 83183		B5	II	4.08	0.13	LWR08238	L	4.63
HD 86440	PHI VEL	B5	IB	3.54	0.01	SWP09513	L	4.37
HD 86440	PHI VEL	B5	IB	3.54	0.01	LWR08239	L	2.07
HD 164353	67 OPH	B5	IB	3.97	0.11	SWP10172	L	6.14
HD 164353	67 OPH	B5	IB	3.97	0.11	LWR08836	L	4.10
HD 58350	ETA CMA	B5	IA*	2.44	0.02	SWP08199	L	1.50
HD 58350	ETA CMA	B5	IA*	2.44	0.02	LWR07127	L	0.72
HD 209419		B5	III	5.78	0.05	SWP33851	L	27.82
HD 209419		B5	III	5.78	0.05	LWP13555	L	13.33
HD 90994	BET SEX	B6	V	5.09	0.00	SWP15791	L	11.23
HD 90994	BET SEX	B6	V	5.09	0.00	LWR12162	L	9.94
HD 79694		B6	IV	5.85	0.02	SWP19527	L	23.54
HD 182255	3 VUL	B6	III	5.18	0.02	SWP19291	L	9.54
HD 182255	3 VUL	B6	III	5.18	0.02	LWR15325	L	9.41
HD 125288		B6	IB	4.33	0.19	SWP19362	L	14.82
HD 125288		B6	IB	4.33	0.19	SWP19460	L	14.82
HD 125288		B6	IB	4.33	0.19	LWR15400	L	8.83
HD 125288		B6	IB	4.33	0.19	LWR15489	L	8.82
HD 17081	PI CET	B7	V	4.25	-0.01	SWP16255	L	6.95
HD 17081	PI CET	B7	V	4.25	-0.01	LWR12501	L	4.67
HD 29335	49 ERI	B7	V	5.31	0.02	SWP15788	L	15.78
HD 29335	49 ERI	B7	V	5.31	0.02	LWR12159	L	11.89
HD 23630	ETA TAU	B7	III*	2.87	0.03	SWP08147	L	2.82
HD 23630	ETA TAU	B7	III*	2.87	0.03	LWR07078	L	1.68
HD 23324	18 TAU	B8	V*	5.64	0.04	SWP08148	L	29.72
HD 23324	18 TAU	B8	V*	5.64	0.04	LWR07079	L	20.10
HD 10205	TAU AND	B8	IV	4.94	0.01	SWP19294	L	10.33
HD 10205	TAU AND	B8	IV	4.94	0.01	LWR15327	L	8.81

HD 23850	27 TAU	B8	III*	3.63	0.01	SWP11245	L	6.42
HD 23850	27 TAU	B8	III*	3.63	0.01	LWR09867	L	3.59
HD 46769		B8	IB	5.80	0.02	SWP19066	L	32.30
HD 46769		B8	IB	5.80	0.02	LWR15094	L	25.32
HD 222173	IOT AND	B8	V	4.29	0.01	SWP33853	L	9.63
HD 222173	IOT AND	B8	V	4.29	0.01	LWP13557	L	6.15
HD 38899	134 TAU	B9	V	4.91	0.00	SWP16639	L	22.00
HD 38899	134 TAU	B9	V	4.91	0.00	LWR12875	L	14.54
HD 196867	ALP DEL	B9	IV	3.77	0.01	SWP15545	L	8.56
HD 196867	ALP DEL	B9	IV	3.77	0.01	LWR12025	L	5.33
HD 202850	SIG CYG	B9	IAB	4.23	0.12	SWP15099	L	28.89
HD 202850	SIG CYG	B9	IAB	4.23	0.12	LWR11614	L	11.79
HD 193432	NU CAP	B9.5	V	4.76	-0.01	SWP16850	L	21.40
HD 193432	NU CAP	B9.5	V	4.76	-0.01	LWR12874	L	16.40
HD 222661	OMG2AQR	B9.5	V	4.49	0.00	SWP15789	L	18.20
HD 222661	OMG2AQR	B9.5	V	4.49	0.00	LWR12160	L	10.76
HD 186882	DEL CYG	B9.5	III	2.87	0.02	SWP16489	L	4.50
HD 186882	DEL CYG	B9.5	III	2.87	0.02	LWR12745	L	2.67
HD 26571		B9	III	8.09	0.27	SWP32996	L	187.24
HD 26571		B9	III	8.09	0.27	LWP12753	L	61.50
HD 212593	4 LAC	B9	IAB	4.57	0.09	SWP33852	L	34.24
HD 212593	4 LAC	B9	IAB	4.57	0.09	LWP13556	L	12.30
HD 95608	60 LEO	A0	V	4.42	0.06	SWP08207	L	59.80
HD 95608	60 LEO	A0	V	4.42	0.06	SWP08207	S	12.00
HD 95608	60 LEO	A0	V	4.42	0.06	LWR07007	L	17.37
HD 103287	GAM UMA	A0	V*	2.44	0.01	SWP08196	L	6.33
HD 103287	GAM UMA	A0	V*	2.44	0.01	SWP08198	S	4.75
HD 103287	GAM UMA	A0	V*	2.44	0.01	LWR07124	L	2.22
HD 199629	NU CYG	A0	V	3.94	0.03	SWP15556	L	25.68
HD 199629	NU CYG	A0	V	3.94	0.03	LWR12039	L	10.76
HD 111775		A0	II	6.33	0.03	SWP09515	L	142.67
HD 111775		A0	II	6.33	0.03	LWR08241	L	78.84
HD 104035		A0	IA	5.61	0.16	SWP09514	L	330.74
HD 104035		A0	IA	5.61	0.16	LWR08240	L	80.05
HD 149212	15 DRA	A0	III	5.00	-0.03	SWP32914	L	26.75
HD 149212	15 DRA	A0	III	5.00	-0.03	LWP12658	L	17.43
HD 166205	DEL UMI	A1	V	4.36	0.00	SWP09132	L	33.65
HD 166205	DEL UMI	A1	V	4.36	0.00	LWR07863	L	13.92
HD 80081	38 LYN	A2	V	3.82	0.01	SWP11235	L	21.40
HD 80081	38 LYN	A2	V	3.82	0.01	SWP11236	L	70.63
HD 80081	38 LYN	A2	V	3.82	0.01	LWR09855	L	11.28
HD 197345	ALP CYG	A2	IA*	1.25	0.04	SWP09133	L	4.39
HD 197345	ALP CYG	A2	IA*	1.25	0.04	LWR07864	L	1.08
HD 216956	ALP PSA	A3	V*	1.16	0.01	SWP09134	L	2.45
HD 216956	ALP PSA	A3	V*	1.16	0.01	LWR07865	L	1.02
HD 122408	TAU VIR	A3	III	4.26	0.01	SWP09516	L	9.60
HD 122408	TAU VIR	A3	III	4.26	0.01	LWR08242	L	5.82
HD 210418	THE PEG	A3	VN	3.53	0.00	SWP36316	L	20.33
HD 210418	THE PEG	A3	VN	3.53	0.00	LWP15565	L	7.18
HD 97603	DEL LEO	A4	V	2.56	0.00	SWP19247	L	9.63
HD 97603	DEL LEO	A4	V	2.56	0.00	LWR15283	L	4.10
HD 116842	80 UMA	A5	III	4.01	0.01	SWP10283	L	19.76
HD 116842	80 UMA	A5	III	4.01	0.01	SWP10285	L	43.50
HD 116842	80 UMA	A5	III	4.01	0.01	SWP10285	S	95.00
HD 116842	80 UMA	A5	III	4.01	0.01	LWR08949	L	16.40
HD 159561	ALP OPH	A5	III	2.08	0.00	SWP16490	L	7.17
HD 159561	ALP OPH	A5	III	2.08	0.00	LWR12747	L	2.77
HD 59612		A5	IB	4.85	0.13	SWP15234	L	139.19
HD 59612		A5	IB	4.85	0.13	SWP15318	L	306.02
HD 59612		A5	IB	4.85	0.13	LWR11748	L	71.80
HD 59612		A5	IB	4.85	0.13	LWR11824	L	215.25
HD 79439	18 UMA	A5	V	4.83	0.04	SWP32779	L	47.03
HD 79439	18 UMA	A5	V	4.83	0.04	SWP32780	L	142.06
HD 79439	18 UMA	A5	V	4.83	0.04	LWR12564	L	14.27
HD 28527		A6	V	4.78	0.00	SWP19459	L	107.00
HD 28527		A6	V	4.78	0.00	LWR15488	L	42.02
HD 28527		A6	V	4.78	0.00	LWR15497	L	35.98
HD 97534		A6	IA	4.60	0.35	SWP33673	L	900.00
HD 97534		A6	IA	4.60	0.35	LWP13335	L	123.00
HD 87696	21 LMI	A7	V	4.48	-0.02	SWP15548	L	74.90
HD 87696	21 LMI	A7	V	4.48	-0.02	LWR12028	L	25.62
HD 76644	IOT UMA	A7	IV*	3.14	-0.03	SWP10284	L	22.84
HD 76644	IOT UMA	A7	IV*	3.14	-0.03	LWR08950	L	7.68
HD 203280	ALP CEP	A7	IV-V	2.44	0.00	SWP32915	L	18.19
HD 203280	ALP CEP	A7	IV-V	2.44	0.00	LWP12660	L	4.31
HD 85123	UPS CAR	A7	II	2.97	0.13	SWP33670	L	53.50
HD 85123	UPS CAR	A7	II	2.97	0.13	LWP13331	L	10.25
HD 27176	51 TAU	A8	V	5.65	0.01	SWP15538	L	353.14
HD 27176	51 TAU	A8	V	5.65	0.01	LWR12009	L	97.39
HD 27176	51 TAU	A8	V	5.65	0.01	LWR12182	L	97.39
HD 157792	44 OPH	A9	V	4.17	-0.02	SWP19461	L	83.60
HD 157792	44 OPH	A9	V	4.17	-0.02	SWP19498	L	101.65
HD 157792	44 OPH	A9	V	4.17	-0.02	LWR15490	L	25.62
HD 147547	GAM HER	A9	III	3.75	-0.01	SWP10872	L	114.49
HD 147547	GAM HER	A9	III	3.75	-0.01	LWR09560	L	23.55
HD 12311	ALP HYI	F0	V	2.86	-0.04	SWP11242	L	39.59
HD 12311	ALP HYI	F0	V	2.86	-0.04	LWR09862	L	8.56
HD 40136	ETA LEP	F0	IV	3.71	0.03	SWP10286	L	102.39
HD 40136	ETA LEP	F0	IV	3.71	0.03	SWP10286	S	3.75
HD 40136	ETA LEP	F0	IV	3.71	0.03	LWR06995	L	15.38
HD 89025	ZET LEO	F0	III*	3.44	-0.01	SWP15536	L	128.40
HD 89025	ZET LEO	F0	III*	3.44	-0.01	LWR09732	L	23.91
HD 36673	ALP LEP	F0	IB	2.58	0.06	SWP15073	L	59.93
HD 36673	ALP LEP	F0	IB	2.58	0.06	LWR11601	L	10.25
HD 113139	78 UMA	F2	V	4.93	0.01	SWP15547	L	353.14
HD 113139	78 UMA	F2	V	4.93	0.01	LWR12027	L	50.22
HD 99028	IOT LEO	F2	IV	3.94	0.04	SWP11311	L	310.30
HD 99028	IOT LEO	F2	IV	3.94	0.04	SWP13426	L	235.42
HD 99028	IOT LEO	F2	IV	3.94	0.04	LWR09918	L	24.60
HD 99028	IOT LEO	F2	IV	3.94	0.04	LWR10090	L	56.38
HD 17584	16 PER	F2	III	4.23	-0.02	SWP19465	L	246.10
HD 17584	16 PER	F2	III	4.23	-0.02	LWR15499	L	43.05
HD 17584	16 PER	F2	III	4.23	-0.02	LWR15527	L	32.80
HD 161471	IOT 1 SCO	F2	IA	3.03	0.33	SWP19525	L	180.00
HD 161471	IOT 1 SCO	F2	IA	3.03	0.33	LWR15565	S	97.00
HD 161471	IOT 1 SCO	F2	IA	3.03	0.33	LWR15565	L	46.13
HD 163506	89 HER	F2	IA	5.46	0.16	SWP15555	L	2640.00
HD 163506	89 HER	F2	IA	5.46	0.16	LWR12038	L	225.50
HD 157950		F3	V	4.54	-0.02	SWP19462	L	70.04
HD 157950		F3	V	4.54	-0.02	SWP19499	L	321.00
HD 157950		F3	V	4.54	-0.02	LWR15491	L	30.75
HD 61110	OMI GEM	F3	III	4.90	-0.01	SWP19458	L	385.20
HD 61110	OMI GEM	F3	III	4.90	-0.01	SWP19464	L	535.00
HD 61110	OMI GEM	F3	III	4.90	-0.01	LWR15487	L	92.25
HD 61110	OMI GEM	F3	III	4.90	-0.01	LWR15498	L	71.75
HD 164259	ZET SER	F3	V	4.62	-0.03	LWP12707	L	30.75
HD 164259	ZET SER	F3	V	4.62	-0.03	LWP15556	L	18.07
HD 164259	ZET SER	F3	V	4.62	-0.03	LWP15556	S	120.00
HD 214470	31 CEP	F3	IV-III	5.08	0.00	LWP12756	L	82.00
HD 8799	OME AND	F4	IV	4.83	0.00	LWP14596	L	35.28
HD 8799	OME AND	F4	IV	4.83	0.00	LWP14598	L	20.53
HD 8799	OME AND	F4	IV	4.83	0.00	LWP14598	S	80.00
HD 27524		F5	V*	6.80	-0.01	SWP04756	L	7020.00
HD 27524		F5	V*	6.80	-0.01	SWP15819	L	3360.00
HD 27524		F5	V*	6.80	-0.01	LWR04119	S	300.00
HD 27524		F5	V*	6.80	-0.01	LWR04119	L	310.61
HD 27524		F5	V*	6.80	-0.01	LWR12183	L	286.91
HD 61421	ALP CMI	F5	IV-V	0.38	0.00	SWP02826	L	59.80
HD 61421	ALP CMI	F5	IV-V	0.38	0.00	SWP06661	L	29.90
HD 61421	ALP CMI	F5	IV-V	0.38	0.00	SWP06662	L	59.80
HD 61421	ALP CMI	F5	IV-V	0.38	0.00	LWR09108	L	0.86
HD 20902	ALP PER	F5	IB	1.79	0.22	SWP15316	L	205.37
HD 20902	ALP PER	F5	IB	1.79	0.22	LWR07094	L	7.18
HD 27561		F5	V	6.61	-0.04	LWP10007	L	184.56
HD 106516		F5	V	6.11	0.01	LWP09607	L	82.00
HD 134083	45 BOO	F5	V	4.93	-0.02	LWP11178	L	15.38
HD 134083	45 BOO	F5	V	4.93	-0.02	LWP11181	L	61.50
HD 210027	IOT PEG	F5	V	3.76	-0.01	LWP11109	L	14.35
HD 108177		F5	VI	9.66	0.00	LWP14966	L	1620.00
HD 173667	110 HER	F6	V	4.19	-0.02	SWP10784	L	643.60
HD 173667	110 HER	F6	V	4.19	-0.02	LWR09459	L	30.60
HD 173667	110 HER	F6	V	4.19	-0.02	LWR09460	L	153.75
HD 82328	THE UMA	F6	IV	3.17	0.00	SWP19460	L	160.50
HD 82328	THE UMA	F6	IV	3.17	0.00	LWR15500	L	14.86
HD 82328	THE UMA	F6	IV	3.17	0.00	LWR15526	L	12.30
HD 82328	THE UMA	F6	IV	3.17	0.00	LWP12330	L	10.25
HD 106365		F6	III	6.12	0.10	SWP16491	L	4800.00
HD 106365		F6	III	6.12	0.10	LWR04122	L	310.61
HD 106365		F6	III	6.12	0.10	LWR04122	S	300.00
HD 30652	PI 3 ORI	F6	V	3.19	-0.03	LWP12506	L	7.01
HD 43318		F6	V	5.65	0.02	LWP12507	L	64.77
HD 69897	CHI CNC	F6	V	5.14	-0.01	LWP12708	L	56.37
HD 142860	GAM SER	F6	V	3.85	0.00	LWP11179	L	19.48
HD 153597	19 DRA	F6	V	4.89	0.00	LWP12331	L	46.13
HD 207078	15 PEG	F6	IV	5.53	-0.04	LWP08446	L	73.80
HD 89449	40 LEO	F6	IV	4.79	-0.01	LWP12329	L	41.00
HD 126660	THE BOO	F7	V	4.05	0.00	SWP15546	L	834.85
HD 126660	THE BOO	F7	V	4.05	0.00	LWR12026	L	30.75
HD 120136	TAU BOO	F7	V	4.50	-0.02	LWP14965	L	29.13
HD 120136	TAU BOO	F7	V	4.50	-0.02	LWP14967	L	14.39
HD 165908	99 HER	F7	V	5.04	0.02	LWP12705	L	56.37
HD 165908	99 HER	F7	V	5.04	0.02	LWP15558	L	25.44
HD 165908	99 HER	F7	V	5.04	0.02	LWP15558	S	180.00
HD 170153	CHI DRA	F7	V	3.57	-0.01	LWP15016	L	12.92
HD 215648	XI PEG	F7	V	4.19	0.00	LWP11107	L	15.38
HD 222368	IOT PSC	F7	V	4.13	0.01	LWP11111	L	28.70
HD 216385	SIG PEG	F7	IV	5.16	-0.02	LWP11110	L	66.63
HD 27808		F8	V	7.14	-0.01	LWR04118	L	1242.40
HD 27808		F8	V	7.14	-0.01	LWR04118	S	900.00
HD 90839	36 UMA	F8	V	4.83	-0.01	LWR15402	L	71.93
HD 102870	BET VIR	F8	V	3.61	0.02	SWP07305	L	1800.00
HD 102870	BET VIR	F8	V	3.61	0.02	SWP07305	S	300.00
HD 102870	BET VIR	F8	V	3.61	0.02	SWP07306	L	5400.00
HD 102870	BET VIR	F8	V	3.61	0.02	LWR04867	S	30.00
HD 102870	BET VIR	F8	V	3.61	0.02	LWR04867	L	30.73
HD 194093	GAM CYG	F8	IB	2.20	0.13	SWP03666	L	1200.00
HD 194093	GAM CYG	F8	IB	2.20	0.13	SWP03666	S	120.00
HD 194093	GAM CYG	F8	IB	2.20	0.13	SWP03667	L	360.00
HD 194093	GAM CYG	F8	IB	2.20	0.13	SWP03667	S	360.00
HD 54605	DEL CMA	F8	IA	1.86	0.10	SWP15831	L	756.00
HD 54605	DEL CMA	F8	IA	1.86	0.10	SWP16800	L	650.00
HD 54605	DEL CMA	F8	IA	1.86	0.10	LWR11823	L	11.38
HD 54605	DEL CMA	F8	IA	1.86	0.10	LWR12189	L	22.55
HD 187691	OMI AQL	F8	V	5.11	0.02	LWP11175	L	92.25
HD 193901		F8	V	8.65	0.02	LWP12976	L	900.00
HD 193901		F8	V	8.65	0.02	LWP12976	S	300.00
HD 217877		F8	V	6.68	0.05	LWP08812	L	195.00
HD 136202	5 SER	F8	IV-V	5.06	0.03	LWP12510	L	43.88
HD 201891		F8	IV-V	7.38	-0.01	LWP15559	L	255.00
HD 208906		F8	IV-V	6.94	-0.01	LWP15557	L	164.30
HD 208906		F8	IV-V	6.94	-0.01	LWP15557	S	1100.00
HD 220657	UPS PEG	F8	IV	4.40	0.08	LWP14389	L	61.50
HD 27383		F9	V	6.88	0.00	LWR04126	L	512.50
HD 27383		F9	V	6.88	0.00	LWR04126	S	300.00
HD 27383		F9	V	6.88	0.00	LWR04128	L	305.97
HD 22879		F9	V	6.68	-0.01	LWP10008	L	112.69
HD 22879		F9	V	6.68	-0.01	LWP12327	L	205.00
HD 90508		F9	V	6.44	0.04	LWP09609	L	180.00
HD 90508		F9	V	6.44	0.04	LWP10010	L	149.55
HD 114762		F9	V	7.31	-0.02	LWP14968	L	210.00
HD 142373	CHI HER	F9	V	4.62	0.00	LWP11180	L	49.20
HD 157089		F9	V	6.95	0.04	LWP12706	L	179.04
HD 200580		F9	V	7.32	-0.02	LWP09605	L	300.00
HD 200580		F9	V	7.32	-0.02	LWP11176	L	240.00
HD 4614	ETA CAS	G0	V	3.44	-0.03	SWP04031	L	1800.00
HD 4614	ETA CAS	G0	V	3.44	-0.03	SWP07433	L	1320.00
HD 4614	ETA CAS	G0	V	3.44	-0.03	SWP09681	L	900.00
HD 4614	ETA CAS	G0	V	3.44	-0.03	LWR04116	S	15.00
HD 4614	ETA CAS	G0	V	3.44	-0.03	LWR04116	L	30.60
HD 4614	ETA CAS	G0	V	3.44	-0.03	LWP15018	L	16.20
HD 109358	BET CVN	G0	V	4.26	-0.01	LWR04861	L	71.68
HD 109358	BET CVN	G0	V	4.26	-0.01	LWR04861	S	70.00
HD 109358	BET CVN	G0	V	4.26	-0.01	LWR15530	L	35.88
HD 114710	BET COM	G0	V	4.26	-0.03	SWP06179	S	900.00
HD 114710	BET COM	G0	V	4.26	-0.03	SWP09465	L	-99.00
HD 114710	BET COM	G0	V	4.26	-0.03	LWR04834	L	81.92

HD 114710	BET COM	G0	V	4.26	-0.03	LWR04834	S	80.00
HD 114710	BET COM	G0	V	4.26	-0.03	LWR04835	L	82.00
HD 114710	BET COM	G0	V	4.26	-0.03	LWR13414	L	38.95
HD 121370	ETA BOO	G0	IV	2.68	-0.05	SWP05729	L	600.00
HD 121370	ETA BOO	G0	IV	2.68	-0.05	LWR04863	S	20.00
HD 121370	ETA BOO	G0	IV	2.68	-0.05	LWR04863	L	20.50
HD 150680	ZET HER	G0	IV*	2.81	0.02	SWP04759	L	2140.00
HD 150680	ZET HER	G0	IV*	2.81	0.02	SWP04759	S	1200.00
HD 150680	ZET HER	G0	IV*	2.81	0.02	LWR04123	L	20.50
HD 150680	ZET HER	G0	IV*	2.81	0.02	LWR04123	S	12.00
HD 6903	PSI3PSC	G0	III	5.55	0.05	LWR04855	L	184.50
HD 6903	PSI3PSC	G0	III	5.55	0.05	LWR04855	S	180.00
HD 111812	31 COM	G0	III*	4.94	0.03	SWP07769	L	240.00
HD 111812	31 COM	G0	III*	4.94	0.03	SWP07769	S	120.00
HD 111812	31 COM	G0	III*	4.94	0.03	SWP08206	L	3600.00
HD 111812	31 COM	G0	III*	4.94	0.03	SWP08206	S	120.00
HD 111812	31 COM	G0	III*	4.94	0.03	LWR04860	L	122.75
HD 111812	31 COM	G0	III*	4.94	0.03	LWR04860	S	120.00
HD 84441	EPS LEO	G0	II	2.98	0.07	LWR09730	L	20.50
HD 84441	EPS LEO	G0	II	2.98	0.07	LWR09731	L	28.70
HD 26630	MU PER	G0	IB*	4.14	0.13	LWR04117	L	186.36
HD 26630	MU PER	G0	IB*	4.14	0.13	LWR04117	S	90.00
HD 4307	18 CET	G0	V	6.15	0.01	LWP08442	L	276.75
HD 4307	18 CET	G0	V	6.15	0.01	LWP08443	L	49.85
HD 48682	PSI5 AUR	G0	V	5.25	-0.04	LWP10011	L	56.38
HD 55575		G0	V	5.58	-0.02	LWP09610	L	82.00
HD 110897	10 CVN	G0	V	5.95	-0.05	LWP12332	L	143.50
HD 152792		G0	V	6.81	0.05	LWP08447	L	425.37
HD 157214	72 HER	G0	V	5.39	0.02	LWP12512	L	70.91
HD 187923		G0	V	6.13	0.05	LWP08810	L	266.50
HD 1461		G0	IV	4.46	0.05	LWP08444	L	440.76
HD 205153		G0	IV	8.21	-0.08	LWP14536	L	750.00
HD 73593	34 LYN	G0	IV	5.37	0.36	LWP07259	L	184.52
HD 27836		G1	V	7.62	-0.02	LWR04127	L	1242.40
HD 27836		G1	V	7.62	-0.02	LWR04127	S	1200.00
HD 115043		G1	V	6.83	-0.02	LWR04862	L	488.10
HD 115043		G1	V	6.83	-0.02	LWR04862	S	480.00
HD 115043		G1	V	6.83	-0.02	LWP13415	L	225.00
HD 14802	KAP FOR	G1	V	5.20	-0.02	LWP11112	L	102.50
HD 28068		G1	V	8.06	0.01	LWP12704	L	660.00
HD 190406	15 SGE	G1	V	5.80	-0.01	LWP12933	L	194.76
	URANUS	G2	V	6.00	0.07	LWR04864	L	277.03
	URANUS	G2	V	6.00	0.07	LWR04864	S	240.00
	URANUS	G2	V	6.00	0.07	LWR04865	L	184.68
	URANUS	G2	V	6.00	0.07	LWR04865	S	360.00
HD 10307		G2	V	4.95	-0.01	SWP10029	L	5400.00
HD 10307		G2	V	4.95	-0.01	LWR04854	S	120.00
HD 10307		G2	V	4.95	-0.01	LWR04854	L	123.05
HD 186408	16CYG A	G2	V	5.96	0.01	LWR04836	L	307.50
HD 186408	16CYG A	G2	V	5.96	0.01	LWR04836	S	300.00
HD 186408	16CYG A	G2	V	5.96	0.01	LWR04841	L	2460.00
HD 186408	16CYG A	G2	V	5.96	0.01	LWP15357	L	179.04
HD 2151	BET HYI	G2	IV	2.80	-0.02	SWP04760	L	648.48
HD 2151	BET HYI	G2	IV	2.80	-0.02	SWP06128	L	1020.00
HD 2151	BET HYI	G2	IV	2.80	-0.02	SWP06128	S	180.00
HD 2151	BET HYI	G2	IV	2.80	-0.02	SWP07307	L	4800.00
HD 2151	BET HYI	G2	IV	2.80	-0.02	SWP07307	S	600.00
HD 2151	BET HYI	G2	IV	2.80	-0.02	SWP07429	L	720.00
HD 2151	BET HYI	G2	IV	2.80	-0.02	LWR04125	L	20.50
HD 2151	BET HYI	G2	IV	2.80	-0.02	LWR04125	S	15.00
HD 2151	BET HYI	G2	IV	2.80	-0.02	LWR09863	L	16.40
HD 2151	BET HYI	G2	IV	2.80	-0.02	LWR09864	L	14.61
HD 159181	BET DRA	G2	II*	2.79	0.11	SWP02348	L	1440.00
HD 159181	BET DRA	G2	II*	2.79	0.11	SWP02349	L	3600.00
HD 159181	BET DRA	G2	II*	2.79	0.11	SWP02350	L	600.00
HD 159181	BET DRA	G2	II*	2.79	0.11	LWR04124	S	12.00
HD 159181	BET DRA	G2	II*	2.79	0.11	LWR04124	L	20.50
HD 209750	ALP AQR	G2	IB	2.96	0.10	LWR12113	L	51.25
HD 13043		G2	V	6.91	-0.02	LWP09654	L	240.00
HD 28344		G2	V	7.85	-0.02	LWP10006	L	600.00
HD 30455		G2	V	6.97	-0.01	LWP10005	L	255.00
HD 111721		G2	V	7.97	0.18	LWP15612	L	900.00
HD 143761	RHO CRB	G2	V	5.41	-0.03	LWP12511	L	64.77
HD 186427	16 CYG	G2	V	6.20	-0.02	LWP15358	L	219.00
HD 224930	85 PEG	G2	V	5.75	0.04	LWP08445	L	133.25
HD 26736		G3	V	8.09	0.01	LWR04129	L	621.21
HD 26736		G3	V	8.09	0.01	LWR04129	S	1200.00
HD 192876	ALP1CAP	G3	IB	4.24	0.15	LWR12040	L	307.48
HD 86728	20 LMI	G3	VA	5.36	0.01	LWP12508	L	89.34
HD 74006	BET PYX	G4	III	3.97	0.06	LWP15568	L	75.00
HD 74006	BET PYX	G4	III	3.97	0.06	LWP15568	S	59.68
HD 74006	BET PYX	G4	III	3.97	0.06	LWP15613	L	74.60
HD 74006	BET PYX	G4	III	3.97	0.06	LWP15613	S	300.00
HD 71369	MI UMA	G4	II-III	3.36	-0.03	LWP12567	L	43.05
HD 26756		G5	V	8.46	0.02	LWR04130	L	2174.20
HD 20630	KAP CET	G5	V	4.83	0.00	SWP09462	L	3000.00
HD 20630	KAP CET	G5	V	4.83	0.00	LWR04857	S	120.00
HD 20630	KAP CET	G5	V	4.83	0.00	LWR04857	L	123.05
HD 20630	KAP CET	G5	V	4.83	0.00	LWR04858	L	615.00
HD 20630	KAP CET	G5	V	4.83	0.00	LWP10009	L	66.63
HD 186427	16CYG B	G5	V	6.20	-0.02	SWP02700	L	10800.00
HD 186427	16CYG B	G5	V	6.20	-0.02	LWR04838	S	360.00
HD 186427	16CYG B	G5	V	6.20	-0.02	LWR04838	L	369.37
HD 186427	16CYG B	G5	V	6.20	-0.02	LWR04840	L	1846.80
HD 161797	MU HER	G5	IV	3.42	0.05	LWR04121	L	31.06
HD 161797	MU HER	G5	IV	3.42	0.05	LWR04121	S	24.00
HD 93497	MU VEL	G5	III	2.69	0.00	SWP02338	L	900.00
HD 93497	MU VEL	G5	III	2.69	0.00	SWP02377	L	240.00
HD 93497	MU VEL	G5	III	2.69	0.00	SWP08212	S	10.00
HD 93497	MU VEL	G5	III	2.69	0.00	SWP08212	L	300.00
HD 93497	MU VEL	G5	III	2.69	0.00	LWR04859	L	20.50
HD 93497	MU VEL	G5	III	2.69	0.00	LWR04859	S	20.00
HD 109379	BET CRV	G5	III	2.65	-0.01	SWP01571	L	2700.00
HD 109379	BET CRV	G5	III	2.65	-0.01	SWP01572	L	5400.00
HD 109379	BET CRV	G5	III	2.65	-0.01	SWP03585	L	5400.00
HD 109379	BET CRV	G5	III	2.65	-0.01	LWR04866	S	24.00
HD 109379	BET CRV	G5	III	2.65	-0.01	LWR04866	L	24.61
HD 206859	9 PEG	G5	IB	4.34	0.17	LWR13095	S	90.00
HD 117176	70 VIR	G5	V	4.98	0.03	LWP11114	L	123.00
HD 197076		G5	V+	6.45	-0.05	LWP08811	L	195.00
HD 197076		G5	V+	6.45	-0.05	LWP15611	L	195.00
HD 197076		G5	V+	6.45	-0.05	LWP15611	S	900.00
HD 115617	61 VIR	G6	V	4.74	-0.01	LWR12163	L	122.98
HD 115617	61 VIR	G6	V	4.74	-0.01	LWP08809	L	82.00
HD 10700	TAU CET	G8	V	3.50	-0.02	SWP04033	L	3420.00
HD 10700	TAU CET	G8	V	3.50	-0.02	SWP04054	L	9000.00
HD 10700	TAU CET	G8	V	3.50	-0.02	SWP05733	L	1440.00
HD 10700	TAU CET	G8	V	3.50	-0.02	SWP05734	L	7320.00
HD 10700	TAU CET	G8	V	3.50	-0.02	LWR04856	L	61.50
HD 10700	TAU CET	G8	V	3.50	-0.02	LWR04856	S	60.00
HD 188512	BET AQL	G8	IV	3.71	0.04	LWR12111	L	74.82
HD 188512	BET AQL	G8	IV	3.71	0.04	LWR12112	L	358.77
HD 76294	ZET HYA	G8	III	3.11	0.05	LWR09650	L	83.44
HD 48329	EPS GEM	G8	IB	2.98	0.26	LWR12667	L	184.50
HD 48329	EPS GEM	G8	IB	2.98	0.26	LWR12667	S	49.00
HD 48329	EPS GEM	G8	IB	2.98	0.26	LWR12669	L	307.48
HD 13783		G8	V	8.29	-0.08	LWP14538	L	750.00
HD 13783		G8	V	8.29	-0.08	LWP15017	L	600.00
HD 13783		G8	V	8.29	-0.08	LWP15019	L	1440.00
HD 64606		G8	V	7.44	-0.01	LWP09611	L	990.00
HD 75732	RHO1CNC	G8	V	5.95	0.13	LWP09649	L	249.00
HD 101501	61 UMA	G8	V	5.33	-0.02	LWP11113	L	128.13
HD 103095		G8	VP	6.45	0.01	LWP13413	L	252.00
HD 211038		G8	V	6.54	0.16	LWP09606	L	360.00
HD 67767	PSI CNC	G8	IV	5.73	-0.01	LWP09608	L	225.00
HD 67767	PSI CNC	G8	IV	5.73	-0.01	LWP09650	L	204.00
HD 182572	31 AQL	G8	IV	5.16	-0.05	LWP11174	L	151.69
HD 37160	PHI2ORI	G8	IIIB	4.09	0.00	LWP07028	L	164.00
HD 150997	ETA HER	G8	III+	3.53	-0.02	LWP11104	L	73.80
HD 216131	MU PEG	G8	III+	3.48	-0.02	LWP14385	L	87.13
HD 72324	UPS2CNC	G9	III	6.36	0.04	LWR09853	L	1653.00
HD 72324	UPS2CNC	G9	III	6.36	0.04	LWR09854	L	599.62
HD 180711	DEL DRA	G9	III	3.07	0.02	LWP12695	L	71.75
HD 185144	SIG DRA	K0	V	4.68	-0.02	LWR05989	L	180.00
HD 185144	SIG DRA	K0	V	4.68	-0.02	LWR05989	S	60.00
HD 185144	SIG DRA	K0	V	4.68	-0.02	LWR12746	L	128.12
HD 185144	SIG DRA	K0	V	4.68	-0.02	LWP13412	L	153.75
HD 198149	ETA CEP	K0	IV	3.43	0.01	LWR12739	L	93.18
HD 62509	BET GEM	K0	III*	1.14	-0.01	SWP04730	L	1200.00
HD 62509	BET GEM	K0	III*	1.14	-0.01	SWP08232	L	7200.00
HD 62509	BET GEM	K0	III*	1.14	-0.01	SWP08232	S	1500.00
HD 62509	BET GEM	K0	III*	1.14	-0.01	SWP10052	L	1400.00
HD 62509	BET GEM	K0	III*	1.14	-0.01	LWR09843	L	6.15
HD 62509	BET GEM	K0	III*	1.14	-0.01	LWR09844	L	14.35
HD 62509	BET GEM	K0	III*	1.14	-0.01	LWR09845	L	40.18
HD 10780		K0	V	5.63	0.00	LWP09652	L	420.00
HD 10780		K0	V	5.63	0.00	LWP09653	L	285.00
HD 10780		K0	V	5.63	0.00	LWP11177	L	210.00
HD 134439		K0	V	9.06	-0.03	LWP12934	L	4500.00
HD 134439		K0	V	9.06	-0.03	LWP12936	L	1800.00
HD 192310		K0	V	5.73	0.07	LWP12935	L	215.25
HD 192310		K0	V	5.73	0.07	LWP12937	L	240.00
HD 192310		K0	V	5.73	0.07	LWP15353	L	307.50
HD 192310		K0	V	5.73	0.07	LWP15555		360.00
HD 6203	25 CET	K0	III-IV	5.43	0.10	LWP07536	L	492.00
HD 6203	25 CET	K0	III-IV	5.43	0.10	LWP07537	L	420.00
HD 19476	KAP PER	K0	III	3.80	-0.03	LWP07026	L	176.27
HD 49293	18 MON	K0	III BA0.1	4.47	0.10	LWP05904	L	120.00
HD 95272	ALP CRT	K0+	III	4.08	0.08	LWP05900	L	307.50
HD 216228	IOT CEP	K0-	III	3.52	0.04	LWP13553	L	143.50
HD 221861		K0	IB	5.84	0.62	LWP12661	L	3600.00
HD 221861		K0	IB	5.84	0.62	LWP12661	S	480.00
HD 10476	107 PSC	K1	V	5.24	-0.02	LWR11854	L	246.01
HD 10476	107 PSC	K1	V	5.24	-0.02	LWR11855	L	491.96
HD 10476	107 PSC	K1	V	5.24	-0.02	LWR12041	L	307.48
HD 4128	BET CET	K1	III	2.04	-0.07	LWR12180	L	61.51
HD 4128	BET CET	K1	III	2.04	-0.07	LWR12180	S	7.00
HD 4128	BET CET	K1	III	2.04	-0.07	LWR12041	L	38.95
HD 132142		K1	V	7.73	-0.07	LWP13416	L	750.00
HD 26965	OMI2ERI	K1-	V	4.43	-0.04	LWP12326	L	71.75
HD 26965	OMI2ERI	K1-	V	4.43	-0.04	LWP12328	L	123.00
HD 142091	KAP CRB	K1	IVA	4.82	0.01	LWP07261	L	180.00
HD 142980	PHI SER	K1	IV	5.54	0.15	LWP07617	L	315.00
HD 142980	PHI SER	K1	IV	5.54	0.15	LWP07619	L	720.00
HD 145148		K1+	IV	5.97	0.01	LWP07616	L	900.00
HD 145148		K1+	IV	5.97	0.01	LWP07618	L	210.00
HD 145328	TAU CRB	K1-	III-IV	4.76	-0.08	LWP07263	L	70.00
HD 22049	EPS ERI	K2	V	3.73	-0.04	LWR12671	L	65.60
HD 85503	MU LEO	K2	III	3.88	0.06	LWR09856	L	230.62
HD 85503	MU LEO	K2	III	3.88	0.06	LWR09857	L	615.00
HD 137759	IOT DRA	K2	III	3.29	0.00	LWR09858	L	338.25
HD 206778	EPS PEG	K2	IB	2.39	0.30	LWR12178	L	270.57
HD 206778	EPS PEG	K2	IB	2.39	0.30	LWR12179	L	338.29
HD 206778	EPS PEG	K2	IB	2.39	0.30	LWR12179	S	33.00
HD 166620		K2	V	6.40	-0.05	LWP13411	L	210.00
HD 166620		K2	V	6.40	-0.05	LWP13417	L	630.00
HD 51440	62 AUR	K2	III	6.00	0.07	LWP07029	L	2520.00
HD 54719	TAU GEM	K2-	III	4.41	0.10	LWP05905	L	576.00
HD 66141		K2	III	4.39	0.09	LWP05902	L	738.07
HD 72184		K2	III	5.90	-0.05	LWP07258	L	480.00
HD 73471	SIG HYA	K2	III	4.44	0.05	LWP05901	L	615.00
HD 219134		K3	V	5.56	0.06	LWR12738	L	339.77
HD 219134		K3	V	5.56	0.06	LWR12740	L	860.98
HD 219134		K3	V	5.56	0.06	LWP14537	L	255.00
HD 219134		K3	V	5.56	0.06	LWP14539	L	600.00
HD 157244	BET ARA	K3	IB	2.85	0.04	LWR12673	L	461.30
HD 157244	BET ARA	K3	IB	2.85	0.04	LWR12673	S	50.00
HD 144872		K3	V	8.61	0.01	LWP15015	L	3600.00
HD 10380	NU PSC	K3-	IIIB BA0.1	4.44	0.10	LWP07534	L	630.00
HD 10380	NU PSC	K3-	IIIB BA0.1	4.44	0.10	LWP07535	L	1260.00
HD 35620	PHI AUR	K3	III CN+2	5.07	0.14	LWP07027	L	1080.00
HD 35620	PHI AUR	K3	III CN+2	5.07	0.14	LWP07533	L	1980.00
HD 125560	20 BOO	K3	III	4.86	-0.03	LWP07260	L	600.00
HD 125560	20 BOO	K3	III	4.86	-0.03	LWP07262	L	360.00
HD 132345	18 LIB	K3-	III CN2	5.87	0.00	LWP07615	L	960.00
HD 89388		K3	IIA	3.40	0.14	LWP13330	L	143.50

HD 89388		K3	IIA	3.40	0.14	LWP13332	L	450.00
HD 62967	BET CNC	K4	III*	3.52	0.05	LWR09738	L	683.26
HD 201091	61 CYGA	K5	V	5.21	0.03	LWR12741	L	923.42
HD 201091	61 CYGA	K5	V	5.21	0.03	LWR12741	S	270.00
HD 201091	61 CYGA	K5	V	5.21	0.03	LWR12743	L	1440.00
HD 29139	ALP TAU	K5	III	0.85	0.03	SWP02806	L	300.00
HD 29139	ALP TAU	K5	III	0.85	0.03	SWP02825	L	2400.00
HD 29139	ALP TAU	K5	III	0.85	0.03	SWP04032	L	5400.00
HD 29139	ALP TAU	K5	III	0.85	0.03	SWP04053	L	9000.00
HD 29139	ALP TAU	K5	III	0.85	0.03	SWP10918	L	1800.00
HD 29139	ALP TAU	K5	III	0.85	0.03	LWR10144	L	35.87
HD 78647	LAM VEL	K5	IB	2.21	0.06	LWR12672	L	799.53
HD 78647	LAM VEL	K5	IB	2.21	0.06	LWR12674	L	676.57
HD 201092	61 CYGB	K7	V	6.03	0.04	LWR05538	L	450.00
HD 201092	61 CYGB	K7	V	6.03	0.04	LWR12742	S	600.00
HD 201092	61 CYGB	K7	V	6.03	0.04	LWR12742	L	5400.00
HD 201092	61 CYGB	K7	V	6.03	0.04	LWR12744	L	3600.00
HD 17709	17 PER	K7	III	4.53	0.03	SWP10708	L	5400.00
HD 17709	17 PER	K7	III	4.53	0.03	LWR09405	S	300.00
HD 17709	17 PER	K7	III	4.53	0.03	LWR09405	L	2880.00
HD 52877	SIG CMA	K7	IB	3.46	0.12	LWR12190	L	615.00
HD 52877	SIG CMA	K7	IB	3.46	0.12	LWR12190	S	30.00
HD 52877	SIG CMA	K7	IB	3.46	0.12	LWR12748	L	1260.00
HD 52877	SIG CMA	K7	IB	3.46	0.12	LWR12748	S	63.00
HD 52877	SIG CMA	K7	IB	3.46	0.12	LWP12977	L	120.00
HD 70272	31 LYN	K7	III	4.25	0.02	LWP07030	L	1710.00
HD 89758	MU UMA	MO	III	3.05	0.02	LWR13054	L	240.00
HD 89758	MU UMA	MO	III	3.05	0.02	LWR13054	S	300.00
HD 6860	BET AND	M0	IIIA	2.06	0.01	LWP14600	L	360.00
HD 6860	BET AND	M0	IIIA	2.06	0.01	LWP14600	S	70.00
HD 9053	GAM PHE	M0-	IIIA	3.41	0.00	LWP15614	L	525.00
HD 9053	GAM PHE	M0-	IIIA	3.41	0.00	LWP15614	S	130.00
HD 146051	DEL OPH	M0.5	III	2.74	0.11	LWP11105	L	341.67
HD 146051	DEL OPH	M0.5	III	2.74	0.11	LWP11462	L	205.00
HD 102212	NU VIR	M1	IIIAB	4.03	-0.09	LWR11960	L	1680.00
HD 102212	NU VIR	M1	IIIAB	4.03	-0.09	LWR11960	S	420.00
HD 39801	ALP ORI	M2	IAB	0.50	0.21	LWR12668	L	41.00
HD 39801	ALP ORI	M2	IAB	0.50	0.21	LWR12668	S	11.00
HD 39801	ALP ORI	M2	IAB	0.50	0.21	LWR12670	L	116.88
HD 219734	8 AND	M2	III	4.85	0.07	LWP13558	L	240.00
HD 219734	8 AND	M2	III	4.85	0.07	LWP14391	L	900.00
HD 206936	MU CEP	M2	IA	4.08	0.70	LWP13554	L	3600.00
HD 95735		M2	V	7.49	0.04	LWP12974	L	1200.00
HD 95735		M2	V	7.49	0.04	LWP12975	L	9000.00
HD 224427	PSI PEG	M3	III	4.66	-0.01	LWP14388	L	684.00
HD 44478	MU GEM	M3	IIIAB	2.88	0.04	LWR11825	L	307.48
HD 44478	MU GEM	M3	IIIAB	2.88	0.04	LWR12737	L	960.00
HD 19058	RHO PER	M4	IIB-IIIA	3.39	0.00	LWR11563	L	300.00
HD 19058	RHO PER	M4	IIB-IIIA	3.39	0.00	LWR11563	S	100.00
HD 19058	RHO PER	M4	IIB-IIIA	3.39	0.00	LWR11822	L	2280.00
HD 19058	RHO PER	M4	IIB-IIIA	3.39	0.00	LWR11822	S	200.00
HD 132813		M5	III	4.60	-0.01	LWP12565	L	1440.00
HD 132813		M5	III	4.60	-0.01	LWP12466	L	270.00

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
93204		O5 V((f))	4	10:42:31.0	-59:28:36	8.44	B	0.10	0.42
93160		O6 III(f)	5	10:42:10.7	-59:18:44	7.82	AB	0.17	0.49
169582		O6 If	4	18:22:57.9	-9:46:57	8.70		0.55	0.87
93222		O7 III((f)	5	10:42:40.4	-59:49:41	8.10		0.05	0.37
101205		O7 IIIn((f))	4	11:35:59.8	-63:05:45	6.46	AB	0.04	0.36
24912	XI PER	O7.5 III(n)((f))	5	3:55:42.8	35:38:56	4.04		0.02	0.33
162978		O7.5 II((f))	5	17:51:49.2	-24:52:44	6.20		0.04	0.35
46056		O8 Vn	4	6:28:41.5	4:52:14	8.24	A	0.20	0.51
46149		O8.5 V	4	6:29:12.9	5:04:11	7.60		0.17	0.48
112244		O8.5 Iab(f)	4	12:52:59.4	-56:33:54	5.37	A	0.02	0.31
57682		O9 IV	5	7:19:38.1	-8:53:00	6.42		-0.19	0.12
93027		O9.5 V	5	10:41:18.3	-59:52:40	8.72		-0.02	0.28
112784		O9.5 III	8	12:57:02.1	-60:19:26	8.26		0.06	0.36
152247		O9.5 II-III	4	16:50:40.9	-41:33:40	7.17		0.19	0.49
30614	ALF CAM	O9.5 Ia	5	4:49:03.8	66:15:38	4.29		0.03	0.30

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
43818		B0 II	9	6:16:16.6	23:29:27	6.91		0.29	0.58
219188		B0.5 III	9	23:11:27.9	4:43:28	7.05		-0.13	0.15
46106		B1 V	13	6:28:58.8	5:03:47	7.93		0.14	0.40
50707	15 CMA	B1 III	7	6:51:23.1	-20:09:40	4.82	V	-0.22	0.04
1383		B1 II	9	0:15:34.7	61:26:58	7.63		0.27	0.51
47240		B1 II	6	6:35:13.2	5:00:04	6.15		0.15	0.39
86606		B1 Ib	7	9:55:17.9	-71:09:02	6.33		-0.06	0.13
157246	GAM ARA	B1 Ib	7	17:21:10.7	-56:19:58	3.33	A	-0.14	0.05
37744		B1.5 V	6	5:38:06.8	-2:51:00	6.21		-0.21	0.04
69081		B1.5 IV	7	8:12:05.5	-36:10:11	5.08	A	-0.20	0.05
83058		B1.5 IV	7	9:32:24.6	-51:01:56	5.00		-0.19	0.06
44506		B1.5 IIIn	7	6:18:47.6	-34:07:13	5.54		-0.19	0.06
74375		B1.5 III	7	8:39:30.8	-59:34:55	4.32	A	-0.12	0.13
122980	CHI CEN	B2 V	7	14:02:59.0	-40:56:27	4.35		-0.20	0.04
28873	DEL CAE	B2 IV-V	7	4:29:18.1	-45:03:36	5.06		-0.20	0.04
39291	55 ORI	B2 IV-V	6	5:48:57.0	-7:31:48	5.35		-0.20	0.04
127381	SIG LUP	B2 III	7	14:29:14.0	-50:14:11	4.41		-0.19	0.05
148703		B2 III	7	16:28:06.5	-34:35:50	4.23		-0.17	0.07
14357		B2 II	9	2:17:38.4	56:38:14	8.52		0.32	0.53
41117	CHI2 ORI	B2 Ia	1	6:00:56.9	20:08:28	4.63		0.27	0.44
25631		B2.5 V	7	4:01:12.4	-20:16:50	6.46		-0.18	0.04
64503		B2.5 V	7	7:50:52.3	-38:43:56	4.49		-0.20	0.02
166596		B2.5 III	7	18:09:40.1	-41:20:59	5.46		-0.18	0.04
31327		B2.5 Ib	6	4:52:59.4	36:05:25	6.07		0.40	0.55
66591		B3 V	7	7:59:42.3	-63:25:42	4.81		-0.17	0.03
134687		B3 IV	7	15:09:27.3	-44:18:47	4.82		-0.18	0.02
24432		B3 II	13	3:51:45.7	48:53:42	6.93		0.58	0.75
136664	PHI2 LUP	B4 V	7	15:19:57.1	-36:40:50	4.53		-0.15	0.03
170523	DEL2 TEL	B4 III	7	18:28:20.1	-45:47:37	5.07		-0.13	0.05
183144		B4 III	6	19:25:15.7	14:10:47	6.32		-0.07	0.11
25340	35 ERI	B5 V	6	3:58:59.8	-1:41:18	5.28		-0.15	0.01
23227	DEL FOR	B5 IV	7	3:40:15.4	-32:05:49	5.00		-0.17	-0.01
76538		B5 III	7	8:52:40.1	-60:09:47	5.78		-0.08	0.08
81848		B6 V	7	9:24:40.2	-53:09:41	5.10		-0.12	0.02
115823		B6 V	7	13:17:34.6	-52:29:08	5.47		-0.13	0.01
23338	19 TAU	B6 IV	1	3:42:13.5	24:18:42	4.30	A	-0.11	0.03
195810	EPS DEL	B6 III	6	20:30:49.4	11:07:55	4.03		-0.12	0.02
74371		B6 Ia	7	8:40:14.7	-45:13:50	5.24		0.21	0.28
17769	SIG ARI	B7 V	6	2:48:43.6	14:52:38	5.48		-0.09	0.04
204770	7 CEP	B7 V	6	21:26:48.3	66:35:26	5.43		-0.11	0.02
173300	PHI SGR	B8 III	13	18:42:32.0	-27:02:38	3.17		-0.11	-0.01
207971	GAM GRU	B8 III	13	21:50:54.4	-37:36:03	3.00		-0.12	-0.02
21790	17 ERI	B9 Vs	10	3:28:08.0	-5:14:43	4.73		-0.09	-0.02
222439	KAP AND	B9 IVn	10	23:37:56.2	44:03:25	4.14	A	-0.07	0.00
164865		B9 Ia	8	18:01:09.6	-24:11:08	7.66		0.87	0.87
98664	SIG LEO	B9.5 Vs	10	11:18:33.4	6:18:13	4.04		-0.06	-0.02
100889	THE CRT	B9.5 Vn	10	11:34:08.5	-9:31:32	4.70		-0.08	-0.04
166014	OMI HER	B9.5 V	10	18:05:35.4	28:45:15	3.84		-0.03	0.01

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
130109	109 VIR	A0 V	2	14:43:43.0	2:06:08	3.74		-0.01	0.00
153808	EPS HER	A0 V	10	16:58:22.4	30:59:55	3.92		-0.02	-0.01
212061	GAM AQR	A0 V	10	22:19:04.4	-1:38:23	3.85	A	-0.06	-0.05
123299	ALF DRA	A0 III	2	14:03:01.9	64:36:51	3.66		-0.05	-0.02
175687	XI1 SGR	A0 II	10	18:54:22.2	-20:43:24	5.07		0.13	0.13
46300	13 MON	A0 Ib	9	6:30:11.9	7:22:16	4.50		0.01	0.01
92207		A0 Ia	13	10:35:32.3	-58:28:23	5.47	V	0.50	0.48
198001	EPS AQR	A1 V	2	20:44:58.2	-9:40:48	3.77		0.00	-0.02
200761	THE CAP	A1 V	10	21:03:08.3	-17:25:57	4.06		-0.01	-0.03
214994	OMI PEG	A1 IV	10	22:39:24.3	29:02:46	4.80		-0.01	-0.01
12953		A1 Ia	9	2:05:09.8	58:11:13	5.69		0.61	0.58
16970	GAM CET	A3 V	10	2:40:42.3	3:01:34	3.46	AB	0.09	0.01
38678	ZET LEP	A3 Vn	10	5:44:41.2	-14:50:21	3.54		0.10	0.02
106591	DEL UMA	A3 V	2	12:12:57.5	57:18:36	3.31	A	0.08	0.00
33111	BET ERI	A3 III	2	5:05:23.3	-5:08:58	2.78	A	0.13	0.04
50019	THE GEM	A3 III	2	6:49:29.6	34:01:24	3.60	A	0.10	0.01
13041	58 AND	A5 IV-V	10	2:05:27.6	37:37:22	4.81		0.12	-0.03
74272		A5 II	15	8:39:34.6	-47:08:16	4.77		0.12	0.02
97534		A6 Ia	13	11:10:26.8	-60:02:43	4.60	A	0.54	0.44
99211	GAM CRT	A7 IV-V	10	11:22:22.8	-17:24:32	4.07	AB	0.21	-0.01
187642	ALF AQL	A7 IV-V	2	19:48:20.5	8:44:05	0.77	A	0.22	0.00
28910	RHO TAU	A8 V	10	4:31:00.4	14:44:27	4.65	V	0.25	-0.02
80404	IOT CAR	A8 Ib	13	9:15:45.1	-59:03:53	2.25		0.18	0.04

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
81937	23 UMA	F0 IV-Vb	13	9:27:36.5	63:16:55	3.66	A	0.33	0.03
7312		F0 III	13	1:10:27.3	-38:07:15	5.91		0.29	-0.03
156897	XI OPH	F1 III-IV	13	17:18:00.2	-21:03:39	4.39	AB	0.38	0.05
135153	1 LUP	F1 II	13	15:11:33.1	-31:20:01	4.90		0.38	0.13
159532	THE SCO	F1 II	13	17:33:43.3	-42:58:05	1.86		0.40	0.15
29875	ALF CAE	F2 V	13	4:38:56.9	-41:57:29	4.45	AB	0.34	-0.01
82434	PSI VEL	F2 IV	13	9:28:43.6	-40:14:49	3.58	AB	0.36	-0.01
432	BET CAS	F2 III-IV	1	0:06:29.7	58:52:26	2.27	A	0.34	-0.03
129502	MU VIR	F2 III	13	14:40:25.2	-5:26:30	3.88		0.38	0.02
182835	NU AQL	F2 Ib	13	19:23:57.6	0:14:14	4.66	A	0.59	0.41
206901	KAP PEG	F3 IV	13	21:42:22.7	25:24:51	4.14	AB	0.42	0.03
112374		F3 Ia	15	12:53:48.4	-26:11:22	6.62		0.68	0.47
26462	45 TAU	F4 V	13	4:08:40.3	5:23:39	5.73	A	0.36	-0.06
185395	THE CYG	F4 V	13	19:35:05.9	50:06:16	4.48	AB	0.38	-0.04
199532	ALF OCT	F4 III	13	20:58:44.0	-77:13:01	5.14		0.49	0.07
209166	20 PEG	F4 III	13	21:58:39.0	12:52:46	5.62	A	0.34	-0.08
160922	OMG DRA	F5 V	13	17:37:14.3	68:46:52	4.79	A	0.43	-0.02
139664		F5 IV-V	13	15:37:44.5	-44:29:50	4.63		0.40	-0.02
43905	45 AUR	F5 III	13	6:17:42.4	53:28:38	5.35		0.43	0.00
79940		F5 III	13	9:13:44.9	-37:12:14	4.62	AB	0.45	0.02
172052		F5 Ib	13	18:36:00.0	-23:13:38	6.73		0.66	0.40
30652	PI3 ORI	F6 V	1	4:47:07.3	6:52:32	3.19	A		

HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
								0.45	-0.03
57623	DEL VOL	F6 V	13	7:16:51.6	-67:51:56	3.96		0.77	0.29
124850	IOT VIR	F7 V	13	14:13:23.3	-5:45:46	4.08		0.51	0.01
151769	20 OPH	F7 IV	13	16:47:03.8	-10:41:46	4.65		0.47	-0.03
8890	ALF UMI	F7 Ib-II	13	1:48:48.7	89:01:43	2.01	A	0.60	0.12
171635	45 DRA	F7 Ib	13	18:31:42.6	57:00:24	4.79		0.61	0.16
172365		F8 Ib-II	13	18:37:09.2	5:13:03	6.35		0.79	0.22
133683		F8 Iab-Ib	13	15:05:01.4	-66:53:36	5.76		0.68	0.13

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
204867	BET AQR	G0 Ib	1	21:28:55.6	-5:47:31	2.90	A	0.83	0.01
185758	ALF SGE	G1 II	1	19:37:51.6	17:53:51	4.38	A	0.78	-0.02
188650		G1 Ib-II	12	19:52:58.5	36:51:46	5.76		0.75	-0.08
100261	OMG1 CEN	G2 Ia	1	11:29:26.8	-59:09:57	5.13	A	1.07	0.19
144608	OMG2 SCO	G3 II-III	11	16:04:28.0	-20:44:06	4.32		0.84	-0.02
82210	24 UMA	G4 III-IV	1	9:30:05.8	70:03:06	4.57		0.77	-0.03
204075	ZET CAP	G4 Ib	15	21:23:48.9	-22:37:44	3.74	A	1.00	0.04
153751	EPS UMI	G5 III	13	16:51:00.9	82:07:21	4.23	A	0.90	0.00
36079	BET LEP	G5 II	11	5:26:06.0	-20:47:52	2.84	AB	0.82	-0.05
148856	BET HER	G7 IIIa	11	16:28:04.1	21:35:50	2.78	A	0.93	-0.01
96566		G8 III	15	11:04:28.9	-62:09:12	4.61		1.03	0.08
115659	GAM HYA	G8- IIIa	11	13:16:11.8	-22:54:29	2.99	A	0.92	-0.03
133208	BET BOO	G8- IIIa: Ba 0.4	11	15:00:03.6	40:35:12	3.51		0.96	0.01
192947	ALF2 CAP	G8 IIIb	12	20:15:16.8	-12:42:04	3.57	ABC	0.94	-0.01
202109	ZET CYG	G8 II CN 1	1	21:10:48.3	30:01:15	3.21	A	0.99	0.00
96436	65 LEO	G9 III	14	11:04:21.1	2:13:38	5.52	AB	0.97	-0.01
76294	ZET HYA	G9 II-III	1	8:52:45.0	6:08:13	3.10		1.00	0.00

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
39364	DEL LEP	K0 III CN-2	11	5:49:10.1	-20:52:55	3.78		1.00	-0.01
88284	LAM HYA	K0 III CN 1	11	10:08:08.9	-12:06:22	3.61	A	1.01	0.00
197989	EPS CYG	K0- III	1	20:44:11.1	33:46:55	2.47	A	1.03	0.02
219615	GAM PSC	K0- III: CN-1.5	11	23:14:34.3	3:00:31	3.70		0.92	-0.09
207089	12 PEG	K0 Ib	1	21:43:46.1	22:43:03	5.29		1.38	0.20
160635	ETA PAV	K1 III	13	17:40:49.2	-64:42:09	3.61		1.19	0.10
163770	THE HER	K1 IIa CN+2	1	17:54:32.1	37:15:21	3.86		1.35	0.21
210745	ZET CEP	K1.5 Ib	1	22:09:06.9	57:57:15	3.35		1.57	0.36
10486		K2 IV	13	1:40:13.2	45:04:15	6.33		1.02	-0.02
161096	BET OPH	K2 III	1	17:41:00.0	4:35:11	2.77		1.17	0.01
163588	XI DRA	K2 III	1	17:52:39.7	56:52:47	3.75	A	1.18	0.02
20644		K2 II-III	13	3:17:18.4	28:52:07	4.47		1.55	0.42
150798	ALF TRA	K2 IIb-IIIa	13	16:43:21.0	-68:56:19	1.91		1.45	0.32
157999	SIG OPH	K2 II	1	17:24:01.8	4:10:56	4.33		1.50	0.21
31398	IOT AUR	K3 II	1	4:53:43.9	33:05:19	2.68		1.53	0.13
127700	5 UMI	K4- III Ba 0.3	12	14:27:36.1	75:55:05	4.27	A	1.43	0.00
131873	BET UMI	K4 III	1	14:50:49.6	74:21:35	2.07	AB	1.47	0.04
209747	NU PEG	K4 III	13	22:03:09.4	4:48:48	4.85		1.45	0.02
139669	THE UMI	K5 III	13	15:32:51.2	77:30:59	4.96		1.58	0.07
164058	GAM DRA	K5 III	1	17:55:26.5	51:29:38	2.23	A	1.52	0.01
44537	PSI1 AUR	K5-M0 Iab-Ib	1	6:21:02.8	49:18:56	4.87		1.96	0.36
80493	ALF LYN	K7 IIIab	1	9:18:00.8	34:36:18	3.14		1.55	0.02
149161	29 HER	K7 III	1	16:30:15.7	11:35:38	4.83		1.49	-0.04
52877	SIG CMA	K7 Ib	1	6:59:43.5	-27:51:43	3.46	A	1.73	0.11

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HD	Name	Sp_Type	Ref	RA(1950.0) hh:mm:ss	DEC(1950.0) dd:mm:ss	V mag	Remarks	B-V mag	E(B-V) mag
9053	GAM PHE	M0- IIIa	11	1:26:11.7	-43:34:25	3.41		1.57	0.00
100029	LAM DRA	M0 III Ca-1	12	11:28:27.5	69:36:26	3.85		1.61	0.04
111631		M0.5 V	2	12:48:09.6	-0:29:26	8.49		1.41	-0.06
112769	36 COM	M1- IIIb	1	12:56:27.0	17:40:42	4.77		1.57	-0.03
141477	KAP SER	M1- IIIab	1	15:46:29.2	18:17:41	4.10		1.61	0.01
168720	106 HER	M1 IIIb	1	18:18:10.8	21:56:19	4.94		1.59	-0.01
49331		M1+ Ib-IIa	11	6:45:13.7	-8:56:32	5.05		1.80	0.15
216399		dM2	16	22:49:52.3	22:37:02	8.65		~1.30	~0.00
1013	CHI PEG	M2+ III	1	0:12:00.6	19:55:43	4.80		1.57	-0.03
86663	PI LEO	M2- IIIab	11	9:57:34.3	8:17:05	4.69		1.60	0.00
119228	83 UMA	M2 IIIab	1	13:38:50.5	54:56:03	4.66		1.63	0.03
36389	119 TAU	M2 Iab-Ib	1	5:29:16.7	18:33:31	4.35		2.07	0.42
206936	MU CEP	M2 Ia	1	21:41:58.5	58:33:00	4.10	A	2.33	0.68
173739		M3 V	14	18:42:12.1	59:33:16	8.90	A	1.54	0.07
112300	DEL VIR	M3 III	1	12:53:04.9	3:40:07	3.38	A	1.57	-0.03
133216	SIG LIB	M3- III	12	15:01:08.2	-25:05:12	3.30		1.68	0.08
40239	PI AUR	M3 II	1	5:56:13.3	45:56:04	4.29		1.70	0.10
108903	GAM CRU	M3.5 III	11	12:28:22.7	-56:50:00	1.62	A	1.60	-0.02
175588	DEL2 LYR	M4 II	1	18:52:45.2	36:50:02	4.28	A	1.67	0.04
123657		M4.5 III	12	14:05:55.8	44:05:29	5.26		1.58	-0.06
145713	10 HER	M4.5 IIIa	15	16:09:30.1	23:37:22	5.58		1.57	-0.07
148783	30 HER	M6- III	1	16:26:59.8	41:59:26	5.00		1.54	0.05
207076		M7 III:	1	21:43:56.4	-2:26:40	6.69		1.49	-0.01

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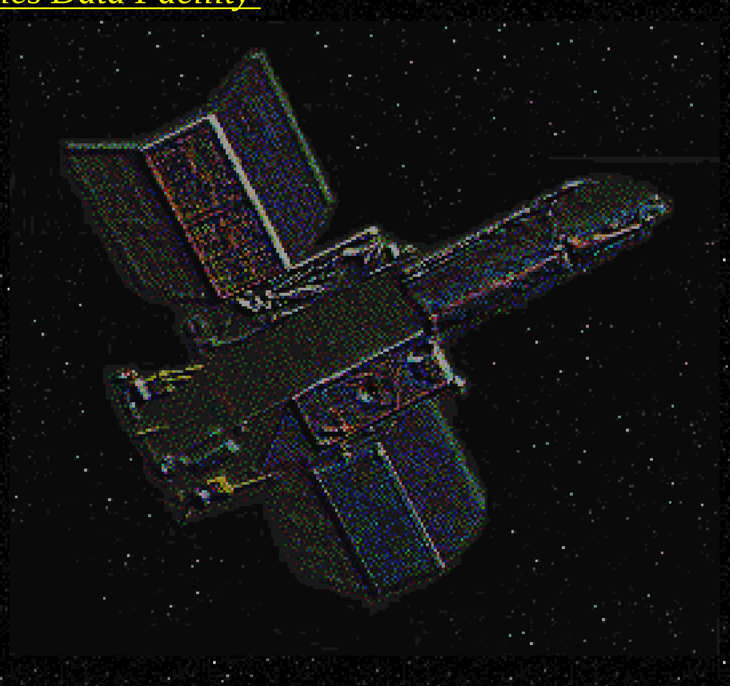
last updated: **Feb. 29, 2000**

Astrophysics Data Facility



IUE

This page contains links to the ADF *IUE* browsers and on-line documentation. The browser pages for a specific *IUE* spectrum can be accessed directly by selecting the camera and entering the EID, e.g., swp 1781, in the **browser selection form.**

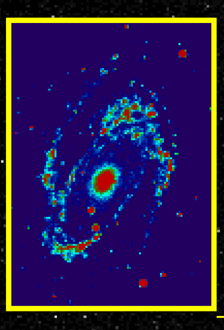
The browsers can also be searched by object, RA and DEC, etc., using **WISARD**.

Information about the Browsers and *IUE* Data in General

- ADF/*IUE* **NEWS**.
- **Overview** of the MX browser pages.
  - NEWSIPS **low dispersion** browser pages.
  - NEWSIPS **high dispersion** browser pages.
- NEWSIPS low dispersion **anonymous ftp site.**
- Known systematic effects in NEWSIPS:
  - **Low dispersion spectra.**
  - **High dispersion combined order spectra**.
  - Reprint of the paper "Science Verification of the *IUE* Final Archive Data Products" (1998, ESA SP-413, *Ultraviolet Astrophysics Beyond the IUE Final Archive*, eds. Wamsteker and Riestra, ESA Pubs. Div., Noordwijk, The Netherlands, p723) as a **gzipped PS file** or an **HTML file**
- **Calibration differences** between the *IUE* NEWSIPS and *HST*-FOS absolute flux scales.
- Construction of **NEWSIPS high dispersion combined order** spectra and noise vectors.
- **General sources** of systematic error in *IUE* data.
- **Miscellaneous** ADF/*IUE* related links.
- Overview of the **SI browser**

Related Project and Data Analysis Homepages

- **STScI/*IUE* archive** homepage.
- **NASA/Goddard *IUE* project** homepage.
- **ESA/Vilspa *IUE* project** homepage.
- **UK/*IUE* project** homepage.
- ***IUE* Data Analysis Center** (*IUE*DAC).
- **PPARC *IUEDR*** data reduction package.



ADF UV/Optical On-Line Resources

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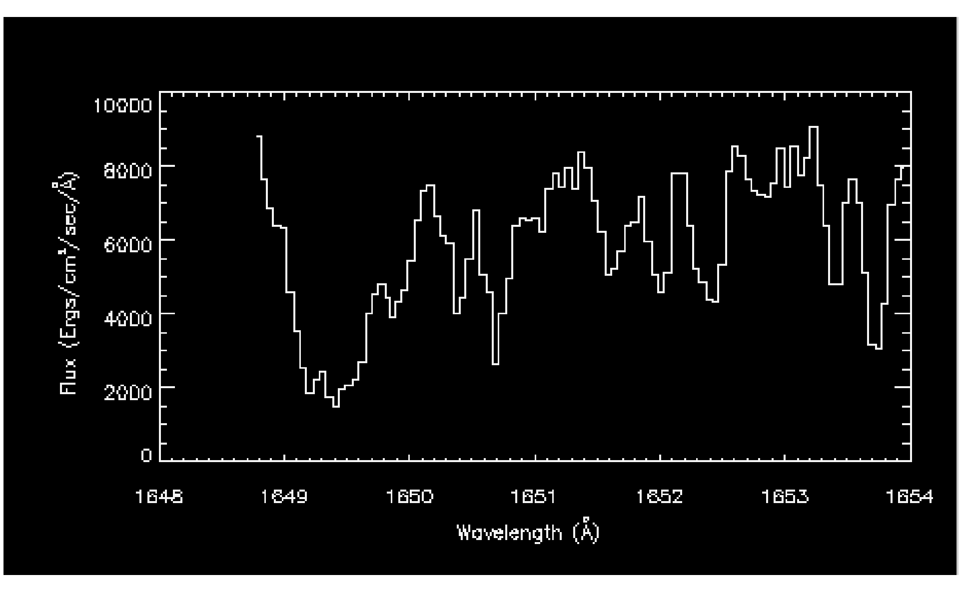
The Alpha Canis Majoris (Sirius) Spectral Atlas



The primary reference for the *Copernicus* Spectral Atlas of Sirius is Rogerson, J. B., (1987ApJS...63..369R). The summary information that follows is taken from that reference.

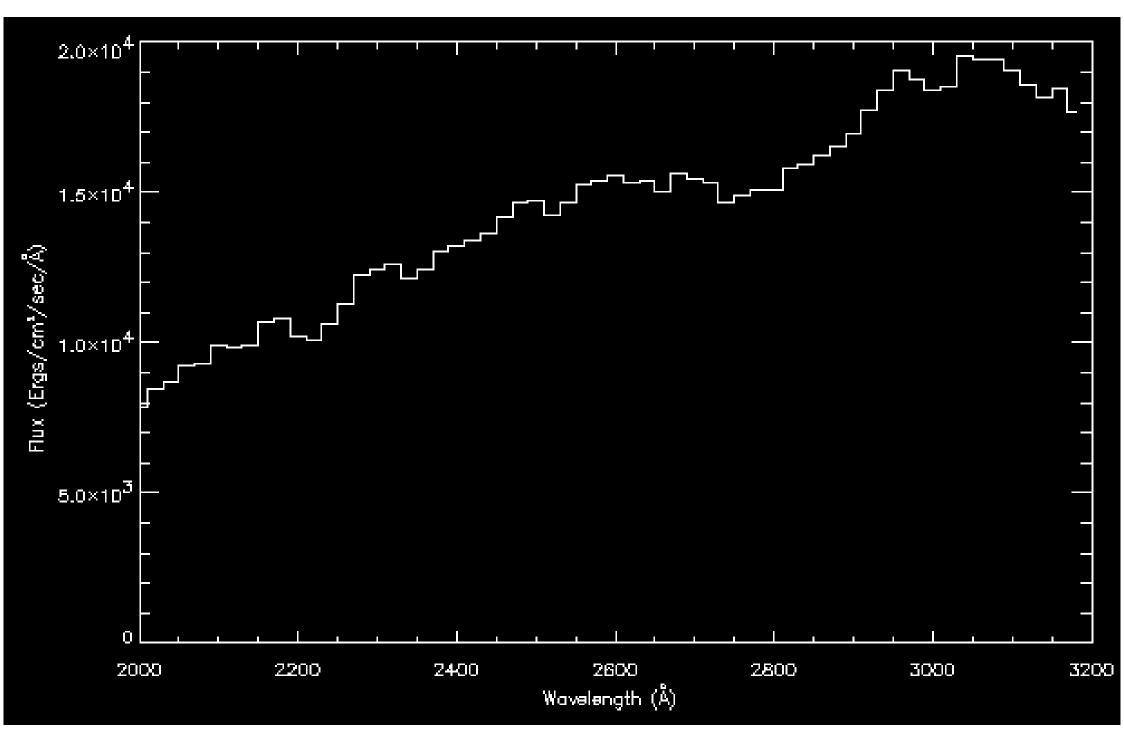
The observations obtained to construct this atlas were obtained primarily during the periods 1977 March 5-8, 1977 March 12-16, and 1977 March 18-April 5. There were several gaps in the coverage of this data; these were filled in with observations obtained during the period 1981 February 8-9. A gap starting at 2292.7 Å was overlooked. The spectral atlas covers wavelengths from 1649 Å to 3170 Å, with a spectral resolution of 0.1 Å. The scans were made in the V1 detector. A complete description of the *Copernicus* science instrument may be found in Rogerson *et al.* (1973ApJ...181L..97R).

Wavelengths were corrected for Doppler shifts due to (a) the heliocentric radial velocity of Sirius, (b) the Earth's heliocentric velocity in the direction of Sirius, and (c) the component of the satellite geocentric orbital velocity in the direction of Sirius. The counts from the source were corrected for counts due to cosmic rays and trapped charge particles, guiding errors and scattered light within the spectrometer. No correction was made for the wavelength variations in the spectrometer sensitivity.

The atlas is a compilation of 36 separate scans of specific spectral regions. There are a total of six files, numbered 2-7 (following the original NSSDC file numbering scheme). File 2 contains the counts for the vacuum spectrum; file 3 contains the normalizing continuum and scattered light values for the vacuum spectrum; file 4 contains the line identification table for the vacuum spectrum; file 5 contains the counts for the air spectrum; file 6 contains the normalizing continuum and scattered light values for the air spectrum; and file 7 contains the line identification table for the air spectrum.

FILENAME	ROWS	FIELDS	WVE_FRST	WVE_LST	TYPE
alphacma2.fts	7119	3	1648.786	2005.380	vacuum spectrum
alphacma3.fts	74	3	1645.000	2010.000	norm. cont.
alphacma4.fts	1351	8	1649.20	1999.73	id table vacuum
alphacma5.fts	28062	3	2004.004	3171.556	air spectrum
alphacma6.fts	236	3	2000.000	3175.000	norm cont
alphacma7.fts	4089	8	2000.00	3170.00	id table air

The Alpha Lyrae (Vega) Spectral Atlas



The primary reference for the *Copernicus* Spectral Atlas of Vega is Rogerson, J. B., (1989ApJS...71.1011R). The summary information that follows is taken from that reference.

The observations used to construct this atlas were obtained during 1975 September 12-21 and 1975 September 27-October 7. Several gaps were filled in on 1976 April 20. The spectral atlas covers wavelengths from 2000 Å to 3187 Å (first order), with a spectral resolution of 0.1 Å. The scans were made in the V1 detector. A complete description of the *Copernicus* science instrument may be found in Rogerson *et al.* (1973ApJ...181L..97R).

Wavelengths were corrected for Doppler shifts due to (a) the heliocentric radial velocity of Vega, (b) the Earth's heliocentric velocity in the direction of Vega, and (c) the component of the satellite geocentric orbital velocity in the direction of Vega. The counts from the source were corrected for counts due to cosmic rays and trapped charge particles, guiding errors and scattered light within the spectrometer. No correction was made for the wavelength variations in the spectrometer sensitivity.

The atlas is a compilation of 23 separate scans of specific spectral regions. There are four files relating to these observations. The file numbers start at 2 following the original naming convention used at NSSDC. File 2 contains the air spectrum; file 3 is the normalization continuum and estimated scattered light; file 4 contains the equivalent flux values in 20 Å intervals in ergs/cm²/s/Å; and file 5 contains the table of line identifications.

FILENAME	ROWS	FIELDS	WVE_FRST	WVE_LST	TYPE
alphalyr2.fts	28724	3	2000.612	3187.295	air spectrum
alphalyr3.fts	239	3	2000.0	3187.0	norm. cont. & scat.
alphalyr4.fts	61	4	2000.0	3200.0	equiv. flux
alphalyr5.fts	2167	8	2000.8	3186.8	line id table

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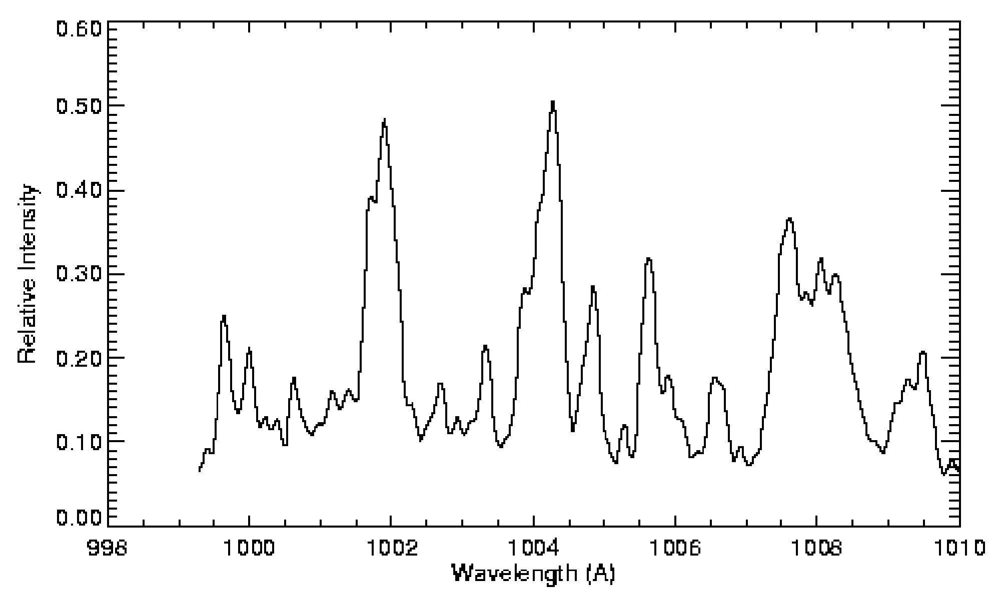
The Beta Orionis Spectral Atlas



The primary reference for the *Copernicus* Spectral Atlas of Beta Orionis is Rogerson, J. B. and Upson, Walter L., (1982ApJS...49..353R). The summary information that follows is taken from that reference.

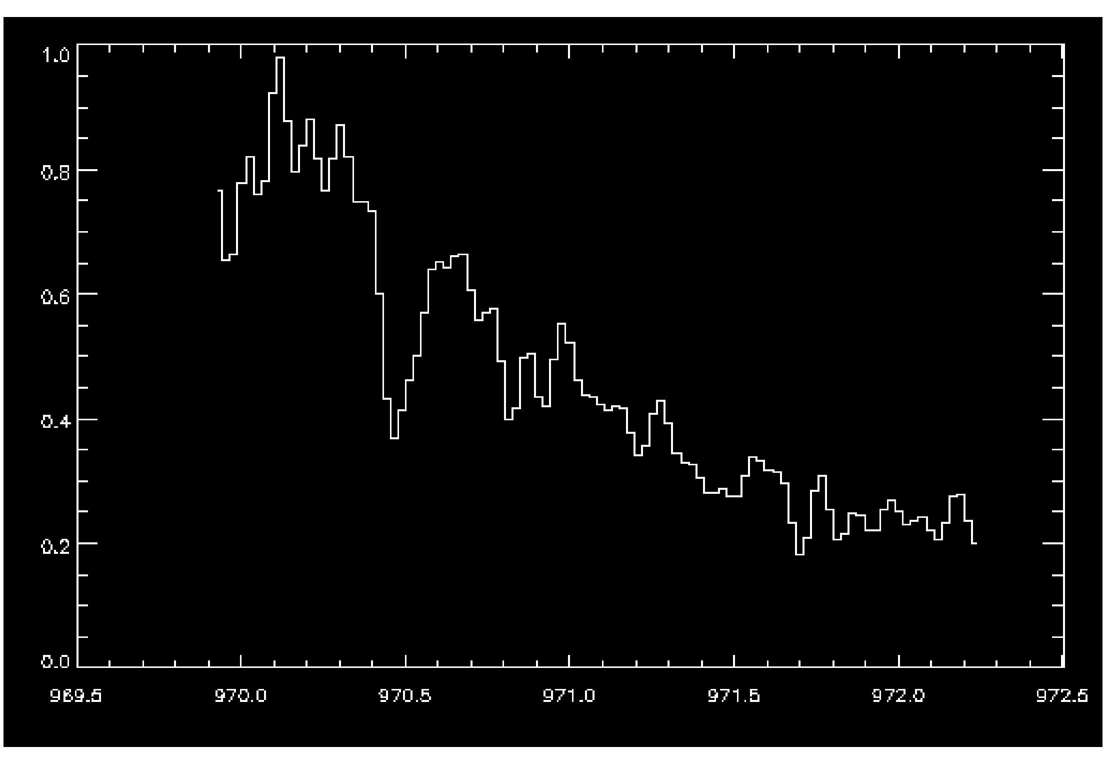
The observations obtained to construct this atlas were obtained primarily during the periods between 1974 December 3-17. Additional observations were obtained on 1975 January 19 to replace some unusable measurements. The spectral atlas covers wavelengths from 999.3 Å to 1420.1 Å (second order) and 1416.5 Å to 1561.1 Å (first order), with a spectral resolution of 0.1 Å in first order and 0.05 Å in second order. The scans were made in the U1 detector. A complete description of the *Copernicus* science instrument may be found in Rogerson *et al.* (1973ApJ...181L..97R)

Wavelengths were corrected for Doppler shifts due to (a) the heliocentric radial velocity of Beta Ori, (b) the Earth's heliocentric velocity in the direction of Beta Ori, and (c) the component of the satellite geocentric orbital velocity in the direction of Beta Ori. The counts from the source were corrected for counts due to cosmic rays and trapped charge particles, guiding errors and scattered light within the spectrometer. No correction was made for the wavelength variations in the spectrometer sensitivity.

The atlas is a compilation of 29 separate scans of specific spectral regions. There are a total of two files relating to the Beta Ori Spectral Atlas. File 1 is the 2nd order continuum and estimated scattered light, and file 2 is the first order continuum and estimated scattered light.

FILENAME	ROWS	FIELDS	WVE_FRST	WVE_LST	TYPE
betaori1.fts	19987	6	999.281	1420.151	2nd order
betaori2.fts	2779	6	1416.514	1561.120	1st order

The Gamma Pegasi Spectral Atlas



The primary reference for the *Copernicus* Spectral Atlas of Gamma Pegasi is Rogerson, J. B., (1985ApJS...57..751R). The summary information that follows is taken from that reference.

The observations used to construct this atalas were obtained during four different periods: 1978 July 27, 1978 October 30-November 22, 1978 December 16-22, and 1979 December 10-17. The spectral atlas covers wavelengths from 969.9 Å to 1430.2 Å (second order) and 1417.0 Å to 1501.4 Å (first order), with a spectral resolution of 0.1 Å in first order and 0.05 Å in second order. The scans were made in the U1 detector. A complete description of the *Copernicus* science instrument may be found in Rogerson *et al.* (1973ApJ...181L..97R).

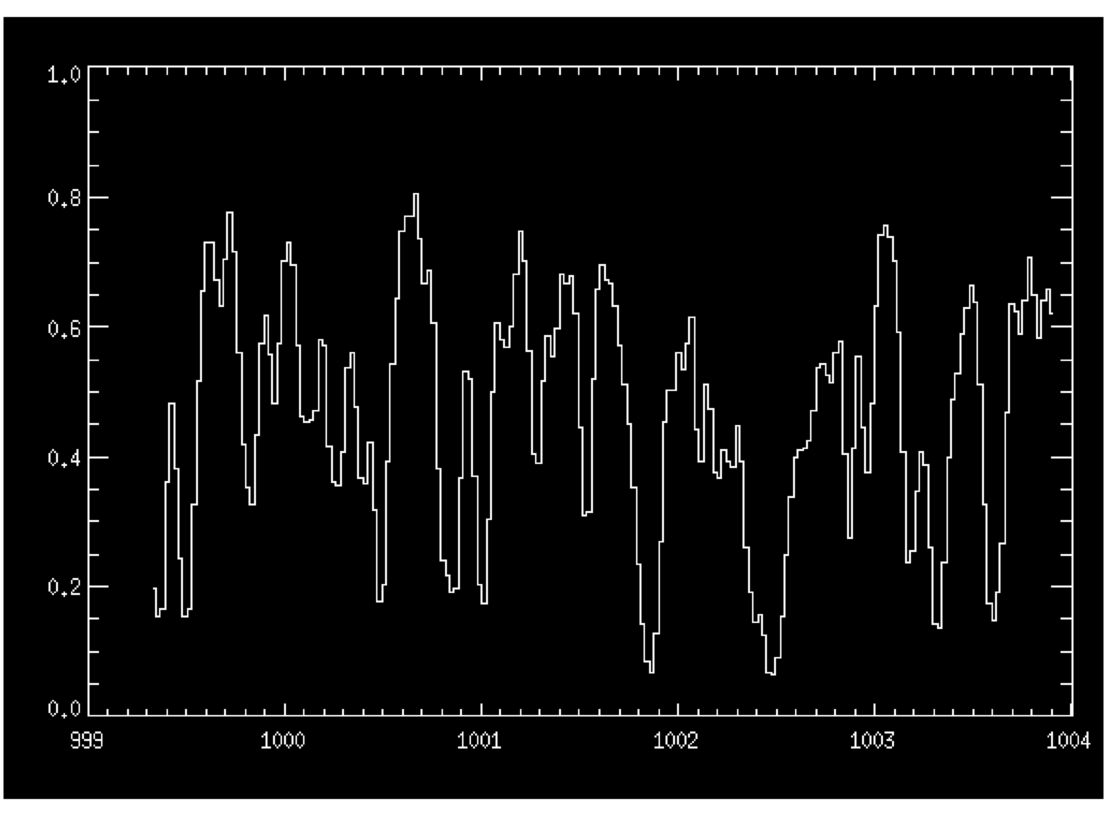
Wavelengths were corrected for Doppler shifts due to (a) the heliocentric radial velocity of Gamma Peg, (b) the Earth's heliocentric velocity in the direction of Gamma Peg, and (c) the component of the satellite geocentric orbital velocity in the direction of Gamma Peg. The counts from the source were corrected for counts due to cosmic rays and trapped charge particles, guiding errors and scattered light within the spectrometer. No correction was made for the wavelength variations in the spectrometer sensitivity.

Since this star is a Beta Cephei variable with a period of 0.1518 days and velocity amplitude of 5 km/s, an additional correction was made for the Beta Cephei type variations. This correction is described in detail in the text.

The atlas is a compilation of 22 separate scans of specific spectral regions. There are a total of two files relating to the Gamma Peg Spectral Atlas. File 1 is the 2nd order spectrum and file 2 is the first order spectrum.

FILENAME	ROWS	FIELDS	WVE_FRST	WVE_LST	TYPE
gampeg1.fts	21699	6	969.932	1430.177	2nd order
gampeg2.fts	1609	5	1417.040	1501.398	1st order

The Iota Herculis Spectral Atlas



The primary reference for the *Copernicus* Spectral Atlas of Iota Hercules is Upson, Walter L. and Rogerson, J. B., (1980ApJS...42..175U). The summary information that follows is taken from that reference.

The observations obtained to construct this atlas were obtained primarily during the periods between 1974 July 11 and September 12. The spectral atlas covers wavelengths from 993.3 Å to 1422.2 Å (second order) and 1417.9 Å to 1467.7 Å (first order), with a spectral resolution of 0.1 Å in first order and 0.05 Å in second order. The scans were made in the U1 detector. A complete description of the *Copernicus* science instrument may be found in Rogerson *et al.* (1973ApJ...181L...97R).

Wavelengths were corrected for Doppler shifts due to (a) the heliocentric radial velocity of Iota Her, (b) the Earth's heliocentric velocity in the direction of Iota Her, and (c) the component of the satellite geocentric orbital velocity in the direction of Iota Her. The counts from the source were corrected for counts due to cosmic rays and trapped charge particles, guiding errors and scattered light within the spectrometer. No correction was made for the wavelength variations in the spectrometer sensitivity.

The atlas is a compilation of 29 separate scans of specific spectral regions. There are a total of two files relating to the Iota Her Spectral Atlas. File 1 is the 2nd order spectrum and file 2 is the first order spectrum.

FILENAME	ROWS	FIELDS	WVE_FRST	WVE_LST	TYPE
iotaher1.fts	20089	6	999.334	1430.177	2nd order
iotaher2.fts	945	6	1417.849	1467.682	1st order

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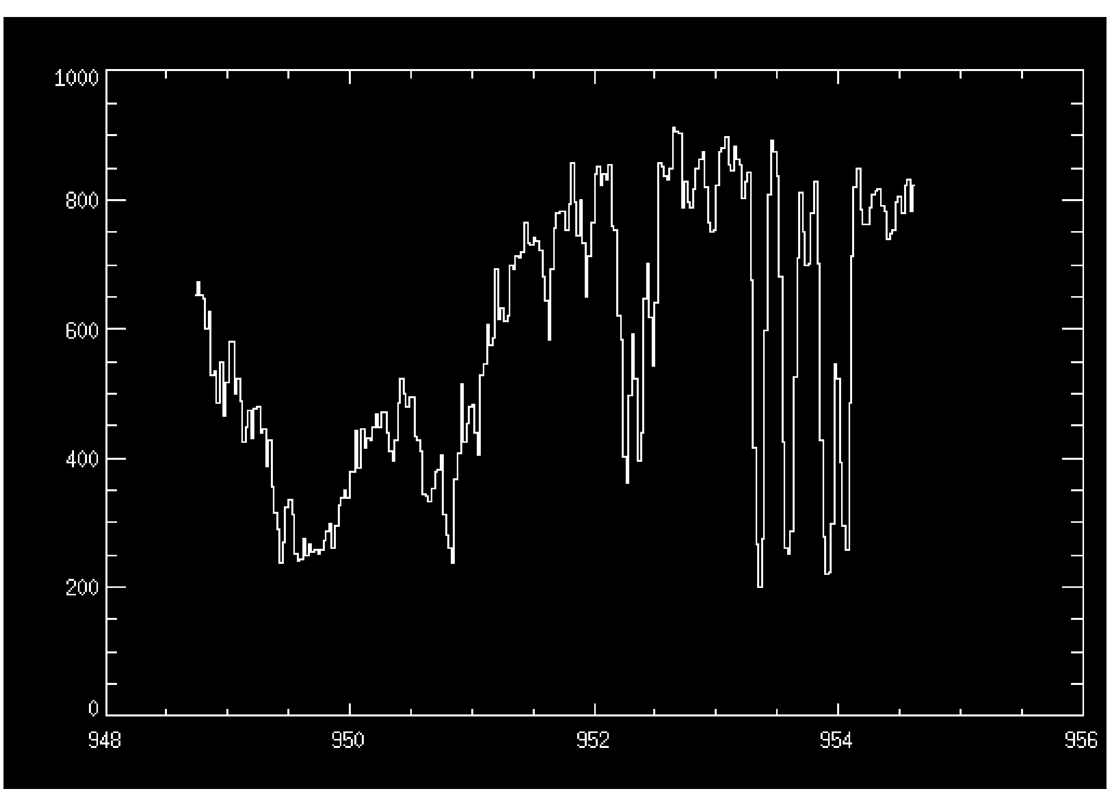
The Tau Scorpii Spectral Atlas



The primary reference for the *Copernicus* Spectral Atlas of Tau Scorpii is Rogerson, J. B. and Upson, Walter L., (1977ApJS...35...37R). The summary information that follows is taken from that reference.

The observations obtained to construct this atlas were obtained primarily during the periods between 1973 July 2 and August 27. The spectral atlas covers wavelengths from 948 Å to 1420.6 Å (second order) and 1418.2 Å to 1560.2 Å (first order), with a spectral resolution of 0.1 Å in first order and 0.05 Å in second order. The scans were made in the U1 detector. A complete description of the *Copernicus* science instrument may be found in Rogerson *et al.* (1973ApJ...181L..97R).

Wavelengths were corrected for Doppler shifts due to (a) the heliocentric radial velocity of Tau Sco, (b) the Earth's heliocentric velocity in the direction of Tau Sco, and (c) the component of the satellite geocentric orbital velocity in the direction of Tau Sco. The counts from the source were corrected for counts due to cosmic rays and trapped charge particles, guiding errors and scattered light within the spectrometer. No correction was made for the wavelength variations in the spectrometer sensitivity.

The atlas is a compilation of 32 separate scans of specific spectral regions. There are a total of two files relating to the Tau Sco Spectral Atlas. File 1 is the 2nd order spectrum and file 2 is the first order spectrum.

ERRATUM: Note that there is a slight wavelength error in both file 2 and the published paper for wavelengths greater than 1499.9 Å. The corrected values are obtained using the relation

W(correct) = 1.0014523 * W(table) - 2.2656.

FILENAME	ROWS	FIELDS	WVE_FRST	WVE_LST	TYPE
tausco1.fts	21780	7	948.735	1420.510	2nd order
tausco2.fts	2721	7	1418.187	1560.372	1st order

OAO-3 "Copernicus" High Resolution Spectral Atlases

During the *Copernicus* mission several stars were observed intensively with the high-resolution spectrometers to obtain as complete wavelength coverage as possible. Ultraviolet high resolution spectral atlases were constructed for six stars: Alpha CMa (Sirius), Alpha Lyr (Vega), Beta Ori (Rigel), Gamma Peg, Iota Her, and Tau Sco.

The atlas data were delivered to GSFC by the Copernicus Project at Princeton University in the early 1980s. The data are now available in FITS binary table format and can be selected from the following table. Each star also has a corresponding journal article describing the details of the extraction and analysis, including identification of spectral features. Summary information on the atlas contents and file descriptions are included on the pages for each atlas.

Star	V	Sp Type	Wavelength (Å)	Resol (Å)	Reference
Alpha CMa	-1.46	A1 Vm	1650-3170	0.10	Rogerson, *Ap.J. Supp*, 63, 369, 1987
Alpha Lyr	0.03	A0 Va	2000-3185	0.10	Rogerson, *Ap.J. Supp*, 71, 1011, 1989
Beta Ori	0.16	B8 Ia	999-1420 1420-1560	0.05 0.10	Rogerson & Upson, *Ap.J. Supp*, 49, 353, 1982
Gamma Peg	2.82	B2 IV	967-1430 1430-1500	0.05 0.10	Rogerson, *Ap.J. Supp*, 57, 751, 1985
Iota Her	3.80	B3 IV	999-1420 1420-1470	0.05 0.10	Upson & Rogerson, *Ap.J. Supp*, 42, 175, 1980
Tau Sco	2.84	B0 V	949-1420 1420-1560	0.05 0.10	Rogerson & Upson, *Ap.J. Supp*, 35, 37, 1977

The files may be read with any FITS reader that supports the binary table format. The IUEDAC procedure IFITSRD is a generic IDL based FITS reader which can be used to read these files.

THE ASTROPHYSICAL JOURNAL SUPPLEMENT SERIES, 113:131–193, 1997 November

The *Extreme Ultraviolet Explorer* Stellar Spectral Atlas

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ABSTRACT

We present an atlas of extreme ultraviolet (EUV) spectra of 95 bright stellar sources observed between 1992 July and 1996 June with the *Extreme Ultraviolet Explorer* (*EUVE*) spectrometers. These data are taken in the short- (SW; 70–190 Å), medium- (MW; 140–380 Å), and long-wavelength bandpasses (LW; 280–760 Å) at roughly 0.5, 1, and 2 Å resolution, respectively. We describe the spectrometers and detail the procedure used to reduce the observational data to spectra. The atlas is grouped by the type of source: O–A stars, F–M stars, white dwarfs, and cataclysmic variables. We present a brief overview of the general nature and EUV spectral distribution of each group and present accompanying notes and individual spectra for each source. We show selected F–M sources in more detail with identifications of the brightest spectral lines illustrating the characteristics of the EUV spectra of stars of various temperatures. The current study is the most complete compilation to date of aggregate spectra of bright EUV stellar sources.

Subject headings: atlases—instrumentation: spectrographs—ultraviolet: stars—white dwarfs

CONTENTS

FOOTNOTES

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§1. INTRODUCTION

The *Extreme Ultraviolet Explorer* (*EUVE*) satellite is a NASA Explorer-class mission devoted to acquiring astronomical data in the wavelength range from 70 to 760 Å. The satellite was launched on 1992 June 7. The *EUVE* science payload consists of three co-aligned, imaging telescopes, a deep survey/spectrometer (DS/S) telescope, and supporting electronic subsystems. A full description of the science instrumentation is presented by Bowyer & Malina (1991) and Welsh et al. (1990).

The three imaging telescopes were designed to survey the entire sky in bandpasses centered at ~100, 200, 400, and 600 Å. The DS/S telescope, which points orthogonally to the imaging telescopes, was designed primarily to collect a strip of deep observations along the ecliptic during the all-sky survey. The Deep Survey (DS) part of this telescope images half of the telescope mirror area in ~100 and 200 Å bandpasses, while the rest of the light is directed to the three spectrometers. All of the science instruments were built under contract from NASA Goddard Space Flight Center by the Space Astrophysics Group, part of the Center for EUV Astrophysics at the University of California, Berkeley. An overview of the mission was presented in Bowyer, Malina, & Marshall (1988) and Bowyer & Malina (1991).

Since the completion of the all-sky survey, the primary focus of the mission has been to acquire spectroscopic observations of specific targets for guest investigators sponsored through a NASA Guest Observer Program. A simultaneous DS image of the target is also obtained with each pointed spectroscopic observation. These data sets are proprietary to the Guest Investigator for 6 months following the observation, after which they are placed in the *EUVE* Archive and become publicly available.

The most recent catalog resulting from the all-sky survey is published in Bowyer et al. (1996). A set of early, brief reviews of some of the scientific results from both imaging and spectroscopic data taken since launch has also been published in Vennes et al. (1995a). Also, see many of the papers in Bowyer & Malina (1996).

In this paper we present an atlas of EUV spectra of 95 stellar sources taken from the *EUVE* Public Archive. In § 2.1, we describe the spectrometers and detail the procedure used to reduce the observational data to spectra. Sections 3–6 contain the atlas, grouped by the type of source: O–A stars, F–M stars, white dwarfs, and cataclysmic variables. For each type, we present a brief overview of the EUV appearance of the objects followed by notes about each source and individual spectra.

§2. THE *EUVE* SPECTRAL ATLAS

§2.1. *Instrumentation and Data Reduction*

§2.1.1. *The EUVE Spectrometers*

EUVE contains three slitless, imaging spectrometers; each receives light from one-sixth of the DS/S telescope collecting area (the other one-half of the light goes to the DS detector). The short-wavelength spectrometer (SW) has a bandpass of 70–190 Å and a resolution of roughly 0.5 Å. The medium-wavelength spectrometer (MW) covers 140–380 Å at roughly 1 Å resolution, and the long-wavelength spectrometer (LW) covers 280–760 Å at roughly 2 Å resolution. For a detailed review of the spectrometer instrumentation, see Abbott et al. (1996) and references therein. We give a brief summary here.

The DS/S telescope uses grazing incidence optics and has a Wolter-Schwarzschild Type II f/3.4 primary with a 40 cm diameter. The spectrometer gratings have variable line spacing and are placed in the converging beam. Each spectrometer has a field of view of 5°.25 in the dispersion direction and 2°.1 perpendicular to it (the latter direction is also known as the imaging direction).

The MW and LW spectrometer bandpasses include the bright geocoronal lines He II 304 Å (in both first and second order) and He I 584 Å. If unrestricted, this resonantly scattered solar radiation would dominate the background of these two spectrometers, seriously degrading the instrument sensitivity. Therefore, wire grid collimators are used to limit the contamination spatially from the diffuse background. The total response function of the collimators is similar to a triangular vignetting function, which restricts the field of view in the dispersion direction to about 0°.3 FWHM, while leaving the field of view in the imaging direction unchanged. The SW spectrometer has no such collimator. To remove out-of-bandpass scattered light further from such sources as the geocoronal H Lyα airglow feature, the spectrometers contain filters. The SW spectrometer contains a single Lexan/boron filter to restrict the throughput at wavelengths longer than 200 Å. The MW and LW spectrometers each have an aluminum filter.

EUVE uses microchannel plate (MCP) detectors for all of its instruments (Siegmund et al. 1984), which provides photon counting and a high efficiency. The detectors have a diameter of 50 mm and a spatial resolution of 120 μm. The detector electronics produce a 2048 × 2048 pixel image with pixels approximately 29 μm on a side, corresponding to 4″.5 in the imaging direction and 11″ in the dispersion direction. The image of the aperture covers a circular region roughly 1750 pixels in diameter (varying slightly from detector to detector).

§2.1.2. *Data Analysis and Display*

All data reduction was performed using the standard software (the EUV package) provided to researchers by the *EUVE* Guest Observer (EGO) Center. This package runs in the IRAF environment (Tody 1986). We used an identical process to that performed at the EGO Center to reduce observations nominally before delivering them to guest investigators, except for the spectral extraction and subsequent steps. We now summarize this process.

The pipeline task CEP in the EUV package was used to remap the detected events to a wavelength and imaging angle (the latter is the angular distance in the imaging direction of a photon from the center of the source). When possible, we used a source position measured from a DS image of the source that was remapped onto the sky. This reduced the possibility of systematic errors from inaccurate target coordinates or telescope flexure. We used the most recent version of the spectrometer wavelength calibration available from the EGO Center, which is detailed in Abbott et al. (1996).

The resulting remapped event list was then filtered to remove times when the data were of lower quality. We removed data taken when the source was blocked by Earth by eliminating all times when the DS/S telescope was pointed in a direction more than 102° from the local spacecraft zenith; this corresponds to an altitude of 365 km above Earth's limb, where atmospheric absorption becomes significant in the LW spectrometer. We removed times of high background rate by eliminating data taken when the detector count rate was above 80 counts per frame in the SW spectrometer, 130 counts per frame in the MW spectrometer, and 150 counts per frame in the LW spectrometer. [5] We discounted intervals when the detectors were turned off by eliminating times when the count rates were less than 3 counts s^{-1} in all of the spectrometers.

The remaining events were binned into a spectral image, which is linear in wavelength along one axis and linear in imaging angle along the other. Where multiple observations of a source were present in the *EUVE* archive, we summed the images from the separate observations into a composite image if doing so substantially improved the signal-to-noise (S/N) ratio of the spectrum. For certain bright continuum sources susceptible to distortions caused by fixed-pattern noise on the detectors, we included only observations that had been carried out using dithering, a technique that reduces the effect of the fixed-pattern noise on the data.

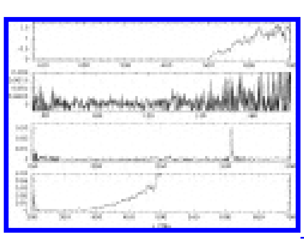
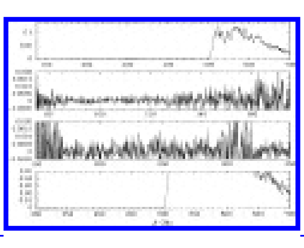
Many *EUVE* sources have a variable flux; examples include binary systems showing orbital variations or eclipses, flaring events in active stellar atmospheres, and effects from stellar rotation. Analysis of the time behavior of the EUV spectrum can lead to important results. In this atlas, however, we show only aggregate spectra, summed in time over one or more observations. In some cases, the detailed descriptions of each source in §§ 3–6 describe some of the published results of timing analysis.

Spectral extraction was done using a simple rectangular aperture. The remapping performed by the CEP task produces spectra that have a nearly constant imaging angle in the spectral image, so it was not necessary to trace the spectra. The spectra chosen for this atlas were all relatively bright, so we centered the aperture by visually locating one or more spectral lines in the spectral image. We summed the pixels in a 24 pixel wide strip centered on the spectrum and subtracted a background formed by averaging the counts in large regions on either side of the spectrum, taking care to avoid including any hot spots or other detector features in the background estimate.

Since the *EUVE* detectors oversample the resolution of the spectrometers in wavelength (containing approximately 7 pixels per resolution element), we blocked or averaged the extracted spectra to improve the S/N. The amount of blocking performed varies among the different types of sources appearing in the atlas and will be described in detail in the figure caption of each spectrum.

We determined the effective exposure time for each observation by computing the total valid time in our data quality filters, correcting for the effects of dead time and primbsching. [6] Because of the filtering, and because the *EUVE* detectors are allowed to turn off independently to prevent damage during times of very high count rate (typically caused by a high background from passage through the South Atlantic Anomaly), most observations have slightly unequal exposure times for each spectrometer.

The three spectra for each source were fluxed by dividing them by their effective exposure times, by the effective area of the appropriate spectrometer, and by their bin widths. *EUVE* spectra contain several overlapping orders. The atlas makes use of two techniques to deal with order effects. For the O–M stars in §§ 3 and 4, flux at second and higher orders in the spectra was simply ignored. In those cases, the higher order features will appear in the spectra with incorrect fluxes (usually underestimated) because of having been divided by the first-order effective areas. For the B stars in Figures 1 and 2, which have no significant flux at short wavelengths, higher order contamination of the spectrum is negligible. In the later spectral types, which are typically dominated by individual emission lines, features in second or higher order are easily identified in the figures because they appear at multiples of the wavelength of bright first-order lines.

 Fig. 1  Fig. 2

In spectra containing bright, relatively smooth continuum emission, including all of the white dwarfs and some of the cataclysmic variables, we have removed second and higher order flux using a bootstrapping algorithm. This technique first estimates the amount of contamination in higher orders from the first-order flux at the smallest wavelengths, subtracts this higher order flux from the spectrum, and then repeats the process using the newly cleaned spectral region. In this way, the algorithm works its way through all spectral orders and all wavelengths. Each subtraction step will add noise to the spectrum, and the cumulative noise added can be substantial at longer wavelengths, so this algorithm is only applied to spectra that have high S/N and for which order contamination is expected to be a problem. When order removal was performed on a source, we averaged the fluxed spectrum, rather than blocking the spectrum before fluxing. We indicate cases in which order removal has been performed in the individual figure captions for the spectra.

For most sources, we display both the individual spectra for each of the three *EUVE* spectrometers and a single, combined spectrum. The latter was formed by seaming together the spectra from the individual spectrometers (trimming away the overlap). The seam points were nominally at 170 and 350 Å, but for certain spectra, we moved a seam point to avoid placing a seam at the exact wavelength of a spectral feature. Some figures depart more drastically from the nominal display organization and will be described in their captions.

Where individual spectra from each spectrometer are shown, we have scaled the spectra so that each is shown over a wavelength range twice that of the next lower wavelength spectrometer. This means that, when no order removal has been applied, features in second and fourth order can easily be identified directly beneath their first-order counterparts in the lower wavelength spectrometers (although blends with first-order lines at the same wavelengths are also possible). See, for example, several lines in the LW spectrometer in Figure 42. As mentioned above, lines in second and higher order will have incorrect fluxes.

This scaling also keeps the plotted size of a resolution element on the page constant over all of the spectrometers in a figure. However, the actual resolution in angstroms increases by a factor of 2 from the SW to MW and MW to LW spectrometers. For example, when an unresolved emission line appears in two different spectrometers, the integrated flux over the line will be the same in both cases, but the line in the longer wavelength spectrometer will be twice as wide and half as high.

§2.2. *Selection and Organization of the Atlas*

We selected sources for inclusion in this atlas primarily by the quality of the *EUVE* spectrum and by their availability in the *EUVE* Public Archive. Our subjective quality criteria were applied by visually examining all public spectra of the appropriate spectral types and eliminating those that had extremely noisy spectra or no detection at all. We have included all selected sources that were public by 1996 June and a less complete selection of interesting sources that have become public up to 1997 February 1.

Because all of these data are taken from the public archive, the complete data sets are also available to any interested researchers by contacting the *EUVE* Public Archive. The authors intend to make all of the extracted spectra presented here available through the World Wide Web as well.

In Table 1 we list all of the sources included in this atlas. The positions are taken from the Second Source *EUVE* Catalog (Bowyer et al. 1996) and from An All-Sky Catalog of Faint EUV Sources (Lampton et al. 1997), except for Altair, HD 149499B, U Gem, and VV Pup, which are from SIMBAD. No *EUVE* names are given for these four sources since they were not detected during the all-sky survey and are not listed in the EUV source catalogs. The exposure times are the average of the SW, MW, and LW exposure times, which can differ slightly as described in the previous section. The observation dates represent the periods during which the observations took place, but the source may not have been continuously observed during the period. Where multiple dates are listed, we have summed the individual observations.

The subsequent sections of this paper contain the atlas, organized by spectral type and by subcategories within each type. However, white dwarfs have been ordered primarily by composition, given that they display extreme variations in photospheric abundances, and only secondarily are ordered by effective temperature. For each section, we present an overview of the EUV characteristics of sources of that type, followed by descriptions of the individual sources and the spectra themselves.

The O–M star spectra are displayed as a combined spectrum over the entire *EUVE* bandpass at the top, with individual SW, MW, and LW spectra below. For six bright, representative cases of emission-line sources, we show the individual spectra in more detail with identifications of prominent lines. The white dwarf spectra are shown as a combined spectrum at the top and one to three individual spectra below. As the white dwarf flux distribution is frequently concentrated in only part of the *EUVE* bandpass, we have omitted individual spectra possessing no significant flux. The source PG1159-035 was observed by *EUVE* and deemed important enough to deserve a description in the text, but the spectrum was undetected and is not shown. All of the cataclysmic variable spectra in the atlas also show flux concentrated in only one or two *EUVE* spectrometers and so are displayed in groups for easier comparison. For the source EX Hya, we have also shown a figure from the analysis by Hurwitz et al. (1997) to emphasize the time-variable nature of many of the spectra in this atlas, which is otherwise hidden by the use of aggregate spectra.

FOOTNOTES

[5] One frame equals 1.024 s.

[6] Primbsching is an algorithm that optimizes the use of a limited telemetry bandwidth among many different detectors with different background rates and, therefore, affects the live time of each, which is accounted for in the calculation of effective exposure time.

§3. O–A STARS

EUVE was not expected to detect early-type stars (O–A) both because they lack an active corona and and because they have large intervening hydrogen column densities as a result of their great distance. However, some predictions stated that the strong stellar winds of these stars, which produce the observed X-ray emission, would also emit in the EUV and that, therefore, *EUVE* would detect the earliest stars with low columns (MacFarland et al. 1991). In fact, many early-type stars were detected in the all-sky survey in the 100 Å Lexan/boron band. However, most, if not all, of the flux could be explained by an out of band UV leak in the Lexan/boron filter (λ > 2200 Å; McDonald et al. 1994).

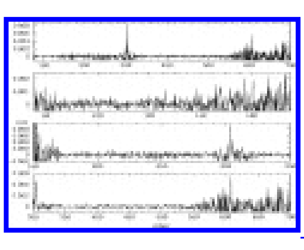
Fortunately, a direction exists in which the intervening hydrogen column is less than 10^{18} cm^{-2} out to a distance farther than 200 pc (Welsh 1991). The constellation Canis Majoris lies in this direction and contains the two early B stars ϵ and β CMa, both of which were detected by their *photospheric* emission in the long-wavelength 600 Å tin bandpass. Indeed, ϵ CMa turned out to be the brightest EUV source in the sky (Vallerga, Vedder, & Welsh 1993).

We discuss the spectra of these two stars as they represent the early class with hot photospheres ($\approx$23,000 K) and EUV-emitting wind. *EUVE* also detected the A star Altair. Active binaries that contain a B star (e.g., Algol) and A-type stars with a white dwarf companion are discussed in subsequent sections.

ϵ *Canis Majoris*.—This B2 II star, 186 pc distant, is the brightest EUV source in the sky because of its intrinsic brightness and the fact that it is in a direction of very low interstellar hydrogen column density (9×10^{17} cm^{-2}). The radiation in both the H Lyman continuum and He I continuum (shortward of 504 Å) is found to be significantly greater than predicted by LTE and non-LTE model atmospheres, though the predicted strong absorption lines are present. In the ϵ CMa spectrum (Fig. 1), the S/N is high enough that all structure in the spectrum above 504 Å is real and not due to statistical variations. Absorption lines of highly ionized species in the hot wind of ϵ CMa are also observed. The strong He II Lyα emission at 304 Å is due to recombination of He^{++}, which is produced by the X-ray and EUV flux in the outer atmosphere and wind. The spectrum also shows strong O III 374 Å line emission produced by the Bowen fluorescence mechanism, an effect not previously observed in the spectra of hot stars. Detailed analysis of the spectrum can be found in Cassinelli et al. (1995). See Figure 1.

β *Canis Majoris*.—This is the only other early-type star (besides ϵ CMa) whose photospheric emission was detected by *EUVE*. A slightly higher interstellar neutral hydrogen column density (2×10^{18} cm^{-2}) results in a spectrum suppressed at the longer wavelengths compared to ϵ CMa. The photospheric continuum is inconsistent with current LTE and non-LTE stellar atmosphere models, though not as much so as ϵ CMa. Most of the same photospheric absorption lines are observed along with the absorption lines from the hot stellar wind. The lack of emission below 504 Å, especially at the He II recombination line at 304 Å, indicates a higher interstellar neutral helium column in this direction ($\approx 2 \times 10^{18}$ cm^{-2}), which implies the existence of a cloud of gas in this line of sight with ionized hydrogen and neutral helium. Detailed analysis of the spectrum can be found in Cassinelli et al. (1996). See Figure 2.

Altair (HD 187642).—This is an A7 V star, the only object in this class for which *EUVE* spectroscopic data exist. Its EUV spectrum reveals the unambiguous detection of the He II 303.78 Å line. Altair's atmosphere contains coronal material with temperatures of 10^5 K. There is no evidence for high-temperature material in the corona of Altair. See Figure 3.

 Fig. 3

§4. F–M STARS

Late-type stars, stars with spectral types F and later, constitute the largest group of EUV sources. The EUV emission from late-type stars consists of line and continuum emission formed over a broad range of temperatures (10^5 through 2×10^7 K or higher). The emission originates in the transition region and corona. One of the most interesting topics of modern astrophysics is *how the photospherically cool stars can have such high temperatures in their outer atmosphere*. The generally accepted theory posits that the heating processes originate in the convection zone where the combined effects of convection and rotation give rise to magnetic fields. The magnetic field energy dissipates in the upper atmosphere, which is in turn heated to high temperatures. The parameters of the convection zone and the stellar rotation rate are, therefore, the key elements that influence the emission. As a result of the large temperature range visible in the EUV, we can study many elements in different stages of ionization. For example, the He II lines can be used as a diagnostic in the low-temperature range, while the hottest line that can be detected is Fe XXIV. The fast-rotating dMe stars and RS CVn binaries show some of the highest temperatures (10^7 K), whereas the spectra of solar-type stars are dominated by lower coronal temperatures (a few 10^6 K).

In addition to presenting spectra of the brightest late-type stars in the standard format for this atlas in Figures 4–40, we also show selected sources in more detail, with identifications of the brightest spectral lines, in Figures 41–46. Procyon and α Cen AB illustrate the characteristics of the coolest EUV spectra; V711 Tau and σ^2 CrB represent the hottest spectra. Capella and ϵ Eri are intermediate cases.

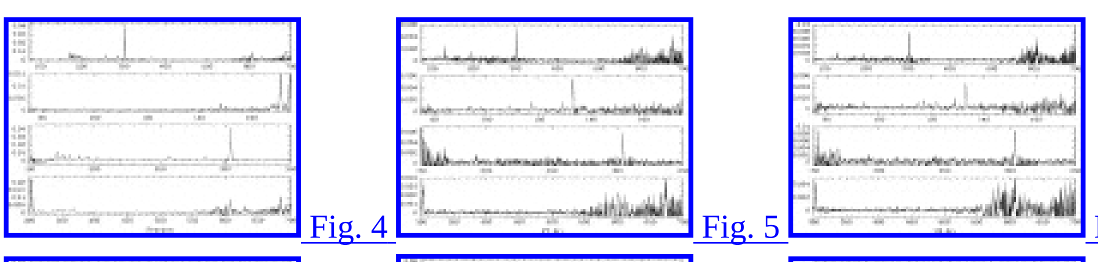


Fig. 4 Fig. 5 Fig. 6

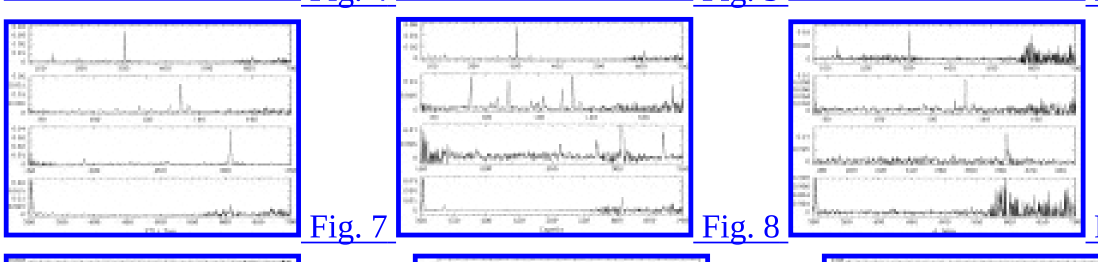


Fig. 7 Fig. 8 Fig. 9

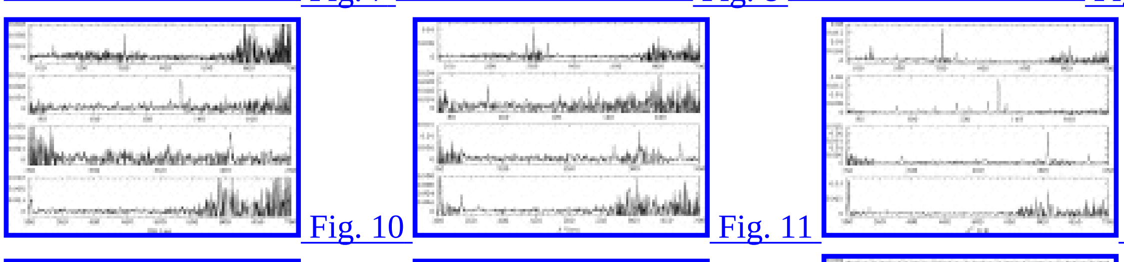


Fig. 10 Fig. 11 Fig. 12

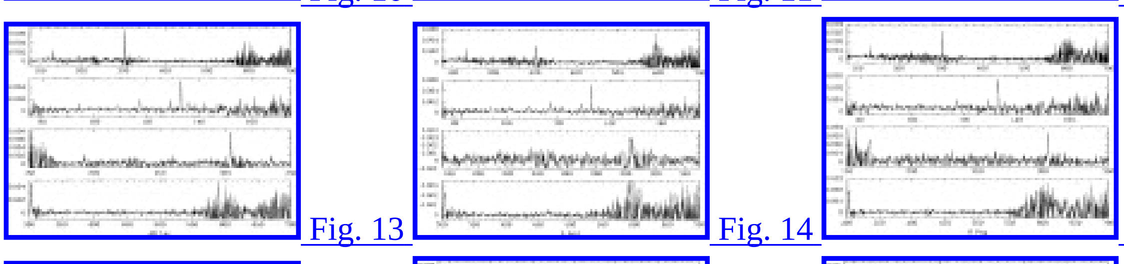


Fig. 13 Fig. 14 Fig. 15

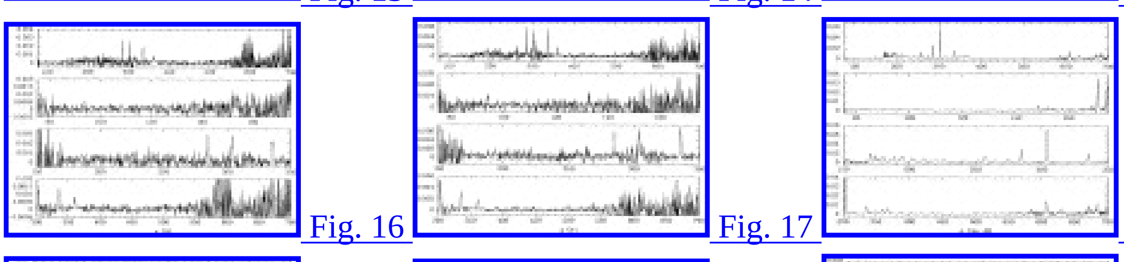


Fig. 16 Fig. 17 Fig. 18

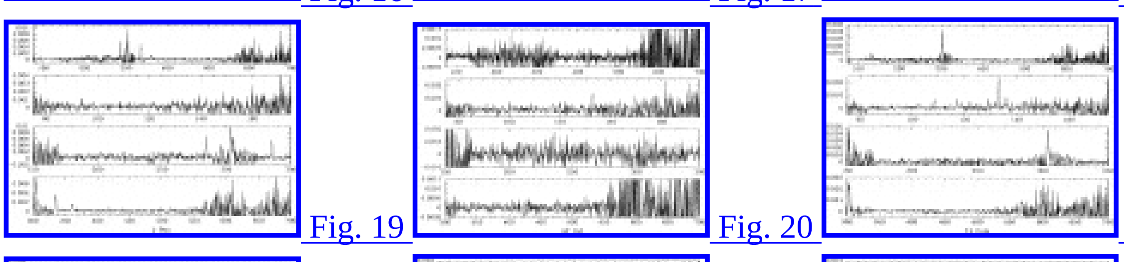
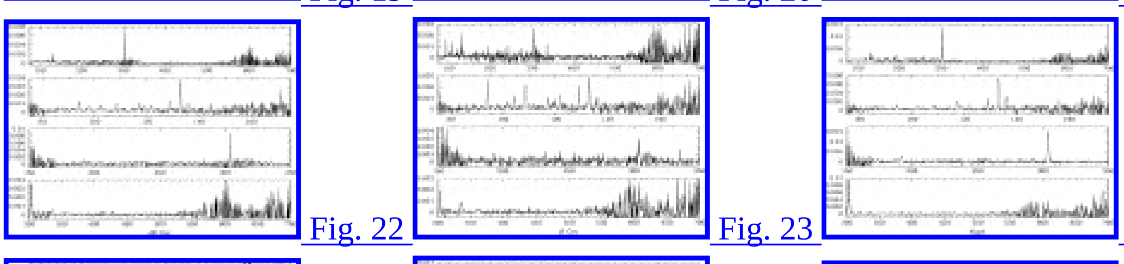


Fig. 19 Fig. 20 Fig. 21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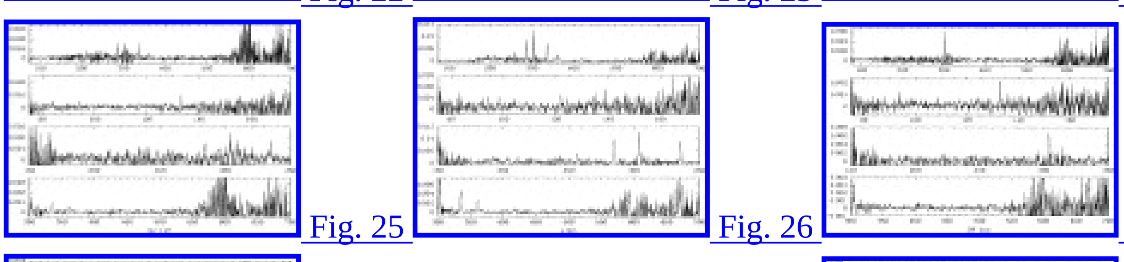


Fig. 25 Fig. 26 Fig. 27

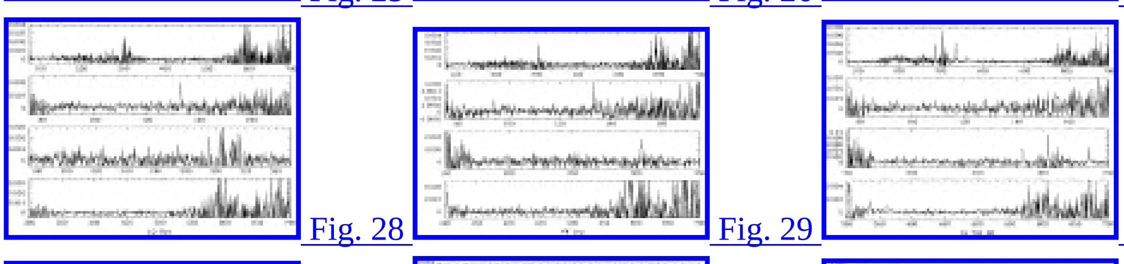


Fig. 28 Fig. 29 Fig. 30

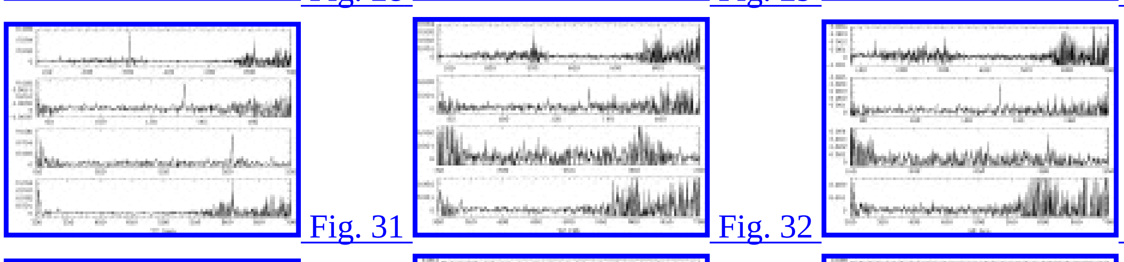


Fig. 31 Fig. 32 Fig. 33

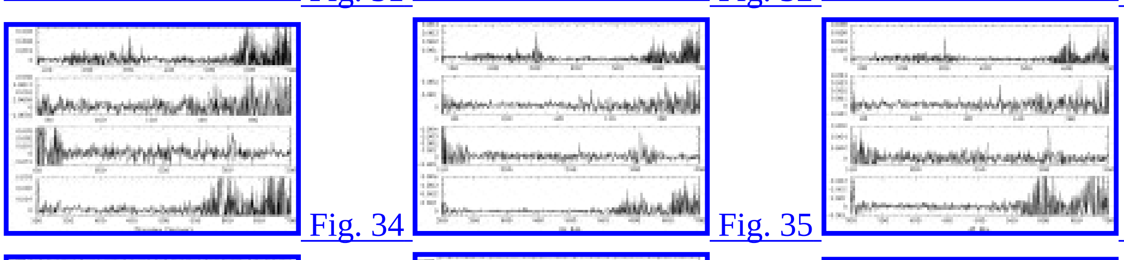


Fig. 34 Fig. 35 Fig. 36

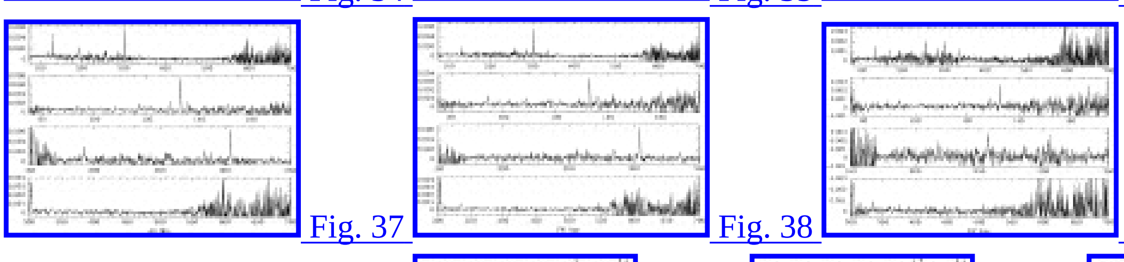


Fig. 37 Fig. 38 Fig. 39

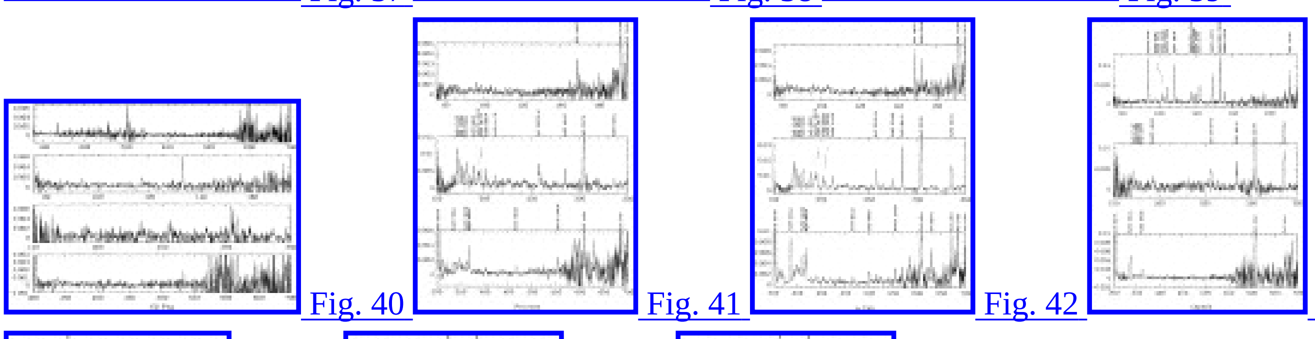


Fig. 40 Fig. 41 Fig. 42 Fig. 43

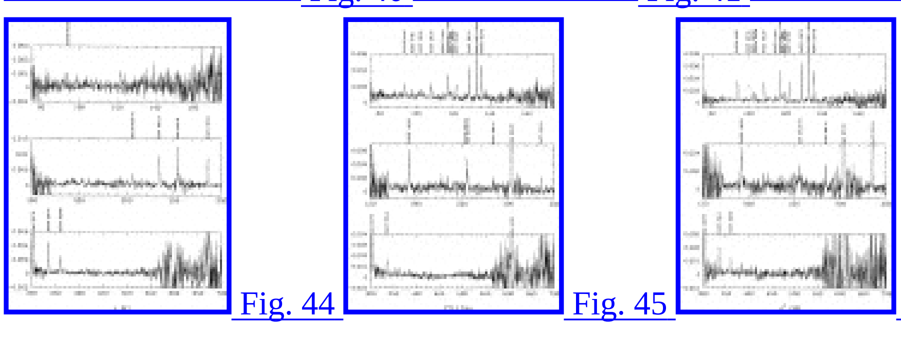


Fig. 44 Fig. 45 Fig. 46

§4.1. *F Star*

Procyon (HD 61421).—This is an F5 subgiant at a distance of 3.5 pc. The *EUVE* spectrum of Procyon is similar to that of α Cen in terms of the emission lines identified. The Procyon spectrum is typical for that of a relatively "cool" coronal source. This is best reflected by its emission-measure distribution, presented by Drake et al. (1995), which shows no evidence for coronal temperatures in excess of 3×10^6 K. Line ratios of Fe X (Foster, Edelstein, & Bowyer 1996) and Fe XIV (Schmitt et al. 1996a) indicate coronal electron densities in the range of $10^{9.2}$–$10^{9.5}$ cm^{-3}. Schrijver, van den Oord, & Mewe (1994) have argued that the nonzero continuum or pseudocontinuum flux present in the short wavelength spectrum is due to resonance scattering in the corona of Procyon. Their interpretation has been recently disputed by Schmitt, Drake, & Stern (1996b). See Figures 4 and 41.

§4.2. *RS CVn Binaries*

RS CVn binaries are, generally, detached systems with periods of 1–20 days that rotate quasi-synchronously with their orbital period. They typically comprise a late-type (G or K) subgiant or giant with a late-type main-sequence subgiant companion. They are chromospherically active, and their optical spectrum shows strong emission reversals in the Ca II H and K lines. The chromospheric and coronal activity of these systems arises from strong magnetic fields generated by the dynamo action. The catalog of chromospherically active binaries of Strassmeier et al. (1988) lists 104 RS CVn systems, 38 of which were detected during the *EUVE* all-sky survey in the Lexan/boron band (Mitrou et al. 1996). Several RS CVn binaries have been observed spectroscopically with *EUVE*. Here we present a range of spectra for the brightest of these systems.

VY Arietis (HD 17433 or GJ 113.1).—This is a single-line spectroscopic binary with an orbital period of 13.2 at a distance of 13 pc. It comprises an early K subgiant and a low-mass companion that has not been detected. Photometric observations indicate a rotation period of 17.4, which implies that the system is not in synchronous rotation (Bopp et al. 1989). The EUV spectrum of VY Ari is dominated by high-temperature lines of iron (Fe XVIII–XXIV) and the He II (304 Å) line is the strongest line in the spectrum. A weak short-wavelength continuum is also present. See Figure 5.

UX Arietis (HD 21242).—This is a double-line spectroscopic binary with spectral types of G5 V/KO IV and an orbital period of 6.438. The rotational period of the system is approximately equal to the orbital period. UX Ari is highly active. Strong Hα and Ca II H and K emission show that the cooler KO subgiant is the more active component of the binary. The system shows photometric variations in the *V* band, attributed to the rotation modulation of starspots on the surface; optical flares have recently been detected (Henry & Newsom 1996). UX Ari is the brightest RS CVn binary in the *EUVE* Lexan/boron band. The EUV spectrum is dominated by high-temperature lines of Fe XVIII–XXIV and He II. A strong continuum is also evident in the short-wavelength spectrum. A preliminary analysis of the DS data obtained during the spectroscopic observations indicates sinusoidal like variations in the Lexan/boron (Antonopoulou et al. 1997). However, these variations have no significant effect on the spectrum. See Figure 6.

V711 Tauri (HR 1099 or HD 22468).—This is a double-line RS CVn binary with spectral types of G5 IV/K1 IV and an orbital period of 2.84. It has been observed by *EUVE* on several occasions, as it is one of the primary wavelength calibration targets. This object is an extremely active RS CVn binary and has shown the most energetic stellar flare on an evolved magnetically active star, with a total energy of approximately 10^{38} ergs (Henry & Hall 1991). The system is known to exhibit rotational modulation in optical and UV wavelengths. Broadband *EUVE* observations (DS, 60–180 Å) have indicated a rotational modulation of about 40% with a minimum occurring at orbital phase $\phi = 0.5$ (Drake et al. 1994). The spectrum presented here is a composite of two spectra and is affected by rotational modulation as well as flare activity. High-ionization stages of Fe (Fe XV–Fe XXIV) and a very strong short-wavelength continuum are detected. This star and σ^2 CrB are the hottest coronae presented in this atlas. See Figures 7 and 45.

Capella (α Aurigae or HD 34029).—This is a double-line spectroscopic binary with G0 III/G5 III spectral type components. Although the spectrum is dominated by highly ionized iron (Fe XV–Fe XXIV), lower ionization stages are also present (e.g., Fe IX–Fe X) as well as the He II 256 Å and 304 Å lines. Plasma with a continuous distribution of temperatures from 10^5 to $10^{7.2}$ K is, therefore, present in the transition region/corona of Capella. A detailed study has been presented by Dupree et al. (1993). Ayres (1996) has suggested that the EUV spectrum of Capella is the blend of coronal emission from both components. See Figures 8 and 43.

σ Geminorum (HD 62044).—This is a single-line spectroscopic binary 59 pc distant. The visible primary has been classified as K1 III, whereas the invisible secondary is probably a main-sequence star of spectral type G or K. It has a photometric period of 19.41, which is very close to the orbital period of 19.6. The optical spectrum of the system exhibits strong emission in the Ca II H and K lines, whereas the Hα absorption is filled in by emission from the chromosphere. Coronal observations of σ Gem obtained with the medium- and low-energy detectors on *EXOSAT* show evidence for two temperature components: one at $\sim 5 \times 10^6$ K, which dominates the X-ray emission, and another at $\sim 40 \times 10^6$ K (Singh et al. 1987). The high-temperature coronal lines (Fe XVIII–XXIV) in the EUV spectrum of σ Gem show that the emission is dominated by temperatures of 10^7 K, somewhat higher than those indicated by the low-resolution *EXOSAT* results. Although the *EUVE* wavelength range contains no line diagnostic for temperatures higher than 2×10^7 K, the strong short-wavelength continuum indicates that higher temperatures exist in the corona of σ Gem. See Figure 9.

DH Leonis (HD 86590).—This is a triple, short-period RS CVn system with spectral types of K0, K7, and K5, an orbital period of 1.07, and distance of 33 pc. In an analysis of *EUVE* spectra of DH Leo, Stern & Drake (1995) report relative strengths of the density-sensitive Fe XXII 117 Å to 114 Å line ratio that are consistent with the low-density limit. See Figure 10.

ξ Ursae Majoris (HD 98230).—This is the B component of the visual binary ADS 8119. It is a single-line spectroscopic binary with an orbital period of 3.98. Dempsey et al. (1993) have presented *ROSAT* PSPC spectra for 44 RS CVn binaries of which ξ UMa has the lowest X-ray luminosity. A two-temperature fit with components at 2×10^7 K and 1×10^6 K seems to fit the PSPC data. The EUV spectrum of ξ UMa contains no evidence for such a high-temperature component. Emission lines of Fe XV–Fe XX and He II appear in the spectrum. The highest temperature implied by a weak Fe XX line is 8 $\times 10^6$ K. This object is the coolest of the RS CVn systems in the present sample. See Figure 11.

σ² Coronae Borealis (HD 146361).—This is a double-line spectroscopic binary system with an orbital period of $1^{\rm d}.1$. This is a very active binary consisting of two dwarfs with spectral types F6 and G0. Although the luminosity class of the two components is not typical of an RS CVn system, it displays many RS CVn–like characteristics and is therefore included in this class of objects. Based on *EUVE* all-sky survey data, Mathioudakis et al. (1995) recently examined the activity versus rotation relation in the EUV in a group of 73 nearby stars. The most active object in the sample was σ² CrB. Its EUV spectrum displays the highest ionization stages of Fe (up to Fe XXIV) and a strong short-wavelength continuum. This object and V711 Tau are the hottest coronae presented in this atlas. A preliminary analysis of the spectrum (Brown 1994) shows that it is a composite of flare and quiescent emission. See Figures 12 and 46.

AR Lacertae (HD 210334).—This is a double-line spectroscopic and eclipsing RS CVn binary of spectral type G2 IV/K0 IV with an orbital period of $1^{\rm d}.98$. The *EUVE* observation of AR Lac lasted approximately 3 days (effective exposure time of 90,000 s), or 1.5 orbital periods. The EUV spectrum of AR Lac is also dominated by lines of Fe XV–Fe XXIV, He II 304 Å, and a short-wavelength continuum. An initial analysis of the *EUVE* Deep Survey and spectroscopic data has been presented by Walter (1996). Using the Stern et al. (1995) technique for fitting the line-to-continuum ratio, Walter derives an iron abundance of 0.4 $M_\odot$ for the corona of AR Lac. The spectrum presented here is the composite spectrum including flare and quiescent data, both in and out of eclipse. See Figure 13.

λ Andromedae (HD 222107).—This is a G8 III–IV star and constitutes the primary of a single-line spectroscopic binary. It has a rotational period of ≈54 days, much longer than its $20^{\rm d}.5$ orbital period. Mewe & Schrijver (1986) analyzed *EXOSAT* observations of λ And and concluded that the data can be described by a two-temperature component at 8×10^6 K and 20×10^6 K. The low-temperature component is consistent with the detection of Fe XVIII–XXIII in the EUV spectrum. Given the high-temperature component present in the *EXOSAT* data, it is somewhat surprising that the Fe XXIV line is not present in the medium wavelength spectrum. However, λ And was detected in Al/Ti/C during the *EUVE* all-sky survey (Mitrou et al. 1996). See Figure 14.

II Pegasi (HD 224085).—This is a single-line spectroscopic binary of spectral type K2 IV–V with an orbital period of approximately $6^{\rm d}.72$. It is known for its very high activity rate in all regions of the electromagnetic spectrum. Despite several attempts in various spectral regions, its companion has yet to be detected. The coronal emission, therefore, originates from the K2 primary. Emission lines of Fe XX–Fe XXIII, He II 304 Å, and a short-wavelength continuum are apparent in the EUV spectrum. See Figure 15.

§4.3. *G Dwarfs*

κ Ceti (HD 20630).—This is a G5 dwarf at a distance of 9.6 pc. κ Ceti has been considered as a solar twin, but it is rotating faster than the Sun (a period of $9^{\rm d}.4$) and therefore is much more active. The strongest lines in the EUV spectrum of κ Ceti are Fe XV–XVI and He II. A weak Fe XVIII feature is also detectable at 93.92 Å, thus indicating the presence of material with temperatures up to 6×10^6 K. See Figure 16.

χ Orionis (HD 39587).—This is a G0 V star at a distance of 9.7 pc. It has a rotational period of $4^{\rm d}.7$ and therefore is more active than the Sun. It is, in fact, considered one of the younger solar twins (Haisch & Basri 1985). The EUV spectrum of χ Ori includes lines of Fe XV–XXIV as well as He II (303.78 Å), with the strongest emission at Fe XV and Fe XVI suggesting a significant coronal temperature component at log $T = 6.4$. The spectrum of χ Ori has been presented in detail by Haisch, Drake, & Schmitt (1994). See Figure 17.

α Centauri AB (HD 128620 or HD 128621).—This is a binary with spectral types G2 V and K1 V located at 1.3 pc. The spectral and activity parameters of the G2 V star make it very similar to the Sun. α Cen is the primary *EUVE* wavelength calibration target. Its spectrum contains ionization stages of Fe IX–XVI as well as lines of other species such as Ni XI (148.37 Å), Ni XII (152.15 Å), He II (256.30 Å), He II (303.78 Å), Mg IX (368.07 Å), Ne VII (465.22 Å), Si XII (499.41 Å), and O V (629.73 Å). The emission-measure distribution of α Cen has been presented by Mewe et al. (1995) and shows continuous emission from plasma below 5×10^6 K, with a broad peak at 3×10^6 K and a tail extended to 5×10^5 K. Several line ratios in the EUV spectra can be used for electron density diagnostics. For example, the line ratios of Fe X 175.26 Å/174.53 Å and 175.26 Å/174.24 Å imply densities of $10^{9.1}$ cm^{-3}; this value is consistent with the one determined from Fe XIV 219.12 Å/211.32 Å and 219.12 Å/211.08 Å (Keenan 1996; Foster et al. 1996). See Figures 18 and 42.

ξ Bootis (HD 131156).—This is a binary system comprising two dwarfs (G8 V + K4 V) located at a distance of 6.7 pc. The brightest component of the binary (G8 V) has a rotational period of $6^{\rm d}.2$. This is one of the few G dwarfs sufficiently bright in the extreme ultraviolet that high-quality spectra can be obtained. Lines of He II and Fe XV–Fe XX are the strongest in the EUV spectrum, which implies a maximum coronal temperature of 10^7 K. See Figure 19.

§4.4. *G Giants*

AY Ceti, also known as 39 Cet (HD 7672).—This is a single-line binary comprised of a G5 IIIe primary and a white dwarf secondary. AY Cet has a circular orbit with a period of 57 days, which is different from its photometric period of 78 days (Fekel & Eitter 1989). The presence of several high-ionization Fe lines in the short-wavelenth spectrum (e.g., Fe XVIII–Fe XXIII) suggests a temperature exceeding a few million K. Schrijver et al. (1995) present a thorough analysis of AY Cet, including a DEM curve. See Figure 20.

31 Comae Berenices (HD 111812).—This is a rapidly rotating single G0 giant with a projected rotational velocity of ∼ 80 km s^{-1} and an estimated rotational period of ≲5 days. In the H-R diagram, the object is located in the Hertzsprung gap. The EUV spectrum of 31 Com is dominated by high-temperature transitions of Fe XIX–XXIII, thus indicating a maximum coronal temperature of 10^7 K. An extensive analysis of 31 Com has been presented by Ayres & Brown (1994), Ayres (1996), and Dupree, Brickhouse, & Hanson (1996). See Figure 21.

§4.5. *Pre–Main-Sequence Star*

AB Doradus (HD 36705).—This is a K0–K2 IV–V star, located at approximately 20 pc. It is one of the fastest rotating late-type stars with a period of $0^{\rm d}.51$. This object is known to exhibit clouds of neutral hydrogen supported high above the photosphere in a manner similar to solar prominences. AB Dor is a pre–main-sequence star, the only object in this class for which high-quality EUV spectra exist. As a result of the very high activity, the EUV spectra are dominated by the highest ionization stages of Fe (Fe XV–XXIV), the He II lines, and a relatively strong short-wavelength continuum. A thorough analysis of the AB Dor spectra have been presented by Rucinski et al. (1995). See Figure 22.

§4.6. *K Giant and Subgiants*

β Ceti (HD 4128), a nearby red giant (K0 III, 16 pc).—This is a single active star and is a member of a class of coronally active "clump" giants (Ayres et al. 1994). See Figure 23.

Algol (β Persei or HD 19356).—This is the prototypical eclipsing binary system with a period of $2^{\rm d}.87$. It is comprised of a B8 V star and a K2 IV subgiant. The EUV spectrum of the system is typical of a high-temperature corona with the highest ionization stages of Fe (Fe XV– Fe XXIV) and the He II 304 Å line dominating the spectrum. The K2 IV corona is widely accepted as the source of the EUV emission from Algol. A short-wavelength continuum (80–120 Å) is a well-pronounced feature in the EUV spectrum. A thorough investigation of Algol has been presented by Stern et al. (1995). The relatively low line-to-continuum ratio indicates a [Fe/H] coronal abundance of 15%–40% of the solar photospheric abundance. See Figure 24.

§4.7. *K Dwarfs*

GJ 117.—This is a dK2 star at a distance of 8 pc. It is one of the few objects in its class with a strong Li I line in the optical spectrum. The high Li abundance (log $N_{\rm Li} = 2.50$) suggests that the object is very young, possibly less than a few million years, and comes from the Scorpio-Centaurus complex (Cayrel de Strobel & Cayrel 1989). The youth is consistent with its small rotational period of $6^{\rm d}.6$. The *EUVE* all-sky survey results give a low Lexan/boron to Al/Ti/C ratio for GJ 117, which indicates that it is a relatively soft coronal source (Mathioudakis et al. 1995). Emission lines of Fe XIV–XX are apparent in the EUV spectrum of the source where the strongest transitions are those of Fe XV (284.15 Å) and Fe XVI (335.41, 360.80 Å) formed at temperatures of ∼2×10^6 K. See Figure 25.

ϵ Eridani (GJ 144 or HR 1084).—This is a chromospherically active, K2 V, nearby dwarf with a distance of 3.29 pc. The most prominent spectral lines are He II at 256 Å and 304 Å, and Fe XVI at 336 Å and 360 Å. Schmitt et al. (1996c) report the detection of emission lines attributable to Fe in the ionization stages, Fe IX to Fe XXI, thus covering a rather large temperature range from less than 10^6 K to 10^7 K. They also have a density determination using line ratios of Fe XIII and Fe XIV resulting in coronal densities for ϵ Eri that are similar to solar active region densities. See Figures 26 and 44.

BF Lyncis (HD 80715).—This is a double-lined spectroscopic binary and one of the brighter members of BY Dra system with $m_v = 7.63$. The system consists of two nearly identical K2 V–K3 V dwarfs with an orbital period of $3^{\rm d}.8025$ and a distance of 29 pc. Stern & Drake (1996) showed that the Fe XXIII/XX feature is prominent, and other ionization stages from XV and XXII are also present, thus indicating a relatively hot corona. See Figure 27.

LQ Hydrae and VW Cephei.— LQ Hya (YZC 11 3651) is a young, single K dwarf (K0 Ve) with $m_v = 7.80$. The star displays extreme chromospheric activity as well as a large and variable spot distribution. See Figure 28. VW Cep is a W UMa–type contact binary and is also a component of a visual binary. See Figure 29. VW Cep is a system with known large flares. Both stars' EUV spectra feature Fe XX–XXIII as well as strong He II lines.

GJ 702AB (HD 165341).—This is a visual binary system comprising two K dwarfs (K0 V/K5 V) at a distance of 5 pc. The orbital period of the binary is 88 yr, whereas the brighter component has a rotational period of $19^{\rm d}.7$. The *EUVE* all-sky survey results have shown that it has a low Lexan/boron to Al/Ti/C ratio, thus indicating that it is a relatively soft coronal source (Mathioudakis et al. 1995). The strongest line in the EUV spectrum is He II 304 Å. The dominant Fe lines are Fe XV–XVI transitions indicating a maximum coronal temperature of ∼3×10^6 K. Several weak features in the 170–200 Å range are most likely attributed to Fe X–XIII. No lines could be positively identified in the short-wavelength spectrum. See Figure 30.

§4.8. *M Dwarfs*

YY Geminorum.—This is a late-type (M1 Ve) eclipsing spectroscopic binary system with flare activity. The He II line is prominent in the EUV spectrum of YY Gem as is Fe XX–XXIII. See Figure 31.

YZ Canis Minoris (GJ 285).—This is a nearby dMe star located at a distance of 6.2 pc. It has a rotational period of $2^{\rm d}.78$ and, therefore, is one of the most active flare stars. *EUVE* spectroscopic observations of YZ CMi were obtained in 1993 February 25–27 and 1994 December 21 and 24. The spectrum presented here is the composite of both data sets. However, note that the second data set was affected by a flare (Robinson et al. 1997). The EUV spectrum of the source is dominated by ionization stages of Fe XVI–Fe XXIII. See Figure 32.

AD Leonis (GJ 388).—This is an active dM4.5e flare star located at 4.9 pc. It has a rotational period of $2^{\rm d}.7$ and is one of the brightest EUV sources in its class. During the *EUVE* spectroscopic observations, which took place in 1993 March, two large flares occurred. The EUV spectrum presented here is a composite of the flare and quiescent states. It is dominated by Fe XV–XXIV and the He II lines. A weak, short-wavelength continuum is also apparent. A detailed analysis and interpretation of the data set has been presented by Cully et al. (1996) and Hawley et al. (1995). See Figure 33.

Proxima Centauri (α Cen C or V645 Cen).—This is the nearest known star to the Sun at a distance of 1.3 pc. This M5 V flare star is the faintest member of the α Cen triple star system. Prox Cen is a flare star that is chromospherically active with strong Mg II emission. This star is of great importance to magnetic dynamo theory because it is expected to have a fully convective envelope (Guinan & Morgan 1996). See Figure 34.

GJ 644 (Wolf 630).—This is a dwarf flare star. It is a member of a visual binary system with $m_v = 9.8$ and spectral type M4. The EUV spectrum indicates a strong He II line. See Figure 35.

AT Microscopii (Gl 799A or 799B).—This is a visual binary system in which both components are assigned the same spectral type, dM4.5e, and it probably forms a triple system with the dMe star AU Mic situated $1^{\circ}.3$ away. AT Mic is 8.8 pc distant. Monsignori Fossi et al. (1995a) studied the model of the coronal differential emission measure (DEM) as a function of temperature. The DEM shows a minimum at 10^6 K and a maximum at 10^7 K. The prominent lines in the AT Mic spectrum are due to highly ionized iron (Fe XVIII–Fe XXIII) formed at temperatures $6.7 \lesssim \log T \lesssim 7.1$. See Figure 36.

AU Microscopii (HD 197481).—This is a well-known flare star, at a distance of 8.8 pc. It is a rapidly rotating M2 Ve star and is suspected to be a spectroscopic binary with a small amplitude variability and a period of $4^{\rm d}.865$. The *EUVE* spectra were obtained in 1992 July and 1993 July, and a large-scale flare was observed during this time. The spectra here represent the composite of flare and the quiescent emission. In the short-wavelength range, Fe XXII (117.2 Å), Fe XXI (128.7 Å), and Fe XXIII (132.86 Å) have been observed, while the prominent lines in the medium-wavelength spectrum are high-temperature Fe XXIV (192.02 Å) as well as low-temperature He II (303.78 Å) chromospheric lines. See Figure 37. A detailed study of temperature, density, and emission measure of AU Mic is shown by Monsignori Fossi et al. (1996).

FK Aquarii.—This is a BY Draconis star with a pair of dM2e stars and a photometric period of $4^{d}.08$. It lies at a distance of 7.7 pc. Spectral differences in the "quiescent" and "active" states of the EUV spectrum suggest possible differences in the plasma density structure, as Stern & Drake (1996) show. See Figure 38.

EV Lacertae (GJ 873).—This is an active dM4.5e flare. This star is known for producing extreme flares at both optical and X-ray wavelengths (Ambruster et al. 1995). See Figure 39.

EQ Pegasi (Gl 896AB).—This is a visual binary comprised of two M dwarfs with spectral types dM4e and dM5e. The separation of the binary is $3''.7$ and, therefore, cannot be resolved by *EUVE*. The coronal emission is, however, dominated by Gl 896A, the brighter component in the binary. As is the case with the vast majority of flare stars, the EUV spectrum of the source is dominated by Fe XV–Fe XXIV lines and He II 256 Å, He II 304 Å. During the spectroscopic observations, two flares with a duration of approximately 15 hr were detected. A detailed analysis of the 1993 August 29–30 observation has been presented by Monsignori Fossi et al. (1995b). See Figure 40.

For six bright, representative cases of emission-line sources, we show the individual spectra in more detail with identifications of prominent lines. See Figures 41, 42, 43, 44, 45, and 46.

§5. WHITE DWARFS

Single white dwarfs (WDs) are the second most numerous category of EUV sources discovered to date, comprising nearly a third of the cataloged objects. They are extremely luminous EUV emitters, having been detected at distances of up to 400 pc. The copious EUV flux produced by white dwarfs is simply thermal emission from their photospheres. Shipman (1979) recognized that for hot white dwarfs with essentially pure hydrogen atmospheres, the opacity at short EUV wavelengths is very small, which allows radiation to escape from very hot, deep layers of the atmosphere. At 100 Å, for example, the flux of a 50,000 K pure H white dwarf exceeds that from a blackbody of the same effective temperature by more than 6 orders of magnitude.

In addition to being fascinating objects in their own right, white dwarfs have long been appreciated as laboratories in which we can study the physics of matter under conditions not achievable in terrestrial laboratories. (A recent review of the physics of white dwarfs may be found in Koester & Chanmugam 1990.) Their extreme compactness, with about half the mass of the Sun occupying a volume comparable to that of Earth, results in very interesting interior physics, which will not be discussed here. Their observable properties are largely determined by their surface gravity, which is typically 4 orders of magnitude stronger than in the Sun. Schatzman (1949, 1958) pointed out that such high gravity should result in white dwarf atmospheres consisting almost purely of the lightest dominant atmospheric constituent because of rapid gravitational settling of the heavier elements, thereby explaining the observational fact that most white dwarfs have either nearly pure hydrogen or helium atmospheres. White dwarfs in which hydrogen is the dominant constituent are referred to as DA's, based on the nondetectability in optical spectra of elements other than hydrogen. Those with mostly He atmospheres, which are hot enough to be detected in the EUV, are designated DO white dwarfs. Another category of degenerate stars, which are usually grouped with white dwarfs but can be regarded as pre–white dwarfs because they are still contracting to the white dwarf sequence, are the PG 1159 (GW Vir) objects. These objects have atmospheres mostly consisting of He and C (Werner, Heber, & Hunger 1991).

In addition to the gravitational settling that works to produce monoelemental atmospheres, the hotter white dwarfs have extremely intense radiation fields. The effect of the strong radiative fluxes is to levitate selectively some elements, even against the extremely strong gravitational fields present (Vauclair, Vauclair, & Greenstein 1979; Vauclair 1989). The greatest effects on the emergent flux resulting from trace heavy elements are seen in the EUV. Therefore, it was the initial *EUVE* spectra of hot DA white dwarfs that finally confirmed that elements other than helium were the long-sought source of excess opacity detected photometrically in hot DA's. Detailed analysis of the EUV spectra now enables us to study the interplay between gravitational settling and radiative levitation under a wide range of physical conditions in white dwarfs.

Because the white dwarfs are intrinsically luminous continuum sources, they also provide a means of characterizing the state of the interstellar matter along the lines of sight to the white dwarfs. When observable, the flux longward of 504 Å can be used to infer the neutral hydrogen column density. The 504 Å edge gives a direct measurement of the He I column density for WDs with low column densities, while the 206 Å He I resonance feature serves the same function for objects with higher column densities. The 228 Å edge allows the determination of the He II column density. Thus, for white dwarfs that are not complicated by uncertain trace element abundances and that have measurable flux longward of 228 Å, the EUV spectra may be used to determine H I, He I, and He II abundances, thereby fully characterizing the ionization balance in the part of the ISM that lies along that line of sight.

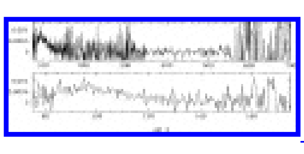
§5.1. *DA White Dwarfs*

The DA white dwarfs may generally be grouped into three categories. With only a couple of exceptions, those cooler than about 50,000 K have pure H atmospheres, with heavy elements being undetectable even in EUV spectra. Representative objects in this category include HZ 43, GD 71, and GD 153. Above about 50,000 K, radiative support produces detectable amounts of heavy elements in nearly all DA's. The general trend is for abundances to increase with increasing temperature and decreasing gravity. In principle, a continuous range of trace element abundances is expected to be observed. In fact, though, presumably fortuitously, the hot DA white dwarfs with detectable amounts of trace heavy elements that have been observed spectroscopically tend to be found in two groups. The first group, typified by G191-B2B and Feige 24, consists of stars with quite high trace element abundances that are readily identifiable by fluxes that peak in the MW spectrometer bandpass, while very little flux is in the SW spectrometer.

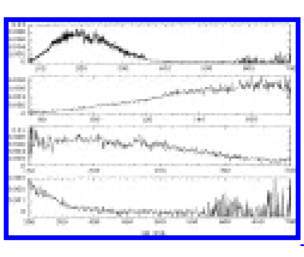
The second group has moderate trace element abundances and is typified by objects such as PG 1123+189 and PG 1234+482. These stars are much less heavily absorbed and have appreciable SW flux with discrete features detectable in well-exposed spectra.

§5.1.1. *Pure Hydrogen DA White Dwarfs*

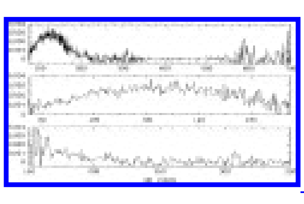
GD 2 (WD 0004+330).—This star, with an effective temperature of 49,360 K and log g = 7.63 (Finley, Koester, & Basri 1997), lies in the region where the transition occurs from pure H atmospheres to atmospheres with significant abundances of trace elements. Therefore, we wish to determine whether trace heavy elements are detectable in the EUV spectrum of GD 2. Unfortunately, this star is quite faint, so that discrete features cannot be seen in the spectrum. It also has a high interstellar H I column (4.8 × 10^{19} cm^{-2} per Diamond, Jewell, & Ponman 1995), the consequence of which is that no flux is detected longward of about 125 Å. Therefore, the overall shape of the spectrum cannot be used to determine trace element abundances. However, with good optical limits on the effective temperature and gravity, the overall flux level in the EUV spectrum may be used to jointly constrain trace element abundances and the interstellar column. See Figure 47.

 Fig. 47

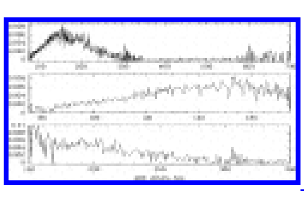
GD 659 (WD 0050-332).—This star definitely lies within pure H temperature range, with T_{eff} = 35,820 K (Finley et al. 1997). It has a moderate column, such that some flux is detected even in the short-wavelength end of the LW spectrometer. The spectrum includes the interstellar He I λ206 features as well as a significant interstellar He II λ228 edge. Holberg et al. (1995) fitted the EUV spectrum, including these features, to determine the interstellar H I, He I, and He II columns. See Figure 48.

 Fig. 48

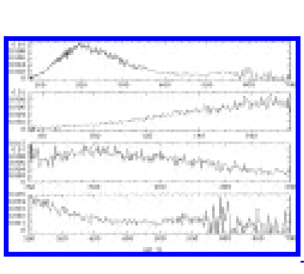
HD 15638B (WD 0226-615).—This star, the white dwarf companion to HD 15638A, was detected as an EUV source by the WFC and identified as a white dwarf by Landsman, Simon, & Bergeron (1993), who determined that the effective temperature was between 40,500 and 52,000 K, while log g was in the range of 7.35–8.3. Landsman et al. also determined the spectral type of the primary to be F6 V. Barstow et al. (1994a) determined the white dwarf parameters using *IUE* and *Voyager* data and the photometric distance for the F companion, obtaining T_{eff} = 53,500 K and log g = 8.2. For these values, Barstow et al. noted that the EUV photometry required the presence of trace absorbers. However, with a somewhat cooler effective temperature, the observed EUV spectrum is consistent with a pure H atmosphere. See Figure 49.

 Fig. 49

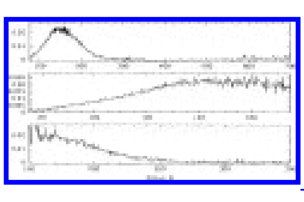
2RE J0515+324.—This is a DA white dwarf companion to an F4 V star, HD 33959C, and was identified as the optical counterpart on the basis of *IUE* observations by Hodgkin et al. (1993). No analysis of the EUV spectrum has been published as yet. See Figure 50.

 Fig. 50

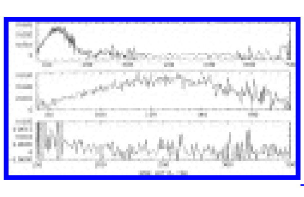
GD 71 (WD 0549+158).—This is a 32,750 K (Finley et al. 1997) pure H DA with very low interstellar columns. Significant flux is seen in all three *EUVE* spectrometer channels. The EUV spectrum was extensively analyzed by Dupuis et al. (1995), who determined the H I and He I columns and obtained an upper limit for the He II column. Barstow, Holberg, & Koester (1994b) had earlier compared the EUV spectrum to stratified models, in which a layer of hydrogen overlies a layer of helium with which it is in diffusive equilibrium, in order to determine whether evidence of helium existed. They found that the observed spectrum was indistinguishable from that of a pure hydrogen atmosphere. See Figure 51.

 Fig. 51

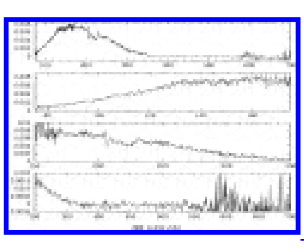
Sirius B.—This star is historically important as the third white dwarf discovered, and the first to have its mass determined Boss (1910), thereby demonstrating the degenerate nature of white dwarfs. Sirius B is near the cool end of the EUV-detectable DA range and is reasonably bright only because it is a mere 2.66 pc distant (Gliese & Jahreiss 1988). In this temperature range (approximately 25,000 K), the intrinsic stellar flux is the result of the combined effects of the steep Wien tail of the Planck function and the decreasing opacity of neutral hydrogen toward shorter wavelengths. The result is that the flux drops from below the Lyman edge to a minimum around 350 Å and then rises to a narrow peak around 150 Å. The 350 Å flux is only about 0.5% of the 150 Å flux (in photons cm^{-2} s^{-1} $Å^{-1}$) and, thus, is essentially undetectable with *EUVE* because of the contribution of the flux peak in higher spectral orders. The intrinsic flux is as high at 800 Å as it is at the 150 Å peak. Hence, if the H I column to the Sirius system is as low as 3.4 × 10^{17} cm^{-2}, as estimated by Bertin et al. (1995) based on D I column measurements, detectable flux could be present longward of about 600 Å along with about equal contributions to the count spectrum from third- and fourth-order flux. Detection of >600 Å flux in the *EUVE* spectrum could provide a valuable confirmation of that column estimate. However, fitting the EUV spectrum to obtain columns requires an accurate normalization of the model flux (via optical or far-UV photometry or spectrophotometry), which is difficult given that Sirius B lies only a few arcseconds distant from the brightest star in the sky. Fitting the SW portion of the spectrum could provide the most accurate effective temperature to date for Sirius B, and then the MW and LW spectra could provide the interstellar columns, given a sufficiently accurate calibration of the SW spectrometer, and all orders of the LW spectrometer. See Figure 52.

 Fig. 52

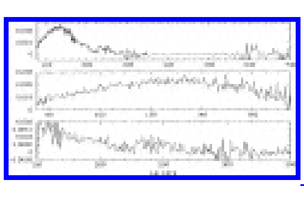
2RE J0715-702.—This is likely to be a pure H DA, given that T_{eff} = 43,870 K and log g = 8.048 (Finley et al. 1997). Flux is present throughout the SW spectrometer channel, with adequate S/N to search for discrete absorption features. The MW flux is essentially zero longward of about 200 Å, due to a relatively high H I column of log $N_{H\,I}$ = 19.6 (Wolff, Jordan, & Koester 1996), making explicit determinations of the interstellar He I and He II column densities impossible. See Figure 53.

 Fig. 53

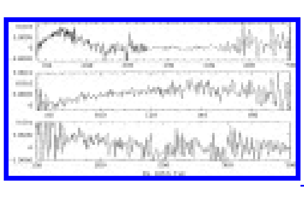
2RE J1032+532.—This lies in the range of effective temperature and gravity in which the transition occurs from pure H to metal-rich, with T_{eff} = 46,900 and log g = 7.77 (Finley et al. 1997). The *ROSAT* PSPC and WFC photometry for this star were analyzed by Wolff et al. (1996) who found slight evidence for trace heavy elements and determined the H I column to be about 1×10^{19} cm^{-2}. Flux is present in both the SW and MW spectrometers, but the star is not detected longward of about 400 Å in the LW spectrometer. This spectrum includes an interstellar He II λ228 edge and a very nice example of the interstellar He I resonance feature at 206 Å. See Figure 54.

 Fig. 54

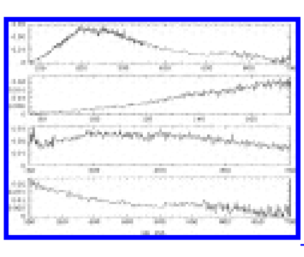
LB 1919 (2RE J1059+512).—This is a difficult object to analyze. Its unusual Balmer line profiles (Finley et al. 1997) render problematical the independent, accurate temperature determination required for an abundance estimate. The overall shape of the spectrum, in which the flux peaks in the SW spectrometer, does indicate that the abundances of any trace elements that may be present are certainly much lower than for DA's such as Feige 24 and G191-B2B. Detectable flux is present shortward of about 300 Å; thus, analysis of the spectrum can, in principle, yield the WD properties and ISM columns. See Figure 55.

 Fig. 55

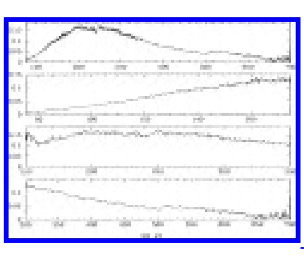
PG 1057+719.—This is cool enough at 41,460 K (Finley et al. 1997) that it is not expected to have any heavy elements in its atmosphere. The ISM column density is high enough that there is almost no flux around the 228 Å He II edge and poor S/N is obtained in the vicinity of the He I 206 Å resonance feature. Analysis of the spectrum will therefore provide a measurement of the H I ISM column, but not a full characterization of the ISM along the line of sight. See Figure 56.

 Fig. 56

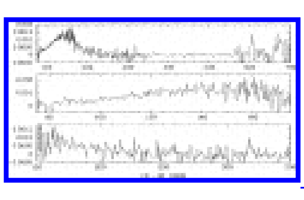
GD 153 (WD 1254+223).—This is a pure H white dwarf with a low column, providing usable flux in all three *EUVE* spectrometer bandpasses. The EUV spectrum has been analyzed by Dupuis et al. (1995), who confirmed that the WD atmosphere is pure H and determined the ISM H I and He I columns and also obtained an upper limit to the He II column. The apparent broad absorption feature between 200 and 250 Å that is most visible in the spectra of GD 153 and HZ 43 is not intrinsic to the stars. Rather, it is a consequence of the ±10% relative accuracy of the calibration effective area of the instrument as a function of wavelength. See Figure 57.

 Fig. 57

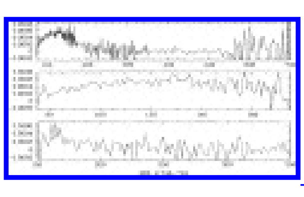
HZ 43.—This is the first extrasolar EUV source discovered (Durisen, Savedoff, & Van Horn 1976; Margon et al. 1976). It is the brightest EUV source, with a very low column, providing an excellent EUV spectrum in all three *EUVE* spectrometer bandpasses. The *EUVE* spectra have been analyzed more than once. Dupuis et al. (1995) obtained the interstellar columns, and Barstow, Holberg, & Koester (1995) obtained a stringent upper limit to the helium abundance in HZ 43. See Figure 58.

 Fig. 58

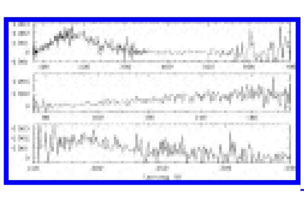
CD -38 10980 (WD 1620-391).—This has nearly the same effective temperature as Sirius B (25,280 K per Finley et al. 1997) but is much fainter given its distance of about 15 pc. Based on the analysis of Finley et al. (1993), at that effective temperature, log $N_{H\ I}$ = 18.8, consistent with the absence of detectable flux longward of about 220 Å. That column is somewhat high given its distance of only 13 pc (Vauclair et al. 1997) but is consistent with the interstellar columns of C, N, O, and S determined by Holberg, Bruhweiler, & Andersen (1995) based on *IUE* observations. The circumstellar material reported by Holberg et al. (1995) in the line of sight to CD -38 10980 (predominantly C II and Si III) is not expected to have a detectable effect on the EUV spectrum. See Figure 59.

 Fig. 59

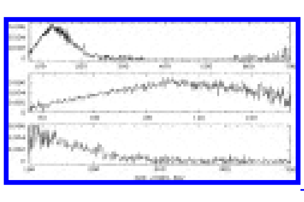
2RE J1746-703 (WD 1740-706).—This is a massive DA, with T_{eff} = 46,420 K, log g = 8.97, and M = 1.21 $M_\odot$ (Finley et al. 1997). As such, it would be expected to have a pure hydrogen atmosphere. The EUV photometry is consistent with pure H, while the overall appearance of the EUV spectrum is indicative of an atmosphere that is pure H or contains only small amounts of trace absorbers. The EUV spectrum was analyzed in detail by Dupuis & Vennes (1997), who derived an upper limit to the He abundance of He/H 1.3×10^{-4}. See Figure 60.

 Fig. 60

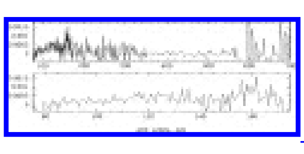
Lanning 18 (WD 1845+019).—This is somewhat hotter than CD -38 10980 (29,460 K per Finley et al. 1997) and has a somewhat lower column of log $N_{H\ I}$ = 18.35 ± 0.3 (obtained by applying that effective temperature to the analysis of Finley et al. (1993). The combination of higher effective temperature and lower column results in detectable flux being present out to about 280 Å. However, the low column and faintness of the source preclude obtaining meaningful constraints on the He I and He II columns using the EUV spectrum. See Figure 61.

 Fig. 61

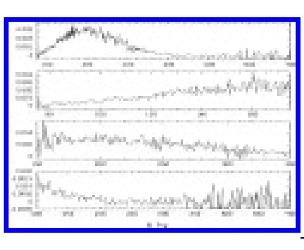
2RE J2009-602.—This is most likely a pure H DA. Wolff et al. (1996) analyzed the *ROSAT* PSPC and WFC photometry, obtaining T_{eff} = 42,900 and log $N_{H\ I}$ = 19.39, independent of an optical temperature determination. Those results are consistent with the EUV spectrum. Additionally, the presence of flux out to about 250 Å, combined with the relatively high column, should allow independent determinations of the He I and He II column densities. See Figure 62.

 Fig. 62

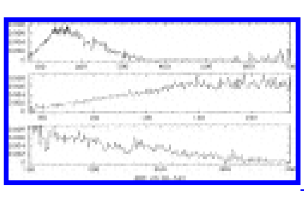
2RE J2024-422 (MCT 2020-4234).—This has precisely the same effective temperature as Lanning 18 but is 1.7 mag fainter at visible wavelengths. As a result, the spectrum (with only a 34 ks exposure) is too faint to be useful for constraining the properties of the star or the interstellar column densities. See Figure 63.

 Fig. 63

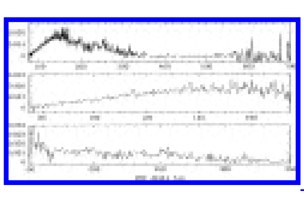
IK Pegasi (HR 8210).—This is a binary consisting of an A8m and a DA. Confirmation of the presence of the white dwarf based on *IUE* spectroscopy was obtained independently by Wonnacott, Kellet, & Stickland (1993) and also by Landsman et al. (1993). Landsman et al. determined that T_{eff} = 35,500 K and log g = 9.0. The analysis of Wonnacott et al. (1993) also indicated that this is a high-mass white dwarf. Barstow et al. (1994a) reported that those values are entirely consistent with the EUV photometry for this star. The latter also estimated that $N_{H\ I} = 7 \times 10^{18}$ cm^{-2}, consistent with the presence of EUV flux out to nearly 400 Å. See Figure 64.

 Fig. 64

2RE J2156-543.—This is cool enough at 44,330 K (Finley et al. 1997) that it is most likely a pure H DA, which is corroborated by the EUV spectrum. Usable flux is present out to about 350 Å, and the star is bright enough in the 200–250 Å range to obtain measurements of the He I and He II columns. See Figure 65.

 Fig. 65

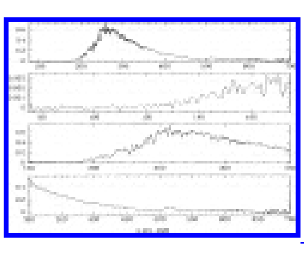
2RE J2324-544 (WD 2321-549).—This has T_{eff} = 44,960 and log g = 7.94 per Finley et al. (1997), and 44,800 and 8.00 per Vennes et al. (1996c). Vennes et al. also analyzed the EUV photometry, which appeared to indicate that trace heavy elements were present in this star. However, that result depends on the *V* magnitude they derived from the *HST* Guide Star Catalog magnitude, which had an estimated error of 0.40 mag. The EUV spectrum will need to be analyzed using an accurate scale factor. Assuming a somewhat fainter *V* magnitude results in the EUV photometry and spectroscopy being consistent with pure H. See Figure 66.

 Fig. 66

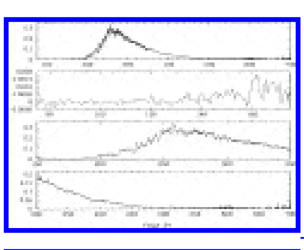
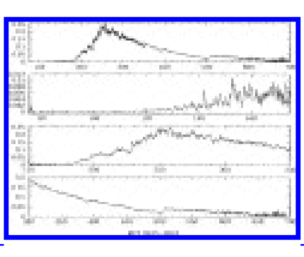
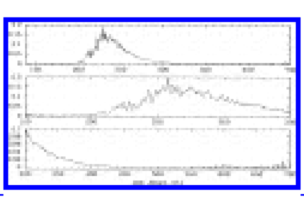
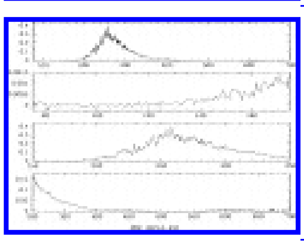
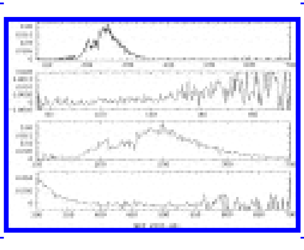
§5.1.2. *Metal-rich DA White Dwarfs*

The heavy element opacity in metal-rich DA stars is in the form of line blanketing and overlapping bound-free absorption edges that begin around 300 Å, increase markedly around 260 Å, and progressively become stronger toward shorter wavelengths. The trace element opacity can be so great that typical metal-rich DA white dwarfs can have fluxes at 100 Å that are 4 orders of magnitude less than that of a pure H model that matches the observed flux longward of 300 Å.

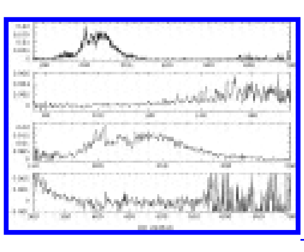
G191-B2B.—This is the "prototypical" metal-rich DA white dwarf. It was known already to have among the highest trace element abundances detected in DA's based on *EXOSAT* photometry (Paerels & Heise 1989). Inclusion of EUV and soft X-ray photometry from *ROSAT* showed that the trace absorber was not He, whether uniformly mixed or in a stratified configuration (Barstow et al. 1993). The first EUV spectrum of G191-B2B, obtained with a rocket-borne spectrometer, showed that trace heavy elements other than He were present but did not allow a firm identification of the constituents (Wilkinson, Green & Cash 1992). Because it is one of the brightest EUV sources, a calibration target, and extremely interesting in its own right, a wealth of spectroscopic data for G191-B2B has been obtained with *EUVE*. The spectrum is so rich it has proved difficult to fit, whether with LTE or NLTE models. Preliminary results have been given by Koester (1995) and Barstow et al. (1995b), and a better fit was presented by Lanz et al. (1996). Additional help in determining the trace element abundances has been provided by individual element abundance measurements obtained by observations in other wavelength ranges, particularly the far-ultraviolet (FUV). A voluminous literature exists on this topic; we mention only one of the earliest (Bruhweiler & Kondo 1981) and one of the latest (Vennes et al. 1996b). See Figure 67.

 Fig. 67

Feige 24, *MCT 0455-2812*, *2RE J0623-374*, *2RE J2214-491*, and *MCT 2331-431*.—The general appearance of the EUV spectra of these other metal-rich DA's is quite similar to that of G191-B2B. All have moderate interstellar absorption with some LW flux detected. 2RE J0623-374, 2RE J2214-491, and MCT 2331-431 have somewhat higher columns than the others, with no flux detected at the He I λ504 edge. The stars in this group do differ in their temperatures, gravities, and elemental abundances. When individual element abundances are obtained for these objects, differential abundance comparisons will be helpful in the theoretical understanding of the factors that determine those abundances. See Figures 68, 69, 70, 71, and 72.

 Fig. 68  Fig. 69  Fig. 70
 Fig. 71  Fig. 72

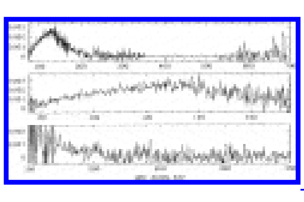
HD 223816B (WD 2350-706).—This was estimated by Barstow et al. (1994a) to have an effective temperature of about 60,000 K if log *g* were assumed to be 7.5, based on the photometric distance for a its G0 V companion and on *IUE* and *Voyager* spectra. The temperatures and gravities are similar to those for G191-B2B. Additionally, the EUV spectrum for HD 223816B, like that of the other metal-rich DA, is qualitatively similar to that for G191-B2B. The relatively higher SW flux suggests that the metal abundances are somewhat lower, though, than for G191-B2B. See Figure 73.

 Fig. 73

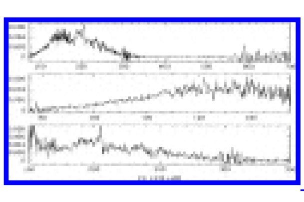
§5.1.3. *Intermediate-Metallicity DA White Dwarfs*

While we expect a continuously varying distribution of trace element abundances among hot DA's, this small sample of stars that definitely have trace elements present is distinctly (and most probably by chance) clumped. In addition to the metal-rich DA's discussed above, a nearly equal number of "intermediate-metallicity" DA's exist that have metal abundances at least an order of magnitude lower. The two groups are readily differentiated by a visual inspection of the EUV spectra. Metal-rich objects, typified by G191-B2B, have very little flux in the *EUVE* SW spectrometer relative to that in the MW. All the intermediate-metallicity DA's, on the other hand, have equivalent flux levels in both the SW and MW spectrometers. Lower abundances result in much brighter spectra that have less heavily overlapping features from the different elements present. Both factors make the intermediate-metallicity DA's promising subjects for the direct identification of trace heavy elements in the EUV spectra.

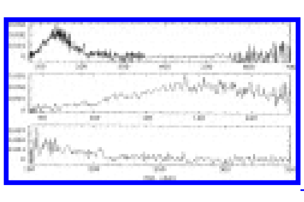
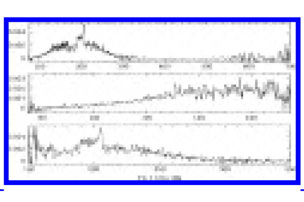
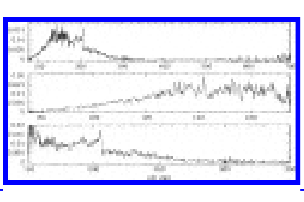
2RE J0029-632.—This is not a candidate for detailed trace element abundance determinations. Given its faintness and high column density, at best one may estimate a metallicity based on the reduction of the observed flux relative to that predicted for pure H composition at the optically determined effective temperature. See Figure 74.

 Fig. 74

PG 1234+482.—More progress has been made in studying this object. Jordan et al. (1994) identified Fe as definitely being present in this star, while only upper limits were obtainable for other elements such as Ni, Ca, C, N, O, and Si. See Figure 75.

 Fig. 75

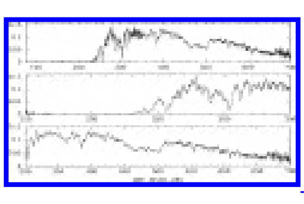
PHL 1043 (or WD 0131-163), *PG 1123*+189, and *GD 246*.—These objects display similar features to those mentioned above and have reasonably well-exposed spectra. Hence, analyses of the EUV spectra for stars in this group should yield useful information on the differential effects of temperature and gravity on trace element abundances. See Figures 76, 77, and 78.

 Fig. 76  Fig. 77  Fig. 78

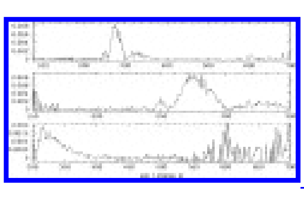
§5.2. *Helium-rich White Dwarfs*

Overall, roughly 10% of white dwarfs have He-dominated atmospheres. However, a much smaller fraction is detectable in the EUV. Photospheric He absorbs strongly shortward of the He II λ228 absorption edge in the hotter objects, while somewhat cooler stars have very little flux shortward of the He I λ504 edge. The intrinsic stellar flux for such objects may be detected only if the interstellar column is sufficiently low. The situation is potentially more favorable for very hot He degenerates ($T_{\rm eff}$ > 100,000 K) that ionize He II sufficiently strongly that significant flux may be present even shortward of 228 Å.

2RE J0503-285 (MCT 0501-2858).—This is a DO white dwarf that differs significantly from HD 149499B and other typical cool DOs as described in Wesemael, Green, & Liebert (1985). It has in its optical spectrum the C IV/He II blend around 4670 Å (Barstow et al. 1994c) that was first discovered in the prototype of the PG 1159 class of hot, He-rich white dwarfs, PG 1159-035 (McGraw et al. 1979; Green & Liebert 1979). However, while the effective temperature of 2RE J0503-285 is around 70,000 K (Barstow et al. 1994c), the previously discovered members of the PG 1159 class have been much hotter (100,000–170,000 K; Dreizler, Werner, & Heber 1995). The EUV photometry showed that trace absorbers other than H, He, and C were present (Barstow et al. 1994c), while *IUE* spectroscopy has resulted in the detection of C, N, O, and Si, but not Fe or Ni, in distinction to the hot H-rich DA's in this temperature range. This star is sufficiently complex that a satisfactory fit to the EUV spectrum has not yet been achieved. See Figure 79.

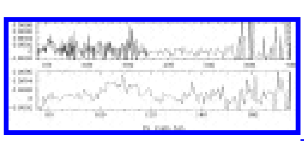
 Fig. 79

HD 149499B.—This is a typical DO white dwarf that was fortuitously detected in the EUV because it is just hot enough and close enough, with only a moderately high interstellar column, so that it is detected only within the He II Lyman series. The flux actually peaks around 275 Å, while essentially none is detected below the 243 Å He II line. Above the 304 Å line, the flux disappears by about 380 Å because of ISM absorption. Napiwotzki et al. (1995) analyzed the EUV and FUV spectra for this star, obtaining consistent results from fitting both the He II Lyman and Balmer series: $T_{\rm eff}$ ~ 50,000 K, log *g* ~ 7.9, He/H > 10, and an interstellar H I column density of 7 × 10^{18}. They did not report the detection of any other trace elements in that preliminary analysis. See Figure 80.

 Fig. 80

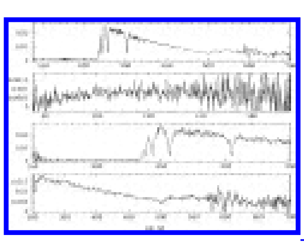
PG 1159-035.—This star, the prototype for the PG 1159 objects, was observed for about 40,000 s with *EUVE* in the hope that the flux around 100 Å would be measurable. Unfortunately, the star was just too faint to obtain a usable spectrum.

PG 1520+525.—This is somewhat brighter then PG 1159-035 and was observed for 155,000 s. The spectrum, though somewhat weak and noisy, was sufficient to place the effective temperature around 150,000 K, based on the observed strength of the O V absorption edge at 120 Å (Werner et al. 1996). See Figure 81.

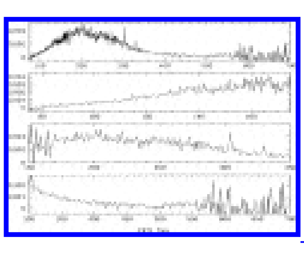
 Fig. 81

§5.3. *Unusual White Dwarfs*

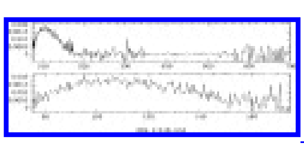
GD 50.—This is the most massive, nonmagnetic, single DA white dwarf known (Bergeron et al. 1991). It is also unique among DA white dwarfs in showing He in the EUV spectrum (Vennes, Bowyer, & Dupuis 1996a). The photospheric features visible in the EUV spectrum are the He II Lyman line series, and little flux is detected below the He II 228 Å edge. See Figure 82.

 Fig. 82

V471 Tauri.—This has properties that differ from those of typical DA's because it is in a close binary system. Recent analyses by Dupuis et al. (1997) confirm that the spectral peculiarities are due to material accreted onto the white dwarf from the stellar wind of the K0 V companion, that is concentrated by the white dwarf's magnetic field onto "spots" on its surface. The time-averaged spectrum displayed in the figure does not properly represent the true nature of this star, though. The spectrum actually varies with rotational phase because of varying trace element abundances over the face of the star. See Figure 83.

 Fig. 83

2RE J1016-052.—This is one of only two white dwarfs classified as DAO that have been detected in the EUV. Optical and FUV observations have detected He II λ4686 and λ1640 features, as well as the C IV λ1550 doublet (Tweedy et al. 1993; Thorstensen, Vennes, & Bowyer 1996). This is a post–common-envelope object consisting of the white dwarf and a low-mass M companion. The spectrum shows only continuum emission that is detectable only below about 170 Å owing to a column density that is in excess of 10^{19} cm^{-2}. While the analysis of the EUV spectrum is less straightforward than it would be if observable flux were present longward of 228 Å, an apparent inconsistency exists between the observed EUV flux and that which would be expected based on the optically determined temperature and He abundance. Analyses of the EUV data are now underway to resolve this discrepancy (Vennes et al. 1997). See Figure 84.

 Fig. 84

H1504+65.—This is perhaps best classified as a "pre–PG 1159" object. It is extremely hot, around 170,000 K, with a C- and O-dominated atmosphere essentially devoid of He, while the features observed in the FUV and optical are from C IV and O VI (Werner 1991; Nousek et al. 1993). Because of its high interstellar column density, flux is detectable only shortward of about 150 Å. However, below that limit, the spectrum has good S/N and has many strong features that are mostly due to O VI. However, additional sources of opacity are present that are not accounted for in pure C/O models (Barstow et al.

1995a). See Figure 85.

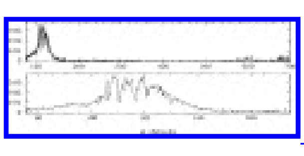


Fig. 85

GD 394.—This is the coolest DA found to have significant trace element abundances. Bruhweiler & Kondo (1983) first detected Si III and Si IV in this star. Its effective temperature from Balmer line fitting is almost 40,000 K (Bergeron, Saffer, & Liebert 1992; Finley et al. 1997), but the temperature obtained from fitting the Lyα profile was 36,000 K (Holberg, Wesemael, & Basile 1986). The FUV continuum is depressed, such that the temperature based on the FUV/optical flux ratio was only 37,000 K (Finley, Basri, & Bowyer 1990). The EUV spectrum was recently analyzed by Barstow et al. (1996). They found that including Si with the abundance determined from FUV observations did not provide the observed EUV opacity. They did, however, obtain a (nonunique) fit to the EUV spectrum by adding C, N, and O at abundances just below those at which features that were not detected in the EUV would become visible. Certainly, more work is required to determine the trace element abundances in this object and produce a self-consistent fit to the full spectrum and to resolve the puzzle of how such a cool DA can have such high trace element abundances. See Figure 86.

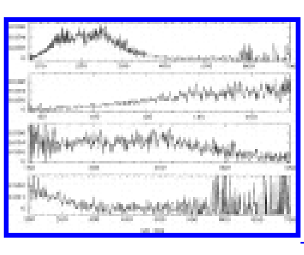


Fig. 86

§6. CATACLYSMIC VARIABLES

The *EUVE* satellite represents a new and exciting realm for research in cataclysmic variables. To date, *EUVE* has performed 25 pointed (spectra and imaging) observations of CVs, of which we display 15 with high S/N. *EUVE* provided the first opportunity to obtain spectral resolution of ~1 Å in the EUV bandpass (70–760 Å). *EUVE* has also supplied us with unprecedented photometric information, which will be reviewed elsewhere.

Cataclysmic variables come in a few varieties: novae, nova-likes, dwarf novae (DNs), AM Herculis stars, and DQ Herculis stars. Here we review *EUVE* spectroscopic observations of DN, AM Her, and DQ Her stars. All have white dwarf primaries: those in AM Her stars possess a very strong magnetic field (10–230 MG), and DQ Her primaries have moderate fields (1–10 MG). The secondary stars are thought to be normal main-sequence dwarfs.

In the AM Her–type CVs, accreting material is magnetically funneled directly onto the white dwarf surface in a tightly confined spot of approximately 1000 km in the EUV spectral range. This accretion spot is the major source of EUV photons in the AM Her stars. The much lower or null magnetic fields in the dwarf novae primaries allow the accreted material to form a roughly flat disk that may extend all the way to the white dwarf surface. This disk–primary star interface, called the boundary layer, is thought to be the source of much of the high-energy emission during a dwarf novae outburst. The DQ Her stars are approximately in between these two extremes, being thought to contain a partial (annulus) disk and a broader curtain-like accretion region. The entire field has been recently reviewed by Warner (1995).

§6.1. *Dwarf Novae at Outburst*

Dwarf novae (DNs) consist of a semidetached binary containing a white dwarf primary and a roughly normal lower main-sequence (K–M) secondary. The secondary loses material via Roche lobe overflow, and this material forms an accretion disk around the primary star that can extend all the way to the WD surface (i.e., the boundary layer). These stars show semiperiodic outbursts of 2–5 mag that are thought to occur when material stored in the accretion disk is suddenly accreted onto the WD surface owing to angular momentum loss caused by thermally unstable viscous heating (see Cannizzo, Shafter, & Wheeler 1988). DNs with orbital periods in the range of 2–3 hr are uncommon, and this interval has been termed the "period gap."

During minimum light DNs are not large producers of high-energy radiation, and their generally moderate to large distances ($\gtrsim$100 pc) mean that the ISM absorbs large amounts of the EUV photons, making DN weak EUV sources while at minimum light. However, when they undergo an outburst, the boundary layer becomes quickly heated to a few hundred thousand kelvins. Spectroscopic study of this high-temperature plasma, peaking its emission in the EUV bandpass, provides one of the best astrophysical laboratories for study of accretion physics. EUV spectra of DNs obtained during outburst are shown in Figures 87*a*–87*c*.

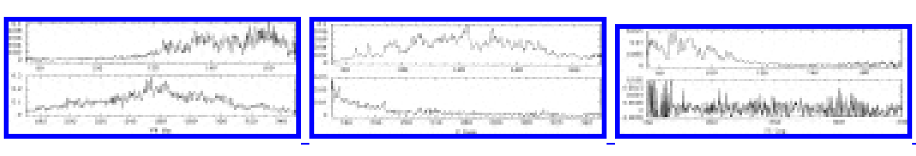


Fig. 87

VW Hydri.—This star shows the softest EUV spectrum of all three DNs observed in outburst to date. The peak in the energy distribution is near 250 Å. However, in VW Hyi, $L_{\rm bl}/L_{\rm disk} \sim 0.2$ (Mauche et al. 1991). Thus, much has yet to be learned from *EUVE* observations of dwarf novae.

U Geminorum.—In the case of U Gem, the total size of the EUV-emitting region during outburst is found to be comparable to that of the WD itself, which indicates that the outburst is mainly confined to the inner disk/boundary layer region (Long et al. 1996). In U Gem, which is an eclipsing system seen at high inclination, emission lines associated with a stellar wind are observed. These wind observations allow the resolution of a long-standing issue about ionization states of CV winds. Evidence of EUV absorption or scattering is also seen in U Gem, attributed to an outer disk bulge at the accretion stream–disk interface. However, the issue is not completely resolved yet, and the absorption could also be due to stream overflow or an increase in the disk thickness (scale height) near the outer rim. In U Gem it is found that $L_{\rm bl}/L_{\rm disk} \sim 1$.

SS Cygni.—This is the hardest of the three DNs during outburst and shows no EUV flux longward of ~130 Å. Mauche, Raymond, & Mattei (1995) present the details of the *EUVE* observation. These authors find that the simple theory that predicts equal luminosities from the boundary layer and the disk, i.e., $\zeta = L_{\rm bl}/L_{\rm disk} = 1$, is strongly violated in this case, yielding $\zeta \lesssim 0.07$. The EUV spectrum of SS Cyg is quite complex and changed by 2 orders of magnitude during the outburst with an almost constant spectral energy distribution. Mauche (1996) also found quasi-coherent oscillations in the *EUVE* data with periods of ~7–9 s.

§6.2. *AM Herculis Stars*

In these types of cataclysmic variable, the accretion stream is magnetically focused onto the white dwarf primary because of the large magnetic fields they possess. The field strengths range from ~10 to 80 MG, with a strength of 250 MG recently discovered in the star AR UMa (Schmidt et al. 1996). The confined accretion stream impacts the white dwarf surface in a small area known as the accretion spot and produces high-energy emission both from a shock slightly above the primary surface and from thermal heating of the surface itself. The spot temperatures are found to be near a few hundred thousand kelvins. Thus, AM Her systems are constant sources of EUV photons. Times of weaker emission, during the so-called low states, occur when the mass transferred from the secondary star falls to a very low value or possibly ceases altogether. See Figures 88*a*–88*i*.

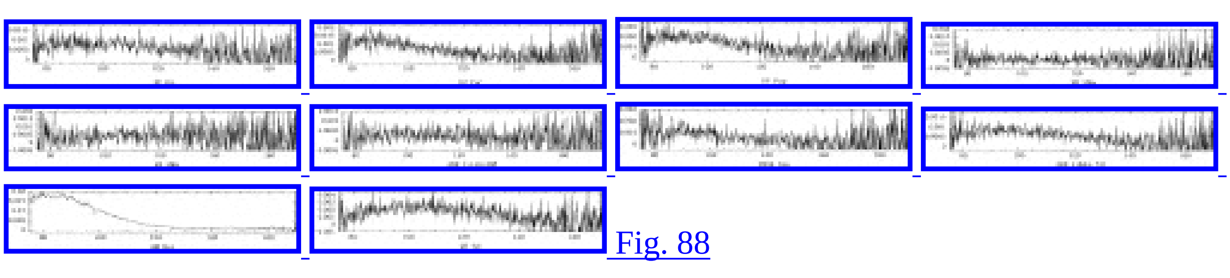


Fig. 88

EF Eridani.—This star shows a typical AM Her–type EUV spectrum, with nonzero flux in the shortest wavelengths observed. There may be indications of line edges caused by highly ionized species. Sirk & Howell (1997) present the EUV light curve and find a spot diameter and height of ~1000 and 120 km, respectively, although EF Eri did not present a simple light-curve shape.

UZ Fornacis.—Warren, Sirk, & Vallerga (1995) used EUV photometry to provide detailed geometric constraints on the accretion spot in this system. They found a spot diameter of less than 2000 km in extent and evidence for extended emission above the white dwarf surface. Sirk & Howell (1997) also found a spot with a vertical height of 200 km and a spot diameter of 1100 km.

VV Puppis.—Vennes et al. (1995b) found that the diameter of the accretion spot was small (250–380 km) and that it had an effective temperature of ~345,000 K. They suggest that absorption lines from O IV may be present. Sirk & Howell (1997) used *EUVE* photometric data to infer a spot diameter of 350 km and spot height of 80 km above the WD surface.

EK Ursae Majoris and *AN Ursae Majoris*.—Both of these sources were extremely weak EUV sources when observed by *EUVE*. They may have been in low states at the time. The spectra show nonzero flux in the shortest wavelengths and may be fittable by a blackbody, possibly with spectral binning in the wavelength direction to enhance the signal. Sirk & Howell (1997) show the EUV light curve of AN UMa.

2RE J1149+288.—Howell et al. (1995) provided the first analysis of EUV photometry for any AM Her star. Their work showed that the accretion spot in 2RE J1149+288 was fairly large, being about 1000 km in diameter. Sirk & Howell (1997) found the spot to be 1008 km in diameter with a height of about 100 km. They also showed that 2RE J1149+288 has a very asymmetric light curve that varied by factors of 2 or 3 in total flux. The EUV spectrum is fairly weak but will likely allow a crude blackbody fit (Mittaz, Mason, & Howell 1997).

V834 Centauri and *2RE J1844-741*.—These two stars show EUV spectra that do not have as much of a turndown at the shortest wavelengths as most of the others. AM Her has a similar appearance although a faster rise at the red end. 2RE J1844-741, like AM Her itself, is suspected of having a relatively weak magnetic field (AM Her ~10 MG; 2RE J1844-741 $\lesssim$ 20 MG), while V834 Cen is near 30 MG. Thus, explaining the spectral shape in 2RE J1844-741 may be possible, at least, in terms of a higher hard X-ray component commonly seen in the lower field AM Her stars. Both spectra show evidence for possible line edges. Sirk & Howell (1997) show the EUV light curve for V834 Cen.

AM Herculis.—This, the canonical AM Herculis star, has the weakest magnetic field of any of these systems, near 11 MG. *EUVE* spectroscopy is discussed by Paerels et al. (1996) who see positive evidence for line edges of highly ionized Ne, but do not detect the expected strong O VI, 2s, 2*p* edges. These authors also find evidence for limb brightening, which indicates the presence of a temperature inversion in the X-ray/EUV atmosphere. Sirk & Howell (1997) find a spot diameter and height of 700 and 100 km, respectively.

QS Telescopii (2RE 1938-46).—This was observed early in the *EUVE* mission during the all-sky survey and was seen to show two transient events, each lasting about 1 hr (Warren et al. 1993). Rosen et al. (1996a) and Rosen et al. (1996b) found that this star presented a dramatically different appearance between the *ROSAT* observations in 1992 and the *EUVE* data obtained in 1994. These authors find a spot temperature of 15 eV from a blackbody fit to the continuum and see evidence for line edges from Ne VI, VII, and VIII.

§6.3. *DQ Herculis Stars*

EUVE has observed two DQ Her stars. These types of cataclysmic variables are systems in which the white dwarf primary has a magnetic field usually weaker than in an AM Her but that is still sufficient to cause a disruption of the inner accretion disk. The DQ Her stars have a partial disk, and the accreted material rains down onto the white dwarf in extended areas or arcs. This inner disk region may be best described as a corona-like volume, producing high-energy photons throughout all orbital phases. The two *EUVE* observations are shown in Figures 89*a* and 89*b*.

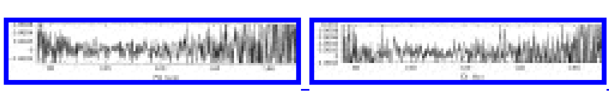
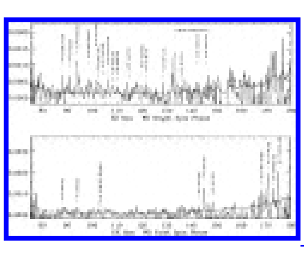


Fig. 89

PQ Geminorum.—Although weak, the *EUVE* spectrum of PQ Gem appears to show some highly ionized emission lines consistent with having their origin in a corona-like region of $10^{5.8}$–$10^{6.0}$ K (Howell et al. 1997). Preliminary analysis of this recently obtained data set also presents a light-curve structure consistent with that seen in X-rays (Duck et al. 1994) and in the UV (Stavroyiannopoulos et al. 1996).

EX Hydrae.—This is an eclipsing DQ Her–type CV. The light curve of EX Hya, when folded onto the 833 s spin period of the WD primary, shows modulation by a factor of 3.7. During the bright portion of the WD spin phase, the EUV spectrum reveals about 20 narrow emission lines (mostly of iron) characteristic of a plasma around 10^7 K. Every line identified in the WD bright phase disappears during the WD faint spin phase and in their stead appear a few tenuous lines indicative of a plasma around 10^6 K (Hurwitz et al. 1997). See Figure 90.

 Fig. 90

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FIGURES

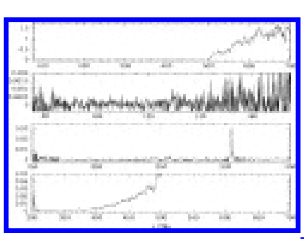 Full image (74kb) | Discussion in text

FIG. 1.—The EUV spectrum of ϵ CMa. The three lower plots show, from top to bottom, the SW, MW, and LW spectra. These have been blocked to bin sizes of 0.13, 0.27, and 0.54 Å, respectively. The top plot shows the three spectra combined, using a uniform spectral bin size of 0.54 Å. The *x*-axes show the wavelength in angstroms, and the *y*-axes show the flux in photons cm^{-2} s^{-1} $Å^{-1}$. Second- and higher order features (if present) have not been removed.

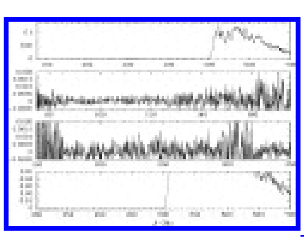 Full image (94kb) | Discussion in text

FIG. 2.—The EUV spectrum of β CMa, displayed in the same manner as Fig. 1

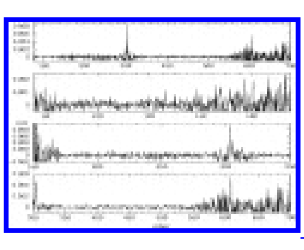 Full image (92kb) | Discussion in text

FIG. 3.—The EUV spectrum of Altair, displayed in the same manner as Fig. 1

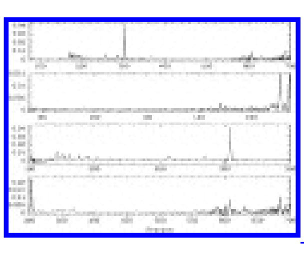 Full image (61kb) | Discussion in text

FIG. 4.—The EUV spectrum of Procyon, displayed in the same manner as Fig. 1

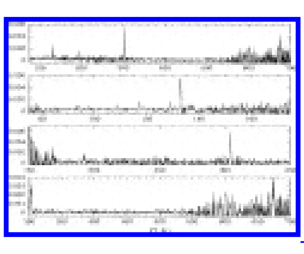 Full image (81kb) | Discussion in text

FIG. 5.—The EUV spectrum of VY Ari, displayed in the same manner as Fig. 1

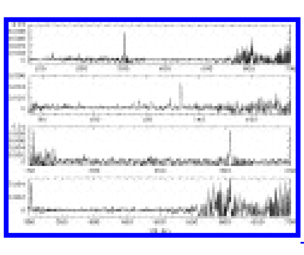 Full image (83kb) | Discussion in text

FIG. 6.—The EUV spectrum of UX Ari, displayed in the same manner as Fig. 1

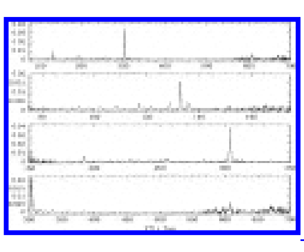 Full image (61kb) | Discussion in text

FIG. 7.—The EUV spectrum of V711 Tau, displayed in the same manner as Fig. 1

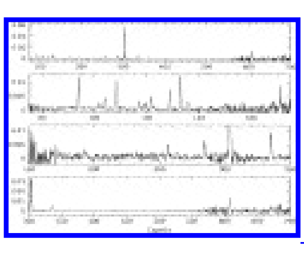 Full image (71kb) | Discussion in text

FIG. 8.—The EUV spectrum of Capella, displayed in the same manner as Fig. 1

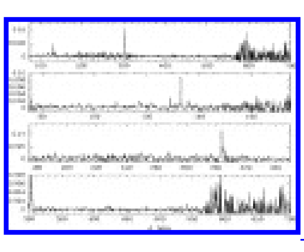 Full image (79kb) | Discussion in text

FIG. 9.—The EUV spectrum of σ Gem, displayed in the same manner as Fig. 1

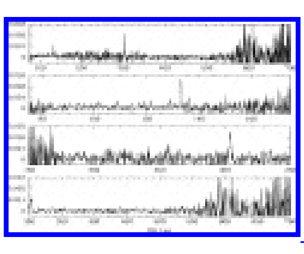 Full image (101kb) | Discussion in text

FIG. 10.—The EUV spectrum of DH Leo, displayed in the same manner as Fig. 1

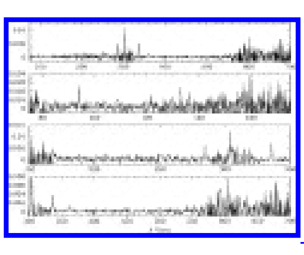 Full image (90kb) | Discussion in text

FIG. 11.—The EUV spectrum of ξ UMa, displayed in the same manner as Fig. 1

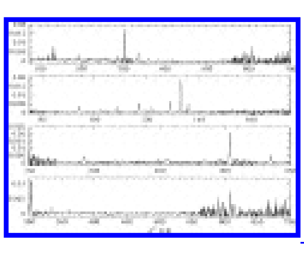 Full image (68kb) | Discussion in text

FIG. 12.—The EUV spectrum of σ^2 CrB, displayed in the same manner as Fig. 1

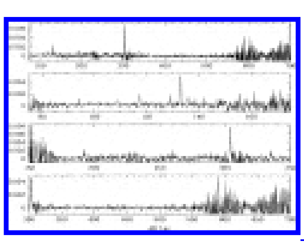 Full image (85kb) | Discussion in text

FIG. 13.—The EUV spectrum of AR Lac, displayed in the same manner as Fig. 1

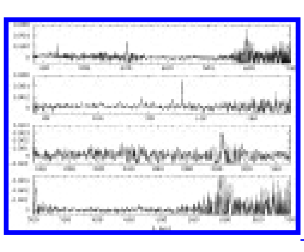 Full image (96kb) | Discussion in text

FIG. 14.—The EUV spectrum of λ And, displayed in the same manner as Fig. 1

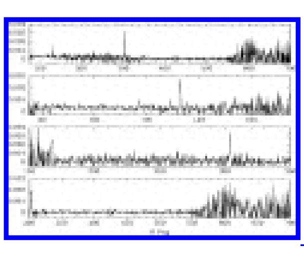 Full image (94kb) | Discussion in text

FIG. 15.—The EUV spectrum of II Peg, displayed in the same manner as Fig. 1

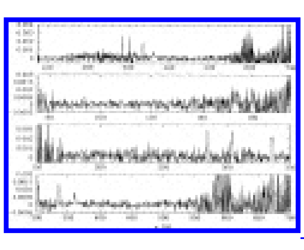 Full image (112kb) | Discussion in text

FIG. 16.—The EUV spectrum of κ Cet, displayed in the same manner as Fig. 1

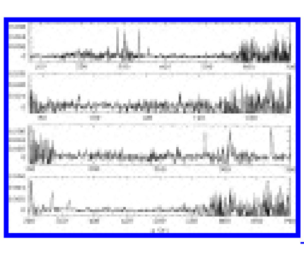 Full image (98kb) | Discussion in text

FIG. 17.—The EUV spectrum of χ Ori, displayed in the same manner as Fig. 1

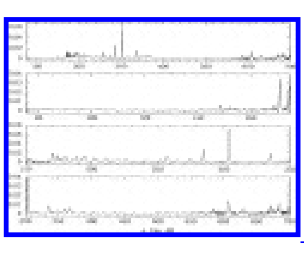 Full image (61kb) | Discussion in text

FIG. 18.—The EUV spectrum of α Cen AB, displayed in the same manner as Fig. 1

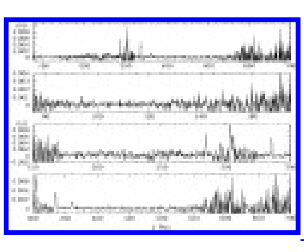 Full image (94kb) | Discussion in text

FIG. 19.—The EUV spectrum of ξ Boo, displayed in the same manner as Fig. 1

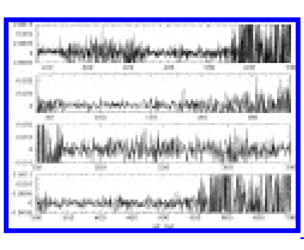 Full image (134kb) | Discussion in text

FIG. 20.—The EUV spectrum of AY Cet, displayed in the same manner as Fig. 1

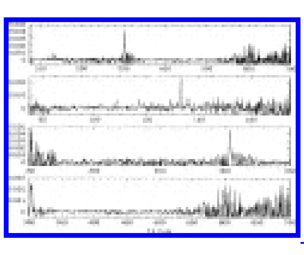 Full image (89kb) | Discussion in text

FIG. 21.—The EUV spectrum of 31 Com, displayed in the same manner as Fig. 1

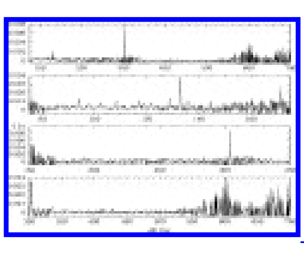 Full image (80kb) | Discussion in text

FIG. 22.—The EUV spectrum of AB Dor, displayed in the same manner as Fig. 1

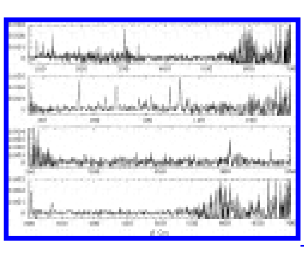 Full image (98kb) | Discussion in text

FIG. 23.—The EUV spectrum of β Cet, displayed in the same manner as Fig. 1

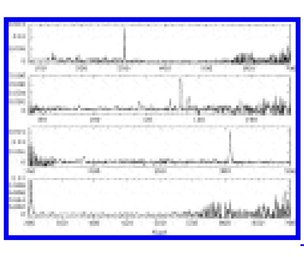 Full image (74kb) | Discussion in text

FIG. 24.—The EUV spectrum of Algol, displayed in the same manner as Fig. 1

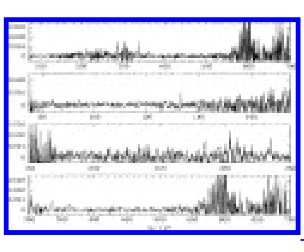 Full image (99kb) | Discussion in text

FIG. 25.—The EUV spectrum of GJ 117, displayed in the same manner as Fig. 1

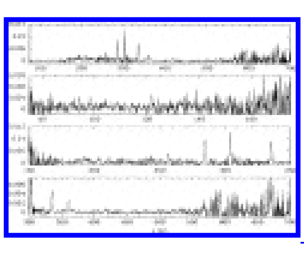 Full image (88kb) | Discussion in text

FIG. 26.—The EUV spectrum of ϵ Eri, displayed in the same manner as Fig. 1

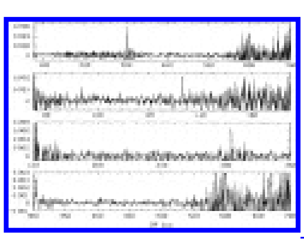 Full image (103kb) | Discussion in text

FIG. 27.—The EUV spectrum of BF Lyn, displayed in the same manner as Fig. 1

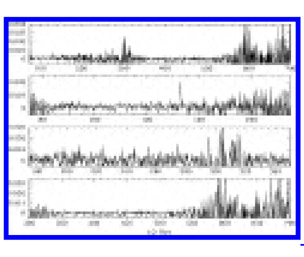 Full image (105kb) | Discussion in text

FIG. 28.—The EUV spectrum of LQ Hya, displayed in the same manner as Fig. 1

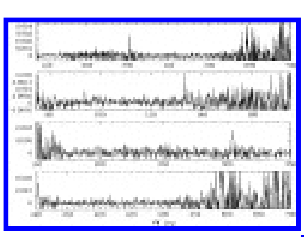 Full image (108kb) | Discussion in text

FIG. 29.—The EUV spectrum of VW Cep, displayed in the same manner as Fig. 1

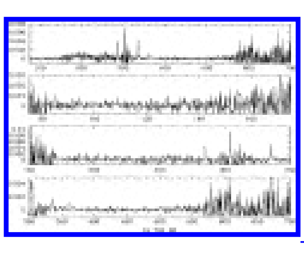 Full image (96kb) | Discussion in text

FIG. 30.—The EUV spectrum of GJ 702AB, displayed in the same manner as Fig. 1

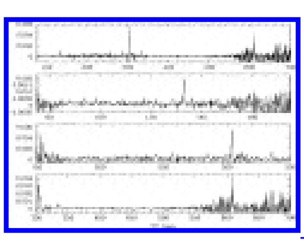 Full image (82kb) | Discussion in text

FIG. 31.—The EUV spectrum of YY Gem, displayed in the same manner as Fig. 1

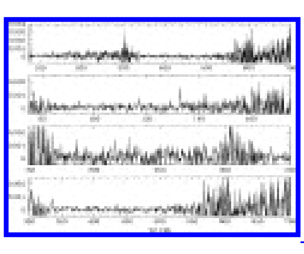 Full image (110kb) | Discussion in text

FIG. 32.—The EUV spectrum of YZ CMi, displayed in the same manner as Fig. 1

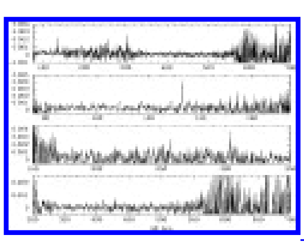 Full image (107kb) | Discussion in text

FIG. 33.—The EUV spectrum of AD Leo, displayed in the same manner as Fig. 1

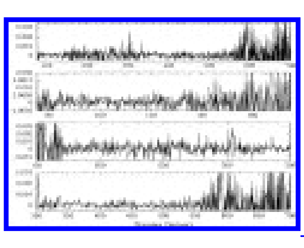 Full image (120kb) | Discussion in text

FIG. 34.—The EUV spectrum of Proxima Centauri, displayed in the same manner as Fig. 1

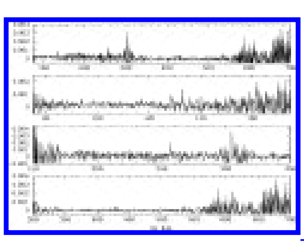 Full image (95kb) | Discussion in text

FIG. 35.—The EUV spectrum of GJ 644, displayed in the same manner as Fig. 1

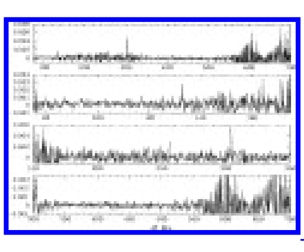 Full image (102kb) | Discussion in text

FIG. 36.—The EUV spectrum of AT Mic, displayed in the same manner as Fig. 1

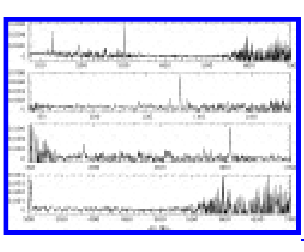 Full image (86kb) | Discussion in text

FIG. 37.—The EUV spectrum of AU Mic, displayed in the same manner as Fig. 1

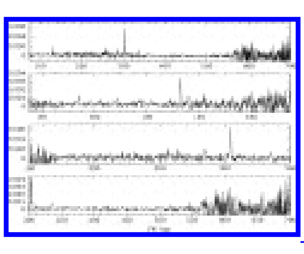 Full image (84kb) | Discussion in text

FIG. 38.—The EUV spectrum of FK Aqr, displayed in the same manner as Fig. 1

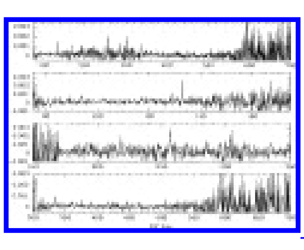 Full image (108kb) | Discussion in text

FIG. 39.—The EUV spectrum of EV Lac, displayed in the same manner as Fig. 1

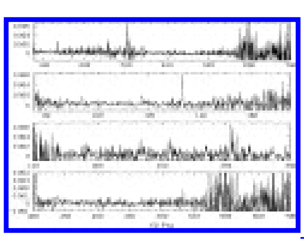 Full image (103kb) | Discussion in text

FIG. 40.—The EUV spectrum of EQ Peg, displayed in the same manner as Fig. 1

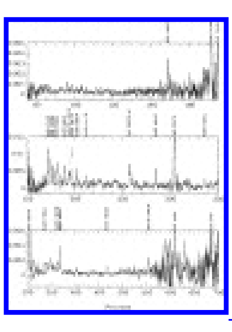 Full image (90kb) | Discussion in text

FIG. 41.—Line identifications in the EUV spectrum of Procyon. The plots show, from top to bottom, the SW, MW, and LW spectra. The spectra are unblocked and have bin sizes of 0.067, 0.13, and 0.27 Å, respectively. Selected bright lines are identified by species and wavelength in angstroms. The *x*-axes show the wavelength in angstroms and the *y* axes show the flux in photons cm^{-2} s^{-1} $Å^{-1}$. Second- and higher order features have not been removed and prominent ones are identified.

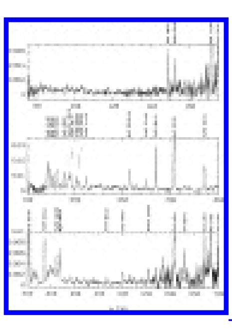 Full image (85kb) | Discussion in text

FIG. 42.—Line identifications in the EUV spectrum of α Cen AB, displayed in the same manner as Fig. 41

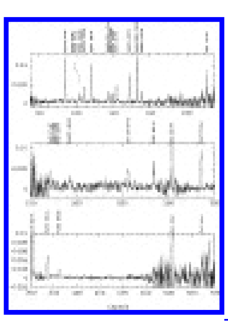 Full image (86kb) | Discussion in text

FIG. 43.—Line identifications in the EUV spectrum of Capella, displayed in the same manner as Fig. 41

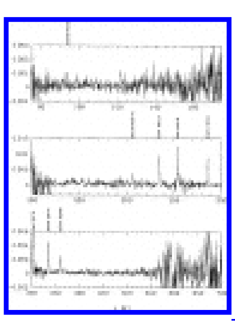 Full image (94kb) | Discussion in text

FIG. 44.—Line identifications in the EUV spectrum of ϵ Eri, displayed in the same manner as Fig. 41

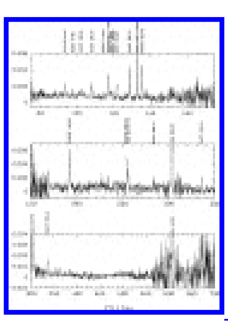 Full image (93kb) | Discussion in text

FIG. 45.—Line identifications in the EUV spectrum of V711 Tau, displayed in the same manner as Fig. 41

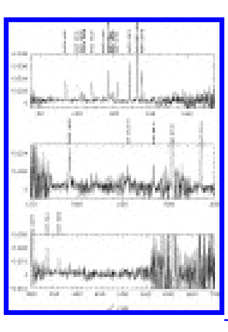 Full image (107kb) | Discussion in text

FIG. 46.—Line identifications in the EUV spectrum of σ^2 CrB, displayed in the same manner as Fig. 41

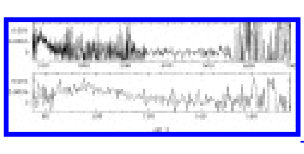 Full image (56kb) | Discussion in text

FIG. 47.—The EUV spectrum of GD 2. The lower plot shows the SW spectrum, with a bin size of 0.4 Å. The top plot shows the SW, MW, and LW spectra combined, with bin sizes of 0.4, 0.8, and 1.6 Å, respectively. The *x*-axes show the wavelength in angstroms, and the *y*-axes show the flux in photons cm^{-2} s^{-1} Å^{-1}. Second- and higher order features have been removed as described in the text.

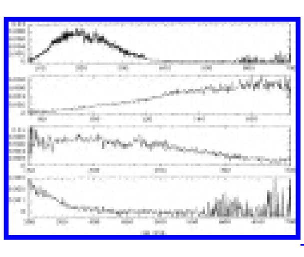 Full image (80kb) | Discussion in text

FIG. 48.—The EUV spectrum of GD 659. The three lower plots show, from top to bottom, the SW, MW, and LW spectra. These have bin sizes of 0.2, 0.4, and 0.8 Å, respectively. The top plot shows the three spectra combined, with the same bin sizes as in the lower plots. The *x*-axes show the wavelength in angstroms, and the *y*-axes show the flux in photons cm^{-2} s^{-1} Å^{-1}. Second- and higher order features have been removed as described in the text.

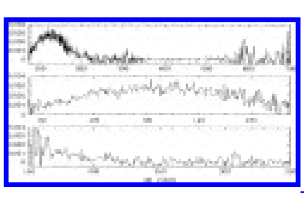 Full image (60kb) | Discussion in text

FIG. 49.—The EUV spectrum of HD 15638, displayed in the same manner as Fig. 50

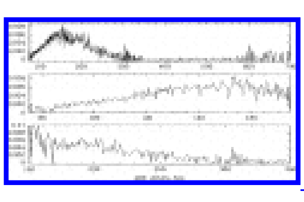 Full image (58kb) | Discussion in text

FIG. 50.—The EUV spectrum of 2RE J0515+324, displayed in the same manner as Fig. 48 except that the LW plot has been omitted and the bin sizes are 0.4, 0.8, and 1.6 Å.

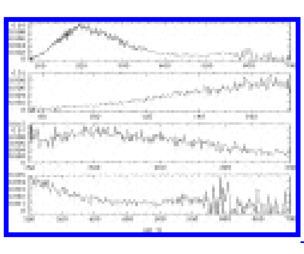 Full image (75kb) | Discussion in text

FIG. 51.—The EUV spectrum of GD 71, displayed in the same manner as Fig. 48 except that the bin sizes are 0.8, 1.6, and 3.2 Å in the top plot and 0.4, 0.8, and 1.6 Å in the lower plots.

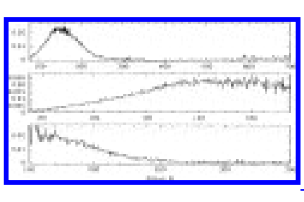 Full image (48kb) | Discussion in text

FIG. 52.—The EUV spectrum of Sirius B, displayed in the same manner as Fig. 48 except that the LW plot has been omitted and the bin sizes are 0.4, 0.8, and 1.6 Å in the top plot and 0.2 and 0.4 Å in the lower plots.

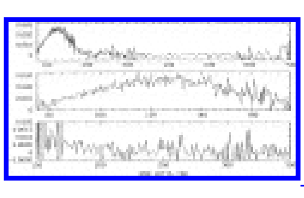 Full image (62kb) | Discussion in text

FIG. 53.—The EUV spectrum of 2RE J0715-702, displayed in the same manner as Fig. 51 except that the LW plot has been omitted

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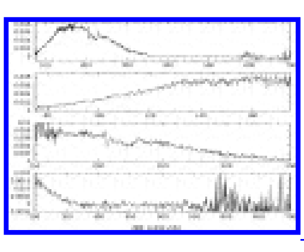 Full image (79kb) | Discussion in text

FIG. 54.—The EUV spectrum of 2RE J1032+532, displayed in the same manner as Fig. 48 except that the bin sizes in the top plot are 0.4, 0.8, and 1.6 Å

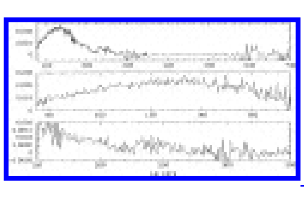 Full image (57kb) | Discussion in text

FIG. 55.—The EUV spectrum of LB 1919, displayed in the same manner as Fig. 53

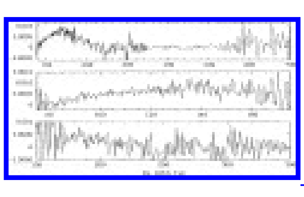 Full image (70kb) | Discussion in text

FIG. 56.—The EUV spectrum of PG 1057+719, displayed in the same manner as Fig. 53

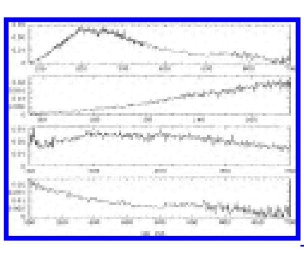 Full image (70kb) | Discussion in text

FIG. 57.—The EUV spectrum of GD 153, displayed in the same manner as Fig. 54

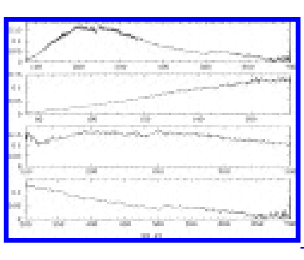 Full image (59kb) | Discussion in text

FIG. 58.—The EUV spectrum of HZ 43, displayed in the same manner as Fig. 48

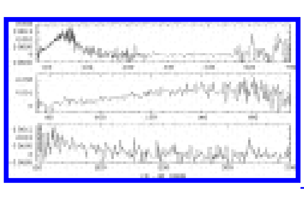 Full image (65kb) | Discussion in text

FIG. 59.—The EUV spectrum of CD -38 10980, displayed in the same manner as Fig. 53

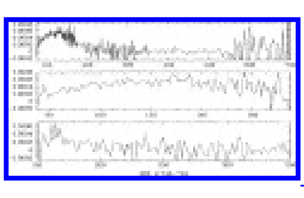 Full image (62kb) | Discussion in text

FIG. 60.—The EUV spectrum of 2RE J1746-703, displayed in the same manner as Fig. 48 except that the LW plot has been omitted and the bin sizes are 0.8, 1.6, and 3.2 Å.

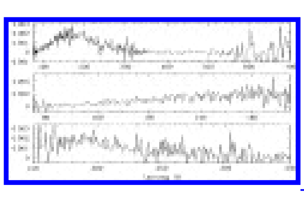 Full image (63kb) | Discussion in text

FIG. 61.—The EUV spectrum of Lanning 18, displayed in the same manner as Fig. 53

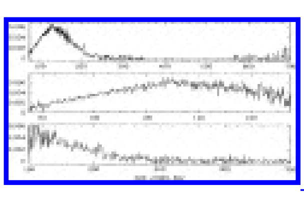 Full image (56kb) | Discussion in text

FIG. 62.—The EUV spectrum of 2RE J2009-602, displayed in the same manner as Fig. 52

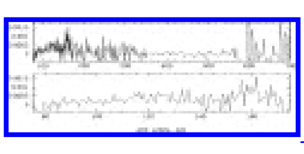 Full image (41kb) | Discussion in text

FIG. 63.—The EUV spectrum of 2RE J2024-422, displayed in the same manner as Fig. 47 except that the bin sizes are 0.8, 1.6, and 3.2 Å

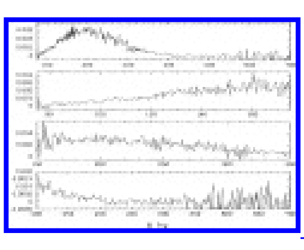 Full image (75kb) | Discussion in text

FIG. 64.—The EUV spectrum of IK Peg, displayed in the same manner as Fig. 51

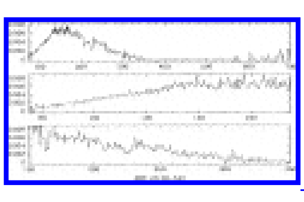 Full image (54kb) | Discussion in text

FIG. 65.—The EUV spectrum of 2RE J2156-543, displayed in the same manner as Fig. 53

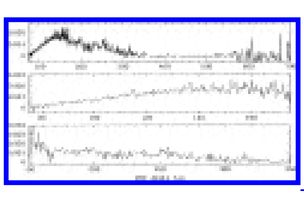 Full image (56kb) | Discussion in text

FIG. 66.—The EUV spectrum of 2RE J2324-544, displayed in the same manner as Fig. 50

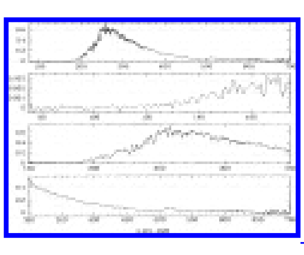 Full image (60kb) | Discussion in text

FIG. 67.—The EUV spectrum of G191-B2B, displayed in the same manner as Fig. 48 except that the bin sizes are 0.1, 0.2, and 0.4 Å in the top plot and 0.8, 0.2, and 0.4 Å in the lower plots.

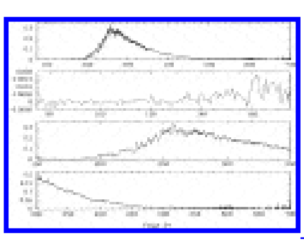 Full image (63kb) | Discussion in text

FIG. 68.—The EUV spectrum of Feige 24, displayed in the same manner as Fig. 67

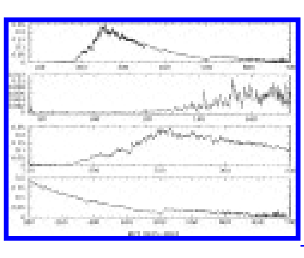 Full image (67kb) | Discussion in text

FIG. 69.—The EUV spectrum of MCT 0455-2812, displayed in the same manner as Fig. 48 except that the bin sizes are 0.2, 0.2, and 0.4 Å in the top plot and 0.2, 0.2, and 0.4 Å in the lower plots.

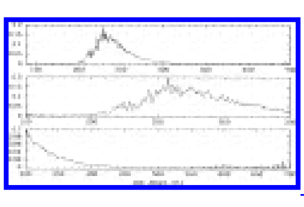 Full image (47kb) | Discussion in text

FIG. 70.—The EUV spectrum of 2RE J0623-374, displayed in the same manner as Fig. 48 except that the SW plot has been omitted and the bin sizes are 0.4, 0.8, and 1.6 Å in the top plot and 0.4, and 0.8 Å in the lower plots.

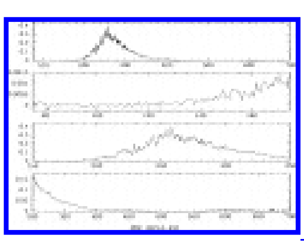 Full image (56kb) | Discussion in text

FIG. 71.—The EUV spectrum of 2RE J2214-491, displayed in the same manner as Fig. 67

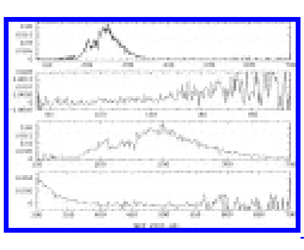 Full image (72kb) | Discussion in text

FIG. 72.—The EUV spectrum of MCT 2331-431, displayed in the same manner as Fig. 48 except that the bin sizes are 0.4, 0.8, and 1.6 Å

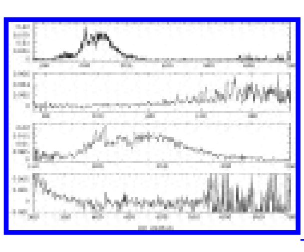 Full image (84kb) | Discussion in text

FIG. 73.—The EUV spectrum of HD 223816, displayed in the same manner as Fig. 48

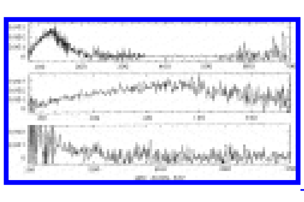 Full image (72kb) | Discussion in text

FIG. 74.—The EUV spectrum of 2RE J0029-632, displayed in the same manner as Fig. 52

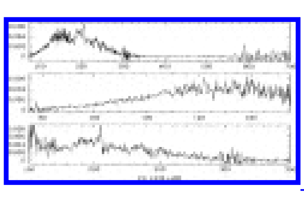 Full image (61kb) | Discussion in text

FIG. 75.—The EUV spectrum of PG 1234+482, displayed in the same manner as Fig. 52

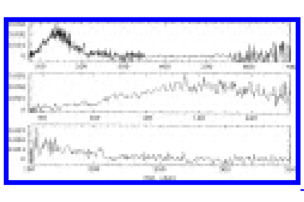 Full image (57kb) | Discussion in text

FIG. 76.—The EUV spectrum of PHL 1043, displayed in the same manner as Fig. 50

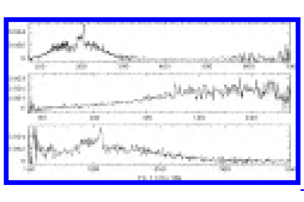 Full image (55kb) | Discussion in text

FIG. 77.—The EUV spectrum of PG 1123+189, displayed in the same manner as Fig. 52

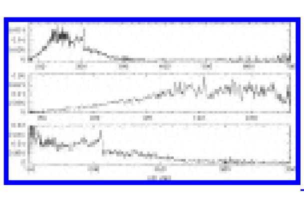 Full image (54kb) | Discussion in text

FIG. 78.—The EUV spectrum of GD 246, displayed in the same manner as Fig. 52

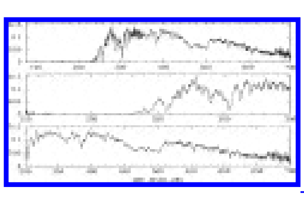 Full image (56kb) | Discussion in text

FIG. 79.—The EUV spectrum of 2RE J0503-285, displayed in the same manner as Fig. 48 except that the SW has been omitted and the bin sizes are 0.1, 0.2, and 0.4 Å in the top plot and 0.1 and 0.2 Å in the lower plots.

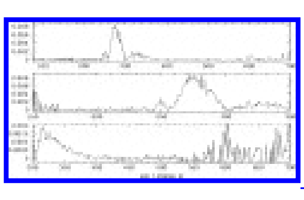 Full image (52kb) | Discussion in text

FIG. 80.—The EUV spectrum of HD 149499 B, displayed in the same manner as Fig. 51 except that the SW plot has been omitted

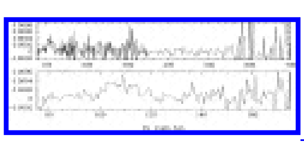 Full image (45kb) | Discussion in text

FIG. 81.—The EUV spectrum of PG 1520+525, displayed in the same manner as Fig. 63

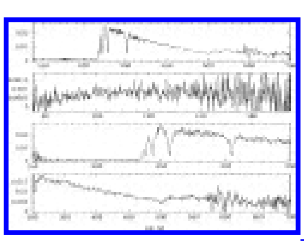 Full image (82kb) | Discussion in text

FIG. 82.—The EUV spectrum of GD 50, displayed in the same manner as Fig. 54

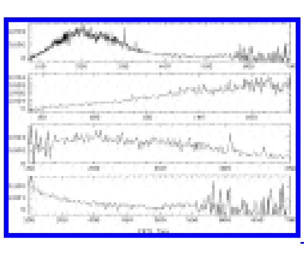 Full image (75kb) | Discussion in text

FIG. 83.—The EUV spectrum of V471 Tau, displayed in the same manner as Fig. 48 except that the bin sizes are 0.4, 0.8, and 1.6 Å

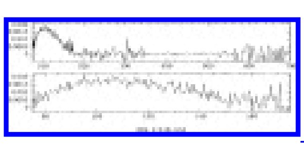 Full image (42kb) | Discussion in text

FIG. 84.—The EUV spectrum of 2RE J1016-052, displayed in the same manner as Fig. 51, except that the MW and LW plots have been omitted

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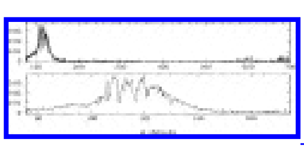 Full image (31kb) | Discussion in text

FIG. 85.—The EUV spectrum of H 1504+65, displayed in the same manner as Fig. 48 except that the MW and LW plots have been omitted

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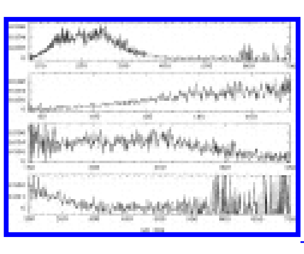
 Full image (97kb) | Discussion in text

FIG. 86.—The EUV spectrum of GD 394, displayed in the same manner as Fig. 54

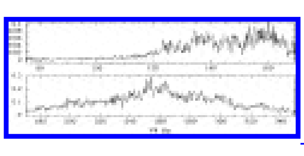
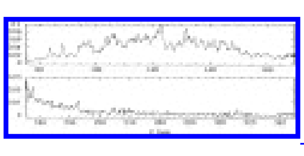
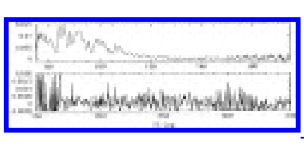
 Full image (39kb)  Full image (34kb)  Full image (50kb) | Discussion in text

FIG. 87.—The EUV spectrum of dwarf novae: (*a*) VW Hyi, (*b*) U Gem, and (*c*) SS Cyg. For each source, the SW and MW spectra are shown with bin sizes of 0.2 and 0.4 Å, respectively. Second- and higher order features have been removed as described in the text.

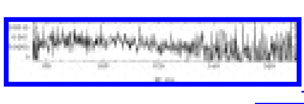
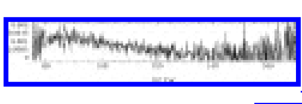
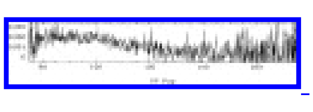
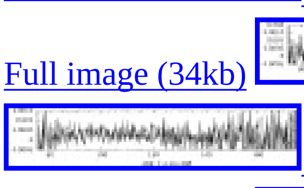
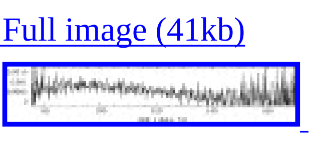
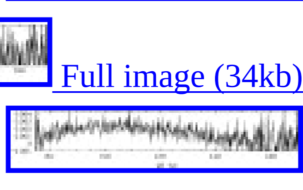
 Full image (35kb)  Full image (33kb)  Full image (34kb)  Full image (33kb)  Full image (41kb)  Full image (39kb)  Full image (34kb)  Full image (31kb)  Full image (16kb)  Full image (33kb) | Discussion in text

FIG. 88.—The EUV spectrum of AM Her stars: (*a*) EF Eri, (*b*) UZ For, (*c*) VV Pup, (*d*) EK UMa, (*e*) AN UMa, (*f*) 2RE J1149+288, (*g*) V834 Cen, (*h*) 2RE J1844-741, (*i*) AM Her, and (*j*) QS Tel. For each source except AM Her, we show the SW spectrum with a bin size of 0.13 Å. For AM Her only, second- and higher order features have been removed as described in the text and the bin size is 0.2 Å.

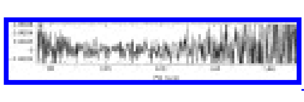
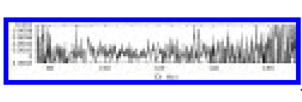
 Full image (41kb)  Full image (39kb) | Discussion in text

FIG. 89.—The EUV spectrum of DQ Her stars: (*a*) PQ Gem and (*b*) EX Hya. We show the SW spectrum of each with a bin size of 0.13 Å.

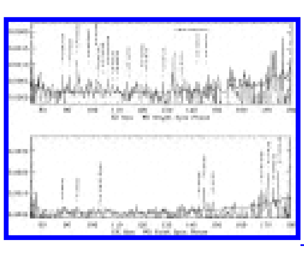
 Full image (111kb) | Discussion in text

FIG. 90.—The SW spectrum of EX Hya extracted at the white dwarf bright spin phases (from Hurwitz et al. 1997). Spectral features are marked at the expected wavelength of the species along with the temperatures (log *T*) where each line is predicted to be bright according to Mewe et al. (1995). Also plotted (*smoother curves*) are the 1 σ uncertainties at each wavelength.

TABLES

TABLE 1
SOURCE LIST

Catalog Name (1)	R.A. (2000) (2)	Decl. (2000) (3)	*EUVE* Name (4)	Other Name (5)	Spectral Type (6)	T_{exp} [a] (ks) (7)	Observation Dates (8)
B Stars							
ϵ CMa...	06 58 43	-28 56.9	2EUVE J0658-28.9	HR 2618	B2 I	68	1994 Mar 8–12
β CMa...	06 22 40	-17 58.5	2EUVE J0622-17.9	HR 2294	B1 II/III	132	1993 Dec 19–22
							1994 Feb 27–Mar 5
A Star							
Altair...	19 50 45	+08 51.7	...	HD 187642	A7 V	85	1993 Jun 27–30
F Star							
Procyon...	07 39 21	+05 13.7	2EUVE J0739+05.2	HD 61421	F5 IV–V	229	1993 Jan 11–15
							1994 Mar 12–18
RS CVn Binaries							
VY Ari...	02 48 46	+31 07.4	2EUVE J0248+31.1	HD 17433	K0	160	1994 Oct 6–12
UX Ari...	03 26 36	+28 43.4	2EUVE J0326+28.7	HD 21242	G5 IV	93	1994 Oct 19–22
V711 Tau...	03 36 49	+00 36.2	2EUVE J0336+00.6	HR 1099	G9 V	169	1992 Oct 22–25
							1993 Sep 16–21
Capella...	05 16 46	+45 59.8	2EUVE J0516+45.9	HD 34029	G5 IIIe	72	1994 Feb 25–27
σ Gem...	07 43 21	+28 53.1	2EUVE J0743+28.8	HD 62044	K1 III	55	1993 Feb 6-7
DH Leo...	10 00 05	+24 32.4	2EUVE J1000+24.5	HD 86590	K0+K V	177	1995 Feb 12–20
ξ UMa...	11 18 13	+31 31.5	2EUVE J1118+31.5	HD 98230	F8.5 V	54	1993 Mar 28–30
σ^2 CrB...	16 14 39	+33 51.4	2EUVE J1614+33.8	HD 146361	G0 Ve	95	1994 Feb 16–21
AR Lac...	22 08 38	+45 44.4	2EUVE J2208+45.7	HD 210334	G2 IV	91	1993 Oct 12–15
λ And...	23 37 32	+46 27.5	2EUVE J2337+46.4	HD 222107	G8 III	98	1993 Oct 16–19
II Peg...	23 55 02	+28 38.0	2EUVE J2355+28.6	HD 224085	K0 V	209	1993 Oct 1–5
							1995 Aug 5–9
G Dwarfs							
κ Cet...	03 19 24	+03 23.1	2EUVE J0319+03.3	HD 20630	G5 V	159	1994 Oct 13–18
χ Ori...	05 54 25	+20 16.8	2EUVE J0554+20.2	HD 39587	G0 V	91	1993 Jan 26–30
α Cen AB...	14 39 44	-60 50.4	2EUVE J1439-60.8	HD 128620	G2 V	143	1993 May 29–Jun 1
							1995 Mar 3–5
ξ Boo...	14 51 22	+19 06.5	2EUVE J1451+19.1	HD 131156	G8 V	79	1993 Apr 2–5
G Giants							
AY Cet...	01 16 34	-02 30.7	2EUVE J0116-02.5	HD 7672	G5 IIIe	87	1993 Sep 28–Oct 1
31 Com...	12 51 42	+27 31.6	2EUVE J1251+27.5	HD 111812	G0 IIIp	312	1993 Feb 11–13
							1995 Apr 17–25

Pre–Main-Sequence Star							
AB Dor...	05 28 46	-65 27.1	2EUVE J0528-65.4	HD 36705	K1 IIIp	255	1993 Nov 4–11
							1994 Nov 12–17
K Giant and Subgiant							
β Cet...	00 43 33	-17 59.6	2EUVE J0043-17.9	HD 4128	K0 III	164	1994 Sep 30–Oct 6
Algol...	03 08 11	+40 57.7	2EUVE J0308+40.9	HD 19356	B8 V+K2 IV	95	1993 Oct 30–Nov 4
K Dwarfs							
GJ 117...	02 52 33	-12 45.6	2EUVE J0252-12.7	HD 17925	K2 V	194	1994 Dec 2–8
ϵ Eri...	03 32 58	-09 26.7	2EUVE J0332-09.4	GJ 144	K2 V	61	1993 Oct 22–24
BF Lyn...	09 22 32	+40 12.2	2EUVE J0922+40.2	HD 80715	K2 V	69	1994 Apr 14–16
LQ Hya...	09 32 25	-11 11.1	2EUVE J0932-11.1	HD 82558	K0 Ve	153	1993 Dec 10–19
GJ 702AB...	18 05 27	+02 29.7	2EUVE J1805+02.4	HD 165341	K0 V	80	1993 Jul 2–5
VW Cep...	20 37 17	+75 36.5	2EUVE J2037+75.6	HD 197433	K0 V	80	1995 Jan 30–Feb 4
M Dwarfs							
YY Gem...	07 34 41	+31 52.8	2EUVE J0734+31.8	GJ 278C	M1 Ve	300	1995 Feb 20–Mar 2
YZ CMi...	07 44 43	+03 33.7	2EUVE J0744+03.5	GJ 285	M4.5 Ve	163	1993 Feb 25–27
							1994 Dec 21–24
AD Leo...	10 19 37	+19 51.8	2EUVE J1019+19.8	GJ 388	M4.5 Ve	84	1993 Mar 1–3
Prox Cen...	14 29 50	-62 40.7	2EUVE J1429-62.6	GJ 551	M5 Ve	79	1993 May 21–24
GJ 644...	16 55 26	-08 20.0	2EUVE J1655-08.3	HD 152751	M3 Ve	187	1994 Jul 30–Aug 8
AT Mic...	20 41 55	-32 26.1	2EUVE J2041-32.4	GJ 799AB	M4 Ve	58	1992 Jul 1–3
AU Mic...	20 45 08	-31 20.7	2EUVE J2045-31.3	GJ 803	M2 Ve	137	1992 Jul 14–17
							1993 Jul 22–23
FK Aqr...	22 38 44	-20 37.4	2EUVE J2238-20.6	GJ 867AB	M0 Vpe	128	1994 Sep 11–16
EV Lac...	22 46 46	+44 19.9	2EUVE J2246+44.3	GJ 873	M4.5 Ve	111	1993 Sep 9–13
EQ Peg...	23 31 51	+19 56.6	2EUVE J2331+19.9	GJ 896AB	M4 V	39	1993 Aug 29–30
White Dwarfs: Pure Hydrogen							
GD 2...	00 07 31	+33 17.3	2EUVE J0007+33.2	WD 0004+330	DA	49	1993 Oct 19–20
GD 659...	00 53 16	-33 00.6	2EUVE J0053-33.0	WD 0050-332	DA	155	1994 Sep 23–30
HD 15638...	02 28 22	-61 18.4	2EUVE J0228-61.3	WD 0226-615	DA+F3 V	68	1993 Sep 2–5
2RE J0515+324...	05 15 27	+32 41.2	2EUVE J0515+32.6	WD 0512+326	DA+F4 V	39	1993 Jan 24–26
GD 71...	05 52 30	+15 53.9	2EUVE J0552+15.8	WD 0549+158	DA	59	1993 Jan 10–11
Sirius B...	06 45 13	-16 42.0	2EUVE J0645-16.7	WD 0642-166	DA	50	1993 Nov 22–23
2RE J0715-702...	07 15 10	-70 24.6	2EUVE J0715-70.4	WD 0715-703	DA	77	1995 Feb 9–12
2RE J1032+532...	10 32 13	+53 29.0	2EUVE J1032+53.4	WD 1029+537	DA	281	1993 Feb 3–5
							1995 Apr 7–15
LB 1919...	10 59 19	+51 24.2	2EUVE J1059+51.4	WD 1056+516	DA	165	1994 Apr 16–20
PG 1057+719...	11 00 42	+71 38.7	2EUVE J1100+71.6	WD 1057+719	DA	114	1994 Jan 5–7
							1994 Feb 21–22
GD 153...	12 57 04	+22 01.2	2EUVE J1257+22.0	WD 1254+223	DA	104	1993 Feb 9–11
							1993 Mar 4
							1993 Apr 5–6
HZ 43...	13 16 24	+29 05.4	2EUVE J1316+29.0	WD 1314+293	DA	53	1996 Jun 5–7
CD -38 10980...	16 23 31	-39 14.0	2EUVE J1623-39.2	WD 1620-391	DA	104	1993 May 19–21
							1993 Jun 30–Jul 2
2RE J1746-703...	17 46 10	-70 40.0	2EUVE J1746-70.6	WD 1740-706	DA	186	1996 Mar 27–Apr 5
Lanning 18...	18 47 37	+01 57.2	2EUVE J1847+01.9	WD 1845+019	DA	36	1993 Jun 22–23
2RE J2009-602...	20 09 02	-60 26.3	2EUVE J2009-60.4	WD 2004-605	DA	104	1994 Jul 9–13
2RE J2024-422...	20 23 57	-42 24.5	2EUVE J2023-42.4	WD 2020-425	DA	35	1992 Jul 18–19
IK Peg...	21 26 24	+19 22.1	2EUVE J2126+19.3	WD 2124+191	DA+A8m	90	1993 Jul 23–27
2RE J2156-543...	21 56 20	-54 39.0	2EUVE J2156-54.6	WD 2152-548	DA	46	1993 Aug 14–16
2RE J2324-544...	23 24 31	-54 42.3	2EUVE J2324-54.7	WD 2321-549	DA	173	1995 Jul 29–Aug 5
White Dwarfs: Metal-rich							
Feige 24...	02 35 09	+03 44.9	2EUVE J0235+03.7	WD 0232+035	DA+M	29	1995 Oct 31–Nov 1
MCT 0455-2812...	04 57 16	-28 07.3	2EUVE J0457-28.1	WD 0455-282	DA	52	1993 Nov 14–16
G191-B2B...	05 05 35	+52 49.7	2EUVE J0505+52.8	WD 0501+527	DA	43	1994 Mar 5–8
2RE J0623-374...	06 23 14	-37 40.9	2EUVE J0623-37.6	WD 0621-376	DA	41	1993 Nov 23–24
							1994 Mar 25
2RE J2214-491...	22 14 10	-49 19.9	2EUVE J2214-49.3	WD 2211-495	DA	201	1993 Aug 26–29
							1994 Aug 12–17
MCT 2331-431...	23 34 03	-47 15.1	2EUVE J2334-47.2	WD 2331-475	DA	55	1993 Aug 8–10
HD 223816B...	23 53 11	-70 23.9	2EUVE J2353-70.3	WD 2350-706	DA+F5 IV	59	1993 Aug 6–8
White Dwarfs: Intermediate-Metallicity							
2RE J0029-632...	00 29 59	-63 25.6	2EUVE J0029-63.4	WD 0027-636	DA	112	1994 Sep 7–11
PHL 1043...	01 34 23	-16 07.6	2EUVE J0134-16.1	WD 0131-164	DA	132	1995 Aug 26–31
PG 1123+189...	11 26 21	+18 38.9	2EUVE J1126+18.6	WD 1123+189	DA+dM	249	1993 Feb 13–14

							1993 Mar 9–10
							1995 Mar 13–19
PG 1234+482...	12 36 48	+47 55.0	2EUVE J1236+47.9	WD 1234+482	DA	97	1993 Feb 19–22
GD 246...	23 12 24	+10 46.7	2EUVE J2312+10.7	WD 2309+105	DA	48	1994 Jul 16–17
							1994 Aug 8
White Dwarfs: Helium-rich							
2RE J0503-285...	05 03 56	-28 53.8	2EUVE J0503-28.8	WD 0501-289	DO	45	1993 Oct 20–22
HD 149499 B...	16 38 31	-57 28.1	…	WD 1634-573	DO	91	1993 Jun 23–27
PG 1159-035...	12 01 48	-03 46.3	2EUVE J1201-03.7	WD 1159-035	PG 1159	40	1993 Apr 6–7
PG 1520+525...	15 21 47	+52 21.3	2EUVE J1521+52.3	WD 1520+525	PG 1159	102	1994 Feb 9–15
White Dwarfs: Unusual							
GD 50...	03 48 52	-00 57.9	2EUVE J0348-00.9	WD 0346-011	DA+He	64	1994 Dec 12–14
V471 Tau...	03 50 24	+17 14.6	2EUVE J0350+17.2	WD 0347+171	DA+K2 V	99	1994 Nov 28–Dec 2
2RE J1016-052...	10 16 32	-05 20.6	2EUVE J1016-05.3	WD 1013-050	DAO+M	108	1994 Jan 27–31
H 1504+65...	15 02 06	+66 11.7	2EUVE J1502+66.1	WD 1501+663	PG 1159	36	1993 Dec 5–7
GD 394...	21 12 47	+50 05.9	2EUVE J2112+50.0	WD 2111+498	DA	48	1993 Sep 13–16
Cataclysmic Binaries: Dwarf Novae (outburst only)							
VW Hyi...	04 09 17	-71 18.2	2EUVE J0409-71.3	2RE J0409-711	DN	1	1994 Jun 1–4
U Gem...	07 55 05	+22 00.1	…	HD 64511	DN	35	1993 Dec 28–29
SS Cyg...	21 42 47	+43 36.5	2EUVE J2142+43.6	HD 206697	DN	122	1994 Jun 24–26
							1994 Jun 29–Jul 2
Cataclysmic Binaries: AM Her							
EF Eri...	03 14 15	-22 34.7	2EUVE J0314-22.5	2RE J0314-223	AM Her	95	1993 Sep 5–9
UZ For...	03 35 30	-25 43.6	2EUVE J0335-25.7	EXO 0333.3-2554	AM Her	77	1995 Jan 15–19
VV Pup...	08 15 06	-19 03.3	…	2RE J0815-190	AM Her	43	1993 Feb 7–9
EK UMa...	10 51 38	+54 04.1	2EUVE J1051+54.0	2RE J1051+540	AM Her	51	1994 Dec 14–15
AN UMa...	11 04 26	+45 03.4	2EUVE J1104+45.0	PG 1101+453	AM Her	41	1993 Feb 27–Mar 1
2RE J1149+288...	11 49 53	+28 44.3	2EUVE J1149+28.7	EQ J1149+28	AM Her	80	1993 Feb 22–25
V834 Cen...	14 09 04	-45 17.9	2EUVE J1409-45.2	1H 1404-450	AM Her	41	1993 May 28–29
AM Her...	18 16 14	+49 51.7	2EUVE J1816+49.8	1H 1814+498	AM Her	199	1993 Sep 23–28
							1995 Mar 8–13
2RE J1844-741...	18 44 57	-74 18.1	2EUVE J1844-74.3	…	AM Her	134	1994 Aug 17–24
QS Tel...	19 38 33	-46 13.5	2EUVE J1938-46.2	2RE J1938-461	AM Her	25	1993 Aug 16–17
Cataclysmic Binaries: DQ Her							
PQ Gem...	07 51 17	+14 44.2	EUVE J0751+14.7	2RE J0751+144	DQ Her	183	1996 Jan 13–19
EX Hya...	12 52 24	-29 15.1	2EUVE J1252-29.2	2E 2876	DQ Her	150	1994 May 26–Jun 1

[a] Average of SW, MW, and LW exposure times rounded to nearest ks.

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EUVE ATLAS SOURCE LIST

Catalog Name	Spectral Type	Observation Dates	Image	Data (fits.Z.tar)
B Stars				
ε CMa	B2 I	1994 Mar 8-12	gif	sw mw lw
β CMa	B1 II-III	1993 Dec 19-22	gif	sw mw lw
A Star				
Altair	A7 V	1993 Jun 27	gif	sw mw lw
F Star				
Procyon	F5 IV-V	1993 Jan 11-15	gif	sw mw lw
RS CVn Binaries				
VY Ari	K0	1994 Oct 6-12	gif	sw mw lw
UX Ari	G5 IV	1994 Oct 19-22	gif	sw mw lw
V711 Tau	G9 V	1992 Oct 22-25	gif	sw mw lw
Capella	G5 IIIe	1994 Feb 25-27	gif	sw mw lw
σ Gem	K1 III	1993 Feb 6-7	gif	sw mw lw
DH Leo	K0+K V	1995 Feb 12-20	gif	sw mw lw
ξ UMa	F8.5 V	1993 Mar 28-30	gif	sw mw lw
σ^2 CrB	G0 Ve	1994 Feb 16-21	gif	sw mw lw
AR Lac	G2 IV	1993 Oct 12-15	gif	sw mw lw
λ And	G8 III	1993 Oct 16-19	gif	sw mw lw
II Peg	K0 V	1993 Oct 1-5	gif	sw mw lw
G Dwarfs				
κ Cet	G5 V	1994 Oct 13-18	gif	sw mw lw
χ Ori	G0 V	1993 Jan 26-30	gif	sw mw lw
α Cen AB	G2 V	1993 May 29-32	gif	sw mw lw
ξ Boo	G8 V	1993 Apr 2-5	gif	sw mw lw
G Giants				
AY Cet	G5 IIIe	1993 Sep 28-32	gif	sw mw lw
31 Com	G0 IIIp	1993 Feb 11-13	gif	sw mw lw
Pre-Main Sequence Star				
AB Dor	K1 IIIp	1993 Nov 4-11	gif	sw mw lw
K Giant and Subgiant				
β Cet	K0 III	1994 Sep 30-36	gif	sw mw lw
Algol	B8 V+K2 IV	1993 Oct 30-33	gif	sw mw lw
K Dwarfs				
GJ 117	K2 V	1994 Dec 2-8<	gif	sw mw lw
ε Eri	K2 V	1993 Oct 22-24	gif	sw mw lw
BF Lyn	K2 V	1994 Apr 14-16	gif	sw mw lw
LQ Hya	K0 Ve	1993 Dec 10-19	gif	sw mw lw
GJ 702AB	K0 V	1993 Jul 2-5	gif	sw mw lw
VW Cep	K0 V	1995 Jan 30-33	gif	sw mw lw
M Dwarfs				
YY Gem	M1 Ve	1995 Feb 20-30	gif	sw mw lw
YZ CMi	M4.5 Ve	1993 Feb 25-27	gif	sw mw lw
AD Leo	M4.5 Ve	1993 Mar 1-3	gif	sw mw lw
Prox Cen	M5 Ve	1993 May 21-24	gif	sw mw lw
GJ 644	M3 Ve	1994 Jul 30-37	gif	sw mw lw
AT Mic	M4 Ve	1992 Jul 1-3	gif	sw mw lw
AU Mic	M2 Ve	1992 Jul 14-17	gif	sw mw lw
FK Aqr	M0 Vpe	1994 Sep 11-16	gif	sw mw lw
EV Lac	M4.5 Ve	1993 Sep 9-13	gif	sw mw lw
EQ Peg	M4 V	1993 Aug 29-30	gif	sw mw lw
White Dwarfs: Pure Hydrogen				
GD 2	DA	1993 Oct 19-20	gif	sw mw lw
GD 659	DA	1994 Sep 23-30	gif	sw mw lw
HD 15638	DA+F3 V	1993 Sep 2-5	gif	sw mw lw
2RE J0515+324	DA+F4 V	1993 Jan 24-26	gif	sw mw lw
GD 71	DA	1993 Jan 10-11	gif	sw mw lw
Sirius B	DA	1993 Nov 22-23	gif	sw mw lw
2RE J0715-702	DA	1995 Feb 9-12	gif	sw mw lw
2RE J1032+532	DA	1993 Feb 3-5	gif	sw mw lw
LB 1919	DA	1994 Apr 16-20	gif	sw mw lw
PG 1057+719	DA	1994 Jan 5-7	gif	sw mw lw
GD 153	DA	1993 Feb 9-11	gif	sw mw lw
HZ 43	DA	1996 Jun 5-7	gif	sw mw lw
CD -38 10980	DA	1993 May 19-21	gif	sw mw lw
2RE J1746-703	DA	1996 Mar 27-36	gif	sw mw lw
Lanning 18	DA	1993 Jun 22-23	gif	sw mw lw
2RE J2009-602	DA	1994 Jul 9-13	gif	sw mw lw
2RE J2024-422	DA	1992 Jul 18-19	gif	sw mw lw
IK Peg	DA+A8m	1993 Jul 23-27	gif	sw mw lw
2RE J2156-543	DA	1993 Aug 14-16	gif	sw mw lw
2RE J2324-544	DA	1995 Jul 29-36	gif	sw mw lw
White Dwarfs: Metal-rich				
Feige 24	DA+M	1995 Oct 31-2	gif	sw mw lw
MCT 0455-2812	DA	1993 Nov 14-16	gif	sw mw lw
G191-B2B	DA	1994 Mar 5-8	gif	sw mw lw
2RE J0623-374	DA	1993 Nov 23-24	gif	sw mw lw
2RE J2214-491	DA	1993 Aug 26-29	gif	sw mw lw
MCT 2331-431	DA	1993 Aug 8-10	gif	sw mw lw
HD 223816B	DA+F5 IV	1993 Aug 6-8	gif	sw mw lw
White Dwarfs: Intermediate-Metallicity				
2RE J0029-632	DA	1994 Sep 7-11	gif	sw mw lw
PHL 1043	DA	1995 Aug 26-31	gif	sw mw lw
PG 1123+189	DA+dM	1993 Feb 13-14	gif	sw mw lw
PG 1234+482	DA	1993 Feb 19-22	gif	sw mw lw
GD 246	DA	1994 Jul 16-17	gif	sw mw lw
White Dwarfs: Helium-rich				
2RE J0503-285	DO	1993 Oct 20-22	gif	sw mw lw
HD 149499 B	DO	1993 Apr 6-7	gif	sw mw lw
PG 1520+525	PG 1159	1994 Feb 9-15	gif	sw mw lw
White Dwarfs: Unusual				
GD 50	DA+He	1994 Dec 12-14	gif	sw mw lw
V471 Tau	DA+K2 V	1994 Nov 28-32	gif	sw mw lw
2RE J1016-052	DAO+M	1994 Jan 27-31	gif	sw mw lw
H 1504+65	PG 1159	1993 Dec 5-7	gif	sw mw lw

GD 394	DA	1993 Sep 13-16	gif	sw mw lw
Cataclysmic Binaries: Dwarf Novae (outburst only)				
VW Hyi	DN	1994 Jun 1-4	gif	sw mw lw
U Gem	DN	1993 Dec 28-29	gif	sw mw lw
SS Cyg	DN	1994 Jun 24-26	gif	sw mw lw
Cataclysmic Binaries: AM Her				
EF Eri	AM Her	1993 Sep 5-9	gif	sw mw lw
UZ For	AM Her	1995 Jan 15-19	gif	sw mw lw
VV Pup	AM Her	1993 Feb 7-9	gif	sw mw lw
EK UMa	AM Her	1994 Dec 14-15	gif	sw mw lw
AN UMa	AM Her	1993 Feb 27-9	gif	sw mw lw
2RE J1149+288	AM Her	1993 Feb 22-25	gif	sw mw lw
V834 Cen	AM Her	1993 May 28-29	gif	sw mw lw
AM Her	AM Her	1993 Sep 23-28	gif	sw mw lw
2RE J1844-741	AM Her	1994 Aug 17-24	gif	sw mw lw
QS Tel	AM Her	1993 Aug 16-17	gif	sw mw lw
Cataclysmic Binaries: DQ Her				
PQ Gem	DQ Her	1996 Jan 13-19	gif	sw mw lw
EX Hya	DQ Her	1994 May 26-32	gif	sw mw lw

EUVE Atlas of Stars

This page takes you to a table containing EUVE (Extreme Ultraviolet Explorer Data) spectra of 94 stars selected by Craig et al. (1997). The list is roughly representative of the sample of stars by the EUVE project during its lifetime (1992-January 2001). These spectra were taken whenever possible with all the three bandpasses, short- (SW; 70-190 Å), medium- (MW; 140-380 Å), and long-wavelength (LW; 280-760 Å). The spectral resolutions for these cameras are 0.5, 1, and 2 Å, respectively.

The stars are organized in a table by spectral type and by subcategories within each type. A user may click on the 'ps' link to browse a multi-panel image or one of the three bandpass links to download the data in compressed FITS format. The x-axis is in wavelength units, while the y-axis is in units of photons/cm^2/s/Å).

It is important to point out that the spectra in this atlas were only the best available at the time of the compilation. In some cases longer exposures were made after the atlas was constructed (late in the mission lifetime) and are available in the HEASARC/MAST archives.

Available Data

A HIGH DISPERSION SPECTROSCOPIC SURVEY OF THE HOT WHITE DWARFS: THE *IUE* NEWSIPS SWP ECHELLE DATA SET

J. B. Holberg

M.A. Barstow

E. M. Sion

Text and FIgures in PostScript format

Tables in Postscript Format

Available *IUE* NEWSIPS data for WD0004+330 (GD 2)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
27176	L	1985 Nov 26	24000	156/88	0.0	Bruhweiler	Z

Available *IUE* NEWSIPS data for WD0050-332 (GD 659)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
18289	L	1982 Oct 14	24000	163/98	-8.8	Basri	Z
28384	L	1986 May 27	22200	180/100	-10.0	Bruhweiler	Z
52116	L	1994 Sep 14	20096	129/84	+2.0	Holberg	Z
52129	L	1994 Sep 15	20096	138/89	+23.5	Holberg	Z
52137	L	1994 Sep 17	20996	132/84	-2.7	Holberg	Z

Co-added spectra:

File	Comment
gd659.fits	----------

Available *IUE* NEWSIPS data for WD0134+833 (GD 419)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
27188	L	1985 Nov 28	25019	148/102	0.0	Vauclair	NS

Available *IUE* NEWSIPS data for WD0205+250 (EG 15)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
23647	L	1984 Aug 9	24600	180/87	0.0	Bruhweiler	Z

Available *IUE* NEWSIPS data for WD0232+035 (Feige 24)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
16292	L	1982 Feb 8	25200	235/113	+22.4	Raymond	Z
18216	L	1982 Oct 5	9899	130/51	+14.0	Bruhweiler	Z
20614	L	1983 Aug 5	10800	133/52	-3.5	Dupree	Z
23474	L	1984 Jul 19	14400	163/60	+42.6	Dupree	Z
25163	S	1985 Feb 3	18600	183/107	+41.2	Raymond	Z
42084	L	1991 Jul 17	21600	191/56	+48.4	Vennes	Z
42089	L	1991 Jul 18	22080	196/61	+34.4	Vennes	Z
42095	L	1991 Jul 19	22200	255/61	+20.8	Vennes	Z
42105	L	1991 Jul 20	25500	209/67	+43.5	Vennes	Z
42128	L	1991 Jul 26	22200	203/62	+40.4	Vennes	Z
52127	L	1994 Sep 15	10800	117/62	-43.5	Vennes	Z
52128	L	1994 Sep 15	9000	103/53	-37.7	Vennes	Z
52156	L	1994 Sep 19	10800	116/54	-42.0	Vennes	Z
52157	L	1994 Sep 19	7200	88/32	+8.4	Vennes	Z

Co-added spectra:

File	Comment
f24_csm.fits	coadded in the frame of the system gamma velocity
f24_stl.fits	coadded in the stellar rest frame (Vennes and Thorstensen 1994)
feige24_ism.fits	coadded in the insterstellar frame

Available *IUE* NEWSIPS data for WD0343-007 (KUV343-7)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
43400	S	1991 Dec 16	4199	66/29	0.0	Finley	NS

Available *IUE* NEWSIPS data for WD0346-011 (GD 50)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
31976	L	1987 Oct 3	46799	225/163	0.0	Holberg	Z

Available *IUE* NEWSIPS data for WD0347+171 (V 471 Tau)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
15898	L	1981 Dec 28	10800	88/50	+5.0	Beavers	Z
15899	L	1981 Dec 29	6840	64/38	-	Beavers	Z
15900	L	1981 Dec 29	12360	83/53	+8.0	Beavers	Z
28826	L	1986 Aug 4	15000	107/73	-	Sion	Z
31611	L	1987 Aug 22	11400	109/58	-	Sion	Z
31630	L	1987 Aug 23	23453	152/99	+17.0	Bruhweiler	Z
32649	L	1988 Jan 1	11160	80/48	-	Guinan	Z
32659	L	1988 Jan 3	13020	91/55	-	Guinan	Z
37928	L	1989 Dec 31	15000	87/54	-32.0	Mullan	Z
42193	L	1991 Aug 7	9420	68/37	-6.0	Hakala	Z

Co-added spectra:

File	Comment
v471.fits	----------

Available *IUE* NEWSIPS data for WD0413-077 (40 Eri B)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
7972	L	1980 Feb 17	13200	255/84	+10.87	Greenstein	Z
14416	L	1981 Jul 7	5220	161/46	-11.70	Bruhweiler	Z
49058	L	1993 Oct 31	5400	155/47	-98.25	Shipman	Z
49059	L	1993 Oct 31	5400	147/46	+132.60	Shipman	Z
49060	L	1993 Nov 1	5880	159/50	+144.20	Shipman	Z
49143	L	1993 Nov 7	6000	164/50	-87.70	Shipman	Z
49144	L	1993 Nov 8	5400	150/47	+158.25	Shipman	Z
49190	L	1993 Nov 10	6000	170/61	+57.90	Shipman	Z
49191	L	1993 Nov 10	6000	166/51	+45.90	Shipman	Z
49192	L	1993 Nov 11	5100	155/45	-46.45	Shipman	Z

Co-added spectra:

File	Comment
40erib.fits	----------

Available *IUE* NEWSIPS data for WD0441+467 (S 216)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
27558	L	1986 Jan 22	18900	210/109	+16.2	Fesen	Z
43949	L	1992 Feb 8	21299	171/57	+19.2	Gonzalez	Z
56071	L	1995 Oct 12	21600	204/125	-14.5	Napiwotzki	Z
56072	L	1995 Oct 12	21600	171/989	-17.8	Napiwotzki	Z

Co-added spectra:

File	Comment
s216.fits	----------

Available *IUE* NEWSIPS data for WD0455-282 (REJ0457-281)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
46304	L	1992 Nov 19	37200	186/124	-2.6	Holberg	Z
56213	L	1995 Nov 18	45000	197/137	+26.1	Barstow	Z
56262	L	1995 Dec 2	47160	232/150	-15.3	Barstow	Z
56267	L	1995 Dec 4	39100	255/123	-5.3	Barstow	Z

Co-added spectra:

File	Comment
re0457.fits	----------

Available *IUE* NEWSIPS data for WD0501+527 (G191-B2B)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
13541	L	1981 Mar 21	4800	116/36	+3.5	Bruhweiler	Z
18217	L	1982 Oct 6	6000	128/48	-34.7	Bruhweiler	Z
22428	L	1984 Mar 6	4800	145/84	-15.5	Bruhweiler	Z
41183	L	1991 Mar 26	7799	148/41	+29.0	Carini	Z
41207	L	1991 Mar 29	7500	146/41	+11.5	Monier	Z
41281	L	1991 Apr 3	9600	171/49	-20.7	Rawley	Z
41301	L	1991 Apr 5	19200	253/98	-7.8	Pitts	Z
46600	L	1992 Dec 27	10500	175/48	+6.4	Pitts	Z
46677	L	1993 Jan 7	5700	150/41	-4.8	Weinstein	Z
46693	L	1993 Jan 9	10500	184/56	+15.0	Newmark	Z
48544	S	1993 Sep 6	14996	113/66	+24.6	Sion	Z
52405	L	1994 Oct 14	10799	174/53	+4.3	Rawley	Z
52677	L	1994 Oct 28	9899	172/51	+19.0	England	Z
55664	L	1995 Aug 23	9597	170/53	-16.4	Nichols	Z

Co-added spectra:

File	Comment
g191_a.fits	----------
g191_b.fits	alternate independent coaddition

Available *IUE* NEWSIPS data for WD0512+326 (KW Aur C)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
45663	L	1992 Sep 17	22800	203/90	+43.9	Guinan	Z
47384	L	1993 Mar 29	24000	175/100	+43.9	Etzel	Z
50435	L	1994 Mar 31	18296	140/81	-8.7	Guinan	Z

Co-added spectra:

File	Comment
kwaurc.fits	----------

Available *IUE* NEWSIPS data for WD0518-105 (REJ0521-102)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
45949	L	1992 Oct 15	2040	34/18	-24.2	Marsh	NS

Available *IUE* NEWSIPS data for WD0549+158 (GD 71)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
18273	L	1982 Oct 13	22200	163/96	+3.1	Basri	Z
22023	L	1984 Jan 16	22500	168/65	+1.8	Bruhweiler	Z
49873	L	1994 Jan 22	20699	160/96	-9.6	Holberg	Z

Co-added spectra:

File	Comment
gd71.fits	----------

Available *IUE* NEWSIPS data for WD0612+177 (EG 46)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
23953	L	1984 Sep 13	19800	120/76	0.0	Bruhweiler	Z
42921	L	1991 Oct 27	44099	196/139	0.0	Holberg	NS
44002	L	1992 Feb 16	43199	190/123	0.0	Holberg	Z

Co-added spectra:

File	Comment
eg46.fits	----------

Available *IUE* NEWSIPS data for WD0621-376 (REJ0623-374)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
45951	L	1992 Oct 15	14400	190/64	-111.2	Holberg	Z
47985	L	1993 Jun 28	11399	77/53	0.0	Vennes	NS
49037	L	1993 Oct 29	6000	184/55	-16.0	Marsh	Z
49038	L	1993 Oct 29	12598	177/53	+45.8	Holberg	Z
49039	L	1993 Oct 30	12598	174/64	+77.5	Holberg	Z

Co-added spectra:

File	Comment
re0623.fits	---------

Available *IUE* NEWSIPS data for WD0642-166 (Sirius B)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
2706	S	1978 Sep 20	20	35/19	0.0	Bohm-Vitense	NS
2730	L	1978 Sep 22	600	255/143	0.0	Bohm-Vitense	B
2750	L	1978 Sep 24	600	207/44	+179.5	Bohm-Vitense	Z
10072	L	1980 Sep 10	3	36/19	0.0	Savedoff	NS
10075	S	1980 Sep 10	1200	160/41	+37.1	Savedoff	Z
22693	S	1984 Apr 8	1200	78/25	-11.3	Gry	Z
22694	S	1984 Apr 8	1200	74/26	-25.9	Gry	Z

Co-added spectra:

File	Comment
siriusb.fits	----------

Available *IUE* NEWSIPS data for WD0644+375 (EG 50)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
13779	L	1981 Apr 22	20700	188/108	0.0	Raymond	Z

Available *IUE* NEWSIPS data for WD1013-050 (REJ1016-053)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
47721	L	1993 May 24	20696	126/84	-2.3	Vennes	Z
49832	L	1994 Jan 14	23399	177/129	0.0	Vennes	Z
49885	L	1994 Jan 24	22500	150/105	+2.1	Vennes	Z

Co-added spectra:

File	Comment
re1016.fits	----------

Available *IUE* NEWSIPS data for WD1031-114 (EG 70)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
33807	L	1988 Jun 24	23100	147/94	0.0	Holberg	Z

Available *IUE* NEWSIPS data for WD1134+300 (GD 140)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
23374	L	1984 Jul 1	14099	107/40	0.0	Bruhweiler	Z

Available *IUE* NEWSIPS data for WD1148-230 (EC1148-2)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
48112	L	1993 Jul 14	5699	96/42	0.0	Sion	Z

Available *IUE* NEWSIPS data for WD1202+608 (Feige 55)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
31178	L	1987 Jun 17	26700	116/185	-6.9	Green	Z
49841	L	1994 Jan 17	20097	207/147	+21.2	Holberg	Z
49844	L	1994 Jan 18	22800	235/182	-10.6	Holberg	Z
49859	L	1994 Jan 21	19500	242/189	+0.2	Holberg	Z
50171	L	1994 Mar 6	24000	156/90	-2.0	Tweedy	Z
53873	L	1995 Feb 9	24000	157/100	-14.5	Holberg	Z
53930	L	1995 Feb 17	24600	178/120	+5.1	Holberg	Z
54495	L	1995 Apr 24	22197	159/92	+11.8	Holberg	Z

Co-added spectra:

File	Comment
f55_stl.fits	coadded in the stellar rest frame (Holberg 1995a)
feige55.fits	coadded in the interstellar frame

Available *IUE* NEWSIPS data for WD1210+533 (PG1210+533)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
31277	L	1987 Jul 1	46799	222/152	0.0	Holberg	Z

Available *IUE* NEWSIPS data for WD1234+481 (HS1234+481)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
39161	L	1990 Jun 29	32519	128/76	0.0	Koester	Z

Available *IUE* NEWSIPS data for WD1254+223 (GD 153)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
20369	L	1983 Jul 3	21720	142/82	+21.5	Bruhweiler	Z
22192	L	1984 Feb 3	20396	135/78	-21.5	Finley	Z

Co-added spectra:

File	Comment
gd153.fits	----------

Available *IUE* NEWSIPS data for WD1302+597 (GD 323)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
40123	L	1990 Nov 16	50399	180/145	0.0	Sion	B
43344	L	1991 Dec 8	57599	178/124	0.0	Sion	Z

Available *IUE* NEWSIPS data for WD1314+293 (HZ 43)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
13689	L	1981 Apr 9	25200	186/88	+0.6	Basri	Z
27225	S	1985 Dec 5	21600	52/132	-	York	Z
49958	L	1994 Feb 4	17819	156/88	-1.4	Holberg	Z
49963	L	1994 Feb 5	19977	159/94	-14.6	Holberg	Z
50068	L	1994 Feb 20	23085	209/115	+15.7	Demartino	Z

Co-added spectra:

File	Comment
hz43.fits	----------

Available *IUE* NEWSIPS data for WD1337+705 (EG 102)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
17182	L	1982 Jun 10	26279	155/100	0.0	Bruhweiler	Z

Available *IUE* NEWSIPS data for WD1615-154 (EG 118)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
16364	L	1982 Feb 18	24000	164/104	0.0	Bruhweiler	Z

Available *IUE* NEWSIPS data for WD1620-391 (CD-38 10980)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
18290	L	1982 Oct 15	7200	147/47	-1.8	Basri	Z
25669	L	1985 Apr 12	7200	141/42	-14.3	Holberg	Z
40922	L	1991 Feb 23	7500	142/39	-23.2	Mansperger	Z
41346	L	1991 Apr 11	8100	142/39	-10.7	Demartino	Z
41379	L	1991 Apr 14	10500	171/46	+2.1	Fernley	Z
41435	L	1991 Apr 20	10800	192/55	+21.5	Rawley	Z
41466	L	1991 Apr 24	12000	178/52	+8.5	Demartino	Z
41467	L	1991 Apr 24	5939	112/35	+2.7	Demartino	Z
41495	L	1991 Apr 27	21600	255/91	-7.5	Mansperger	Z
42260	L	1991 Aug 15	12000	190/53	+19.3	Monier	Z
42297	L	1991 Aug 20	6780	129/34	+3.4	Demartino	Z
42309	L	1991 Aug 22	8340	146/37	+7.0	Demartino	Z
47010	L	1993 Feb 20	10200	170/59	-10.5	England	Z
47273	L	1993 Mar 13	9000	169/66	-25.6	Newmark	Z
48308	L	1993 Aug 5	10800	173/62	+16.9	Mansperger	Z
50517	L	1994 Apr 10	9000	186/103	+4.2	Teays	Z
51681	L	1994 Aug 1	10800	179/68	-10.4	Rawley	Z
51794	L	1994 Aug 13	10800	177/73	+4.8	England	Z

Co-added spectra:

File	Comment
cd-38a.fits	----------
cd-38b.fits	alternate independent coaddition

Available *IUE* NEWSIPS data for WD1631+781 (REJ1629+780)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
42033	L	1991 Jul 10	23700	143/49	-3.8	Sion	Z
44010	L	1992 Feb 17	26400	154/86	+22.5	Holberg	Z
49563	L	1993 Dec 10	24300	158/99	-16.7	Sion	Z

Co-added spectra:

File	Comment
re1629.fits	----------

Available *IUE* NEWSIPS data for WD1800+685 (KUV)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
57789	L	1996 Aug 13	42000	180/126	-1.4	Barstow	Z
57791	L	1996 Aug 14	42000	192/123	+0.9	Barstow	Z
57793	L	1996 Aug 15	42000	220/126	+0.5	Barstow	Z

Co-added spectra:

File	Comment
kuv18004.fits	----------

Available *IUE* NEWSIPS data for WD1845+019 (Lanning 18)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
34660	L	1988 Nov 1	22500	152/87	0.0	Holberg	Z

Available *IUE* NEWSIPS data for WD2004-605 (REJ2009-602)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
49050	L	1993 Oct 30	31194	200/128	0.0	Holberg	Z

Available *IUE* NEWSIPS data for WD2028+390 (GD 391)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
20842	L	1983 Aug 30	23399	144/80	0.0	Bruhweiler	Z

Available *IUE* NEWSIPS data for WD2032+248 (Wolf 1346)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
13542	L	1981 Mar 21	15000	181/101	+19.9	Bruhweiler	Z
14415	L	1981 Jul 7	15000	148/60	-22.3	Bruhweiler	Z
52152	L	1994 Sep 18	24600	202/101	-1.8	Holberg	Z
52167	L	1994 Sep 20	25620	210/113	+28.4	Holberg	Z
52175	L	1994 Sep 21	24600	224/102	-21.6	Holberg	Z

Co-added spectra:

File	Comment
wolf1346.fits	----------

Available *IUE* NEWSIPS data for WD2111+498 (GD 394)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
16891	L	1982 May 5	18000	132/52	+20.3	Bruhweiler	Z
22754	L	1984 Apr 15	23399	180/101	+7.2	Bruhweiler	Z
49756	L	1994 Jan 3	19376	133/87	-30.3	Holberg	Z
49758	L	1994 Jan 4	20696	181/87	+1.5	Holberg	Z

Co-added spectra:

File	Comment
gd394.fits	----------

Available *IUE* NEWSIPS data for WD2117+539 (G231-40)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
25184	L	1985 Feb 6	24900	170/124	0.0	Bruhweiler	Z

Available *IUE* NEWSIPS data for WD2211-495 (REJ2214-491)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
44766	L	1992 May 25	7200	169/44	-12.0	Sion/Holberg	Z
44767	L	1992 May 25	7200	167/45	-18.0	Sion	Z
47954	L	1993 Jun 25	7200	182/42	+122.6	Holberg	Z
47955	L	1993 Jun 25	7200	158/44	+28.4	Holberg	Z
47956	L	1993 Jun 25	7200	195/109	+16.9	Holberg	Z
47996	L	1993 Jun 29	7200	161/43	-19.0	Holberg	Z

Co-added spectra:

File	Comment
re2214.fits	----------

Available *IUE* NEWSIPS data for WD2309+105 (GD 246)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
17010	L	1982 May 21	24000	193/106	-2.1	Basri	Z
46544	L	1992 Dec 20	21900	170/93	+8.2	Vennes/Chayer	Z
46546	L	1992 Dec 21	24300	174/94	+5.5	Vennes/Chayer	Z
46560	L	1992 Dec 22	25500	210/119	-11.4	Vennes/Chayer	Z
46723	L	1993 Jan 13	22200	166/95	+46.2	Vennes	Z

Co-added spectra:

File	Comment
gd246.fits	----------

Available *IUE* NEWSIPS data for WD2331-475 (REJ2334-471)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
44778	L	1992 May 25	26399	155/91	+124.2	Sion	Z
47877	L	1993 Jun 16	23399	124/93	-	Barstow/Sion	NS
47964	L	1993 Jun 26	23700	136/96	-	Vennes	NS
47974	L	1993 Jun 27	22500	139/94	-	Vennes	Z
47993	L	1993 Jun 28	25200	145/100	+44.3	Holberg	Z
48186	L	1993 Jul 20	23399	183/95	-121.6	Vennes	Z
48514	L	1993 Aug 31	23399	150/77	-20.2	Vennes	Z
48522	L	1993 Sep 1	23700	151/94	-34.7	Vennes	Z

Co-added spectra:

File	Comment
re2334.fits	----------

Available *IUE* NEWSIPS data for WD2350-706 (HD223816B)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
49030	L	1993 Oct 28	42292	209/145	-	Sion	Z

Available *IUE* NEWSIPS data for WD0005+511 (KPD0005+5106)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
26191	L	1985 Jun 17	25200	206/111	-5.3	Sion	Z
52108	L	1994 Sep 14	21600	157/97	+4.7	Holberg	Z
52146	L	1994 Sep 17	25500	178/106	+5.9	Holberg	Z
52185	L	1994 Sep 22	25500	171/107	-4.8	Holberg	Z

Co-added spectra:

File	Comment
kpd0005.fits	----------

Available *IUE* NEWSIPS data for WD0044-121 (NGC 246)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
3353	L	1978 Nov 15	6720	170/53	-42.4	Heap	Z
41997	L	1991 Jul 3	7200	156/40	-3.2	Cassatella	Z
42068	L	1991 Jul 13	13380	224/59	-5.1	Heap	Z
42073	L	1991 Jul 15	6900	150/39	+10.2	Tweedy	Z
42104	L	1991 Jul 20	9000	181/48	-6.5	Demartino	Z
42214	L	1991 Aug 10	9000	179/48	-5.3	Talavera	Z
42247	L	1991 Aug 14	7200	154/48	+39.5	Monier	Z
47843	L	1993 Jun 10	9896	216/76	-5.3	Quigley	Z
47844	L	1993 Jun 10	8097	186/84	+17.7	Quigley	Z

Co-added spectra:

File	Comment
ngc246.fits	----------

Available *IUE* NEWSIPS data for WD0112+104 (PG0112+104)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
37656	L	1989 Nov 22	48000	180/109	0.0	Sion	W

Available *IUE* NEWSIPS data for WD0501-289 (REJ0503-289)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
46428	L	1992 Dec 7	28499	152/98	+3.1	Sion	Z
49788	L	1994 Jan 7	21896	133/90	+7.5	Holberg	Z
52796	L	1994 Nov 13	49499	235/163	-17.8	Holberg	Z
52803	L	1994 Nov 14	36299	190/129	-40.7	Holberg	Z

Co-added spectra:

File	Comment
re0503.fits	----------

Available *IUE* NEWSIPS data for WD1034+001 (PG1034+001)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
18509	L	1982 Nov 8	19800	195/70	-5.3	Sion	Z
26201	L	1985 Jun 18	15719	149/58	+5.3	Sion	Z

Co-added spectra:

File	Comment
pg1034.fits	----------

Available *IUE* NEWSIPS data for WD1159-034 (PG1159-035)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
23032	L	1984 May 16	61199	230/164	+9.3	Liebert	Z
53903	L	1995 Feb 13	40015	226/171	-8.2	Holberg	Z
54675	L	1995 May 14	52499	231/164	-7.4	Burleigh	Z
54976	L	1995 Jun 10	52799	232/172	+2.4	Barstow	Z

Co-added spectra:

File	Comment
pg1159.fits	----------

Available *IUE* NEWSIPS data for WD1211+332 (HZ 21)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
31287	L	1987 Jul 3	68819	255/201	0.0	Sion	Z

Available *IUE* NEWSIPS data for WD1634-573 (HD149499B)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
6272	L	1979 Aug 24	5400	141/42	-24.0	Sion	Z
13781	L	1981 Apr 22	2400	205/148	-3.4	Raymond	Z
13782	L	1981 Apr 22	1680	119/83	+8.2	Raymond	Z
13783	L	1981 Apr 23	5340	140/81	+14.1	Raymond	Z
17467	L	1982 Jul 23	4500	159/92	+11.9	Bruhweiler	Z

Co-added spectra:

File	Comment
hd149499b.fits	----------

Available *IUE* NEWSIPS data for WD1645+325 (GD 358)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
31432	L	1987 Jul 29	63239	247/187	+27.2	Sion	Z
33681	L	1988 May 31	47700	207/155	-27.2	Sion	Z

Co-added spectra:

File	Comment
gd358.fits	----------

Available *IUE* NEWSIPS data for WD1821+643 (K1-16)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
33849	L	1988 Jul 1	47700	207/153	0.0	Holberg	Z

Available *IUE* NEWSIPS data for WD2117+342 (RXJ2117.1+341)

(The links in the **SWP Number** column (or **File** column for co-added spectra) will generate a request form for the data from that spectrum.)

SWP Number	Aperture	Date	Exp (sec)	C/B	Shift (mA)	Observer	Status
47556	L	1993 Apr 27	21600	168/87	+1.1	Levenhagen	Z
47563	L	1993 Apr 28	21720	172/61	-1.0	Leuenhagen	Z
55411	L	1995 Aug 3	26400	177/86	-39.8	Werner	Z

Co-added spectra:

File	Comment
rxj2117.fits	----------

FOS

Faint Object Spectrograph

The Faint Object Spectrograph (FOS) was one of the original 4 axial instruments on the Hubble Space Telescope (HST). The FOS, which was removed from HST during the Second Servicing Mission in February 1997, was used to make spectroscopic observations of astrophysical sources from the near ultraviolet to the near infrared (1150-8000 Angstroms).

ST-ECF Post Operational HST Archives

The Post-Operational Archives (POA) branch of the Space Telescope - European Coordinating Facility (ST-ECF) has taken over the main responsibility of FOS (re-)calibration. Their web pages contain all of the information that was previously on the STScI FOS pages, supplemented with more recent FOS news including a new and improved version of the FOS calibration pipeline (POA_CALFOS), which replaces CALFOS in the standard IRAF/STSDAS FOS calibration. We invite you to check out their web pages.

THE ASTROPHYSICAL JOURNAL, 475:469–478, 1997 February 1

SEE ERRATUM

A Composite *HST* Spectrum of Quasars

1

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ABSTRACT

We construct a composite quasar spectrum from 284 *HST* FOS spectra of 101 quasars with redshifts $z > 0.33$. The spectrum covers the wavelengths between 350 and 3000 Å in the rest frame, with a peak S/N level of ~130 per Å at ~1200 Å. Since ~90% of the sample quasars have redshift $z < 1.5$, the spectrum is suitable for studying the wavelength region shortward of Lyα without large effects from intervening Lyα forest absorption. Data in the waveband between 350 and 600 Å are mainly from the spectra of $z > 1.5$ quasars, for which significant corrections for the accumulated Lyman-series line and continuum absorption have been applied.

There is a significant steepening of the continuum slope around 1050 Å. The continuum between 1050 and 2200 Å can be modeled as a power law $f_\nu \propto \nu^\alpha$ with $\alpha = -0.99 \pm 0.05$. For the full sample the power-law index in the extreme ultraviolet (EUV) between 350 and 1050 Å is $\alpha = -1.96 \pm 0.15$. For the radio-loud subsample (60 objects), the EUV spectral index is $\alpha \simeq -2.2$, while for the radio-quiet subsample (41 objects) it is $\alpha \simeq -1.8$. The continuum flux in the wavelengths near the Lyman limit shows a depression of ~10%. The break in the power-law index and the slight depression of the continuum near the Lyman limit are features expected in Comptonized accretion-disk spectra. Comptonization produces a power-law tail in the wavelength band shortward of ~1000 Å and smears out the Lyman-limit edge of the intrinsic accretion-disk spectrum.

In the EUV waveband, we detect several possible emission features, including one around 690 Å that may be O III + N III produced by the Bowen fluorescence effect. Comparing our composite spectrum with one made at higher redshifts by Francis et al., we find that the equivalent widths of Lyα and high-ionization emission lines are larger in our sample, reflecting a known luminosity dependence. The equivalent widths of low-ionization lines do not exhibit such a dependence, suggesting that the quasar EUV continuum above ~50 eV is steeper at higher luminosity.

Radio-quiet quasars appear to show a slightly harder continuum and lower ionization levels in their emission lines.

Subject headings: atomic processes—quasars: general—ultraviolet: galaxies

CONTENTS

FOOTNOTES

[1] Based on observations with the NASA/ESA *Hubble Space Telescope*, obtained at the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS5-26555.

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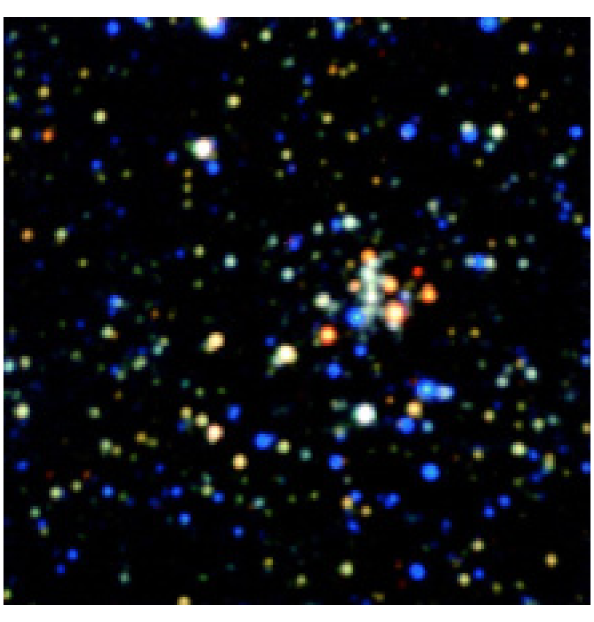

As of 23 July 2001, the Astrophysical Journal Web Peer Review System supports authors and referees for the ApJ (Part 1), the Letters (Part 2), and the Supplement.

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309.600	2.79	2.72	2.78
309.900	-2.08	2.47	2.53
310.200	-4.3	2.31	2.37
310.500	3.65	2.46	2.51
310.800	-4.7	2.12	2.19
311.133	1.49	2.23	2.28
311.500	7.97	2.36	2.41
311.833	0.827	2.28	2.34
312.200	2.65	2.28	2.33
312.500	0.766	2.16	2.22
312.800	1.07	2.11	2.17
313.100	5.96	2.21	2.26
313.400	4.22	2.1	2.16
313.700	6.14	1.97	2.03
314.100	0.541	1.68	1.74
314.500	1.9	1.66	1.72
314.800	3.15	1.66	1.72
315.133	2.54	1.61	1.67
315.500	1.74	1.55	1.6
315.800	-2.89	1.37	1.44
316.100	5.44	1.59	1.64
316.433	2.89	1.49	1.55
316.833	-1.35	1.32	1.38
317.200	-3.3	1.24	1.3
317.500	1.67	1.38	1.43
317.800	4.15	1.44	1.49
318.133	3.24	1.38	1.44
318.500	-4.55	1.08	1.16
318.800	3.19	1.3	1.35
319.167	-0.224	1.17	1.24
319.500	-3.28	1.07	1.13
319.800	3.73	1.26	1.31
320.133	0.341	1.15	1.21
320.600	1.96	1.14	1.2
320.900	2.41	1.13	1.19
321.200	0.432	1.05	1.11
321.500	0.652	1.05	1.11
321.800	0.919	1.04	1.1
322.100	1.23	1.03	1.09
322.400	0.927	0.984	1.04
322.700	3.52	1.05	1.1
323.000	1.89	1.11	1.16
323.300	1.14	1.09	1.15
323.600	1.44	1.08	1.13
323.900	2.92	1.09	1.15
324.200	2.84	1.08	1.13
324.500	0.646	0.983	1.05
324.800	0.631	0.938	0.998
325.100	2.75	0.911	0.97
325.400	3.68	0.914	0.972
325.700	1.36	0.84	0.902
326.000	-0.058	0.784	0.845
326.300	3.38	0.882	0.934
326.600	0.102	0.77	0.835
326.900	2.05	0.81	0.865
327.833	4.41	0.888	0.941
329.400	3.44	1.51	1.55
329.700	2.71	1.26	1.32
330.000	2.16	1.17	1.23
330.300	1.83	1.1	1.16
330.600	2.25	1.32	1.37
330.900	1.92	1.15	1.22
331.200	2.53	1.3	1.35
331.500	2.61	1.37	1.42
331.800	0.719	0.88	0.965
332.100	2.88	1.51	1.55
332.400	2.89	1.38	1.44
332.700	2.12	1.24	1.3
333.000	1.59	1.11	1.18
333.300	2.42	1.42	1.47
333.600	2.83	1.38	1.44
333.900	2.92	1.4	1.46
334.200	4.05	1.6	1.65
334.500	4.57	1.72	1.77
334.800	1.95	1.32	1.4
335.100	3.78	1.56	1.61
335.400	2.66	1.34	1.41
335.700	1.6	1.09	1.16
336.000	2.77	1.46	1.5
336.300	3.83	1.51	1.57
336.600	3.41	1.13	1.36
336.900	2.61	0.708	0.755
337.200	2.79	0.684	0.779
337.500	2.24	0.69	0.491
337.800	3.22	0.81	0.868
338.100	4.29	0.796	1.32
338.400	3.74	0.743	0.98
338.700	3.51	0.767	1.18
339.000	3.33	0.754	1.2
339.300	2.63	0.559	0.996
339.600	2.13	0.599	0.948
339.900	2.54	0.666	0.501
340.200	3.01	0.747	0.569
340.500	2.03	0.649	0.634
340.800	2.42	0.619	0.393
341.100	2.23	0.591	0.343
341.400	2.07	0.705	0.844
341.700	2.29	0.561	0.675
342.000	1.26	0.504	0.812
342.300	1.73	0.581	0.631
342.600	2.95	0.677	0.898
342.900	3.61	0.856	1.42
343.200	1.44	0.532	0.732
343.500	1.71	0.585	0.856
343.800	2.79	0.65	0.799
344.100	2.03	0.54	0.5
344.400	2.82	0.587	0.804
344.700	2.38	0.506	0.619
345.000	2.23	0.512	0.544
345.300	1.39	0.514	0.706
345.600	1.85	0.581	0.41
345.900	2.25	0.58	0.389
346.200	2.43	0.571	0.375
346.500	2.56	0.558	0.346
346.800	2.06	0.562	0.473
347.100	2.38	0.558	0.468
347.400	1.52	0.396	0.916
347.700	2.35	0.52	0.674
348.000	3.93	0.648	0.565
348.300	3.11	0.674	0.587
348.600	2.11	0.508	0.425
348.900	2.84	0.53	0.686
349.200	2.46	0.538	0.538
349.500	2.51	0.528	0.405
349.800	2.6	0.594	0.554
350.100	3.13	0.727	0.738
350.400	2.95	0.672	0.499
350.700	2.45	0.633	0.467
351.000	1.69	0.625	0.637
351.300	1.61	0.56	0.916
351.600	1.6	0.577	1.03
351.900	1.47	0.492	1.22
352.200	1.95	0.533	0.764
352.500	1.57	0.546	0.787
352.800	2.13	0.659	0.853
353.100	2.37	0.601	0.735
353.400	2.71	0.631	0.858
353.700	2.72	0.611	0.435
354.000	2.2	0.568	0.257
354.300	2.36	0.615	0.298
354.600	2.57	0.545	0.821
354.900	2.09	0.519	0.566
355.200	2.76	0.594	1.14
355.500	2.41	0.569	0.8
355.800	2.58	0.564	0.684
356.100	2.94	0.606	1.06
356.400	3.09	0.656	0.814
356.700	3.02	0.663	0.745
357.000	2.34	0.564	0.737
357.300	2.45	0.491	0.94
357.600	1.64	0.451	1.11
357.900	2	0.554	0.608
358.200	2.43	0.555	0.885
358.500	2.39	0.566	0.649
358.800	2.53	0.577	0.518
359.100	2.56	0.617	0.803
359.400	1.75	0.571	0.804
359.700	2.68	0.601	0.515
360.000	3.26	0.63	0.522
360.300	3.16	0.689	0.455
360.600	2.46	0.588	0.629
360.900	1.91	0.526	0.378
361.200	2.95	0.584	0.868
361.500	2.6	0.544	0.799
361.800	2.29	0.514	0.592
362.100	2.79	0.657	0.606
362.400	2.88	0.563	0.777
362.700	1.98	0.55	0.488
363.000	1.93	0.519	0.503
363.300	1.61	0.487	0.414
363.600	1.7	0.499	0.316
363.900	1.57	0.748	0.405
364.200	1.36	0.67	0.546
364.500	1.72	0.751	0.812
364.800	1.79	0.782	0.748
365.100	2.51	0.829	0.684
365.400	1.82	0.798	0.483
365.700	1.57	0.733	0.559
366.000	2.85	0.887	0.402
366.300	3.18	0.994	0.479
366.600	1.59	0.703	0.731
366.900	1.31	0.672	0.705
367.200	2.22	0.885	0.556
367.500	1.69	0.733	0.441
367.800	1.7	0.707	0.525
368.100	2.99	0.957	0.928
368.400	3.04	0.897	1.05
368.700	2.44	0.858	0.931
369.000	3.24	0.98	0.894
369.300	2.55	0.823	0.586
369.600	1.69	0.744	1.21
369.900	2.28	0.809	0.879
370.200	2.79	0.774	0.885
370.500	2.16	0.514	0.762
370.800	2.58	0.6	0.54
371.100	2.46	0.585	0.43
371.400	1.11	0.397	0.983
371.700	2.06	0.527	0.513
372.000	1.98	0.539	0.435
372.300	1.61	0.514	0.488
372.600	2.07	0.587	0.481
372.900	2.26	0.598	0.568
373.200	2.91	0.659	0.493
373.500	2.4	0.574	0.731
373.800	1.84	0.511	0.43
374.100	1.88	0.609	0.446
374.400	2.43	0.566	0.435
374.700	2.97	0.636	0.709
375.000	2.62	0.579	0.415
375.300	2.59	0.577	0.43
375.600	2.54	0.618	0.372
375.900	2.49	0.544	0.448
376.200	2.01	0.573	0.731
376.500	2.55	0.644	0.637
376.800	1.34	0.476	0.66
377.100	1.23	0.423	1.02
377.400	1.32	0.447	0.823
377.700	2.16	0.526	0.467
378.000	2.28	0.552	0.384
378.300	3.93	0.783	1.24
378.600	2.7	0.605	0.926
378.900	2.01	0.509	0.557
379.200	2.07	0.549	0.412
379.500	2.17	0.528	0.473
379.800	1.97	0.468	0.742
380.100	2.61	0.562	0.624
380.400	2.13	0.508	0.784
380.700	1.7	0.501	0.532
381.000	2.09	0.506	0.497
381.300	2.38	0.528	0.593
381.600	2.82	0.56	0.702
381.900	3.51	0.612	1.18
382.200	2.94	0.615	0.753
382.500	1.92	0.41	1.04
382.800	2.4	0.462	0.656
383.100	2.72	0.468	0.794
383.400	2.34	0.47	0.646
383.700	2.11	0.494	0.606
384.000	2.06	0.431	0.497
384.300	2.32	0.476	0.767
384.600	2.32	0.475	0.66
384.900	2.69	0.569	0.901
385.200	2.16	0.453	0.646
385.500	2.64	0.46	0.72
385.800	2.74	0.524	0.546
386.100	2.51	0.477	0.465
386.400	2.08	0.453	0.507
386.700	2.36	0.501	0.77
387.000	2.27	0.495	0.573
387.300	2.01	0.469	0.755
387.600	2.62	0.577	0.561
387.900	2.12	0.439	0.491
388.200	2.51	0.478	0.91
388.500	3.02	0.577	0.435

388.800	1.87	0.427	0.64
389.100	2.4	0.419	1.03
389.400	2.34	0.558	0.513
389.700	2.66	0.569	0.71
390.000	2.98	0.594	0.905
390.300	1.52	0.46	0.612
390.600	2.2	0.534	0.478
390.900	2.92	0.615	0.516
391.200	2.82	0.548	0.69
391.500	2.52	0.514	0.627
391.800	2.51	0.548	0.607
392.100	2.17	0.519	0.462
392.400	2.31	0.522	0.408
392.700	2.38	0.557	0.405
393.000	3.04	0.576	0.428
393.300	2.29	0.569	0.577
393.600	1.31	0.463	0.962
393.900	2.09	0.544	0.652
394.200	2.33	0.54	0.731
394.500	2.4	0.608	0.548
394.800	2.65	0.535	0.35
395.100	2.33	0.509	0.642
395.400	2.06	0.502	0.704
395.700	2.75	0.538	0.627
396.000	3.23	0.683	0.464
396.300	1.9	0.449	0.669
396.600	2.64	0.547	0.865
396.900	3.75	0.692	0.978
397.200	2.37	0.534	0.538
397.500	2.45	0.548	0.359
397.800	2.86	0.642	0.596
398.100	2.42	0.527	0.389
398.400	2.22	0.492	0.662
398.700	2.33	0.54	0.846
399.000	2.26	0.55	0.543
399.300	2.73	0.563	0.492
399.600	2.3	0.536	0.836
399.900	2.33	0.597	0.804
400.200	3.27	0.681	0.629
400.500	2.66	0.633	0.357
400.800	2.49	0.555	0.616
401.100	2.24	0.566	0.588
401.400	2.76	0.623	0.402
401.700	2.42	0.595	0.541
402.000	2.69	0.646	0.449
402.300	2.47	0.636	0.544
402.600	2.45	0.638	0.512
402.900	3.14	0.707	0.466
403.200	2.83	0.608	0.358
403.500	2.75	0.61	0.502
403.800	3.38	0.74	0.736
404.100	2.83	0.635	0.7
404.400	2.88	0.615	0.539
404.700	2.95	0.673	0.469
405.000	2.34	0.564	0.393
405.300	2.02	0.491	0.729
405.600	2.45	0.641	0.464
405.900	2.56	0.566	0.407
406.200	2.58	0.58	0.486
406.500	2.25	0.544	0.536
406.800	2.84	0.614	0.663
407.100	3.27	0.703	0.751
407.400	2.21	0.512	0.545
407.700	2.52	0.526	0.691
408.000	2.87	0.677	0.472
408.300	3.19	0.635	0.633
408.600	3.17	0.649	0.863
408.900	3.21	0.681	0.791
409.200	2.9	0.568	0.499
409.500	3.32	0.6	0.868
409.800	2.51	0.597	0.367
410.100	2.61	0.551	0.312
410.400	2.68	0.553	0.319
410.700	2.63	0.644	0.498
411.000	2.63	0.542	0.395
411.300	2.63	0.535	0.516
411.600	2.7	0.514	0.541
411.900	2.43	0.506	0.386
412.200	2.49	0.554	0.36
412.500	2.14	0.449	0.482
412.800	1.94	0.451	0.384
413.100	2.37	0.519	0.385
413.400	2.52	0.542	0.386
413.700	2.43	0.539	0.448
414.000	2.54	0.526	0.568
414.300	2.25	0.483	0.462
414.600	2.73	0.481	0.566
414.900	2.65	0.493	0.806
415.200	2.37	0.43	0.7
415.500	2.12	0.437	0.442
415.800	2.19	0.507	0.412
416.100	2.63	0.522	0.662
416.400	3.2	0.613	0.939
416.700	2.82	0.54	0.648
417.000	2.31	0.475	0.713
417.300	1.95	0.439	0.939
417.600	2.96	0.526	0.618
417.900	2.33	0.467	0.814
418.200	2.43	0.466	0.789
418.500	2.56	0.465	0.532
418.800	2.84	0.479	0.775
419.100	2.27	0.493	0.39
419.400	2.71	0.491	0.276
419.700	2.58	0.492	0.471
420.000	2.21	0.488	0.358
420.300	2.45	0.484	0.453
420.600	2.64	0.518	0.59
420.900	2.32	0.495	0.362
421.200	2.16	0.457	0.474
421.500	2.44	0.506	0.528
421.800	2.9	0.537	0.945
422.100	2.99	0.507	0.62
422.400	2.82	0.481	0.646
422.700	2.78	0.497	0.711
423.000	2.86	0.478	0.607
423.300	2.62	0.455	0.52
423.600	2.22	0.433	0.345
423.900	2.1	0.431	0.386
424.200	2.03	0.47	0.465
424.500	2.13	0.438	0.419
424.800	1.94	0.395	0.693
425.100	2.25	0.42	0.678
425.400	2.6	0.416	0.627
425.700	2.79	0.478	0.858
426.000	2.64	0.429	0.574
426.300	2.59	0.38	0.688
426.600	1.98	0.355	0.787
426.900	1.99	0.501	0.601
427.200	1.77	0.481	0.513
427.500	1.94	0.507	0.33
427.800	2.3	0.512	0.326
428.100	2.74	0.541	0.556
428.400	3.05	0.602	0.806
428.700	2.26	0.522	0.379
429.000	2.13	0.501	0.39
429.300	2.21	0.541	0.542
429.600	2.55	0.543	0.342
429.900	2.57	0.538	0.554
430.200	1.86	0.476	0.356
430.500	2.26	0.488	0.621
430.800	2.91	0.572	0.606
431.100	2	0.478	0.423
431.400	2.23	0.487	0.389
431.700	2.35	0.528	0.364
432.000	2.36	0.499	0.349
432.300	2.22	0.487	0.316
432.600	2.53	0.552	0.395
432.900	2.23	0.495	0.533
433.200	2.8	0.521	0.372
433.500	2.98	0.554	0.501
433.800	2.86	0.538	0.603
434.100	2.04	0.458	0.618
434.400	1.95	0.473	0.673
434.700	2.51	0.513	0.711
435.000	2.53	0.541	0.547
435.300	2.58	0.566	0.461
435.600	2.63	0.522	0.359
435.900	2.21	0.516	0.548
436.200	1.82	0.448	0.697
436.500	1.96	0.468	0.444
436.800	1.92	0.475	0.413
437.100	2.22	0.414	0.469
437.400	2.17	0.38	0.534
437.700	2.27	0.367	0.596
438.000	2.77	0.428	0.534
438.300	2.25	0.382	0.64
438.600	1.86	0.34	0.471
438.900	2.31	0.37	0.463
439.200	3.09	0.437	0.52
439.500	2.62	0.4	0.385
439.800	2.32	0.372	0.371
440.100	2.36	0.38	0.471
440.400	2.48	0.396	0.479
440.700	2.5	0.373	0.43
441.000	2.19	0.346	0.588
441.300	2.18	0.365	0.604
441.600	2.25	0.36	0.584
441.900	2.77	0.431	0.571
442.200	2.15	0.356	0.364
442.500	2.24	0.35	0.407
442.800	2.81	0.417	0.493
443.100	2.08	0.317	0.5
443.400	2.15	0.335	0.486
443.700	2.78	0.381	0.544
444.000	2.54	0.352	0.581
444.300	2.42	0.348	0.486
444.600	3.03	0.435	0.495
444.900	2.67	0.384	0.499
445.200	2.44	0.384	0.444
445.500	1.82	0.308	0.629
445.800	1.92	0.306	0.725
446.100	2.33	0.362	0.407
446.400	2.51	0.355	0.559
446.700	2.11	0.329	0.419
447.000	1.86	0.351	0.525
447.300	2.34	0.349	0.467
447.600	2.4	0.357	0.411
447.900	2.36	0.37	0.336
448.200	2.45	0.367	0.477
448.500	2.57	0.371	0.453
448.800	1.91	0.3	0.77
449.100	1.87	0.292	0.678
449.400	2.29	0.34	0.434
449.700	2.86	0.434	0.352
450.000	2.81	0.413	0.435
450.300	2.56	0.454	0.604
450.600	2.31	0.377	0.504
450.900	2.35	0.367	0.391
451.200	2.54	0.399	0.341
451.500	2.25	0.346	0.674
451.800	1.81	0.316	1
452.100	2.27	0.37	0.514
452.400	2.64	0.38	0.442
452.700	2.89	0.401	0.538
453.000	2.48	0.379	0.46
453.300	2.97	0.385	0.464
453.600	3.11	0.403	0.539
453.900	2.84	0.426	0.595
454.200	2.76	0.42	0.434
454.500	2.73	0.419	0.469
454.800	2.01	0.383	0.375
455.100	1.95	0.367	0.304
455.400	2.31	0.399	0.43
455.700	2.42	0.388	0.517
456.000	2.8	0.398	0.512
456.300	2.59	0.399	0.465
456.600	2.85	0.437	0.59
456.900	3.15	0.46	0.717
457.200	2.77	0.425	0.359
457.500	2.47	0.367	0.481
457.800	2.37	0.365	0.472
458.100	2.66	0.445	0.326
458.400	3.06	0.448	0.454
458.700	2.94	0.437	0.609
459.000	2.07	0.349	0.568
459.300	2.25	0.346	0.503
459.600	2.22	0.36	0.804
459.900	2.4	0.344	0.622
460.200	3.12	0.409	0.746
460.500	3.2	0.445	0.791
460.800	2.57	0.351	0.636
461.100	2.41	0.363	0.736
461.400	2.86	0.446	0.562
461.700	2.67	0.384	0.506
462.000	2.56	0.369	0.504
462.300	2.18	0.362	0.582
462.600	2.04	0.309	0.833
462.900	2.22	0.303	0.651
463.200	2.01	0.299	0.642
463.500	1.65	0.289	0.505
463.800	2.52	0.339	0.474
464.100	2.98	0.378	0.46
464.400	3.06	0.364	0.429
464.700	2.58	0.348	0.405
465.000	2.25	0.318	0.379

465.300	2.35	0.351	0.547
465.600	2.56	0.389	0.446
465.900	2.72	0.349	0.346
466.200	2.81	0.355	0.362
466.500	2.74	0.392	0.255
466.800	2.96	0.369	0.202
467.100	2.76	0.368	0.324
467.400	2.87	0.415	0.674
467.700	2.62	0.37	0.549
468.000	2.45	0.347	0.474
468.300	2.52	0.386	0.433
468.600	2.51	0.353	0.337
468.900	2.17	0.323	0.302
469.200	2.83	0.408	0.515
469.500	3.07	0.378	0.555
469.800	3	0.407	0.546
470.100	2.45	0.353	0.366
470.400	2.4	0.359	0.369
470.700	2.92	0.429	0.408
471.000	3.05	0.409	0.401
471.300	3.04	0.403	0.406
471.600	2.57	0.368	0.373
471.900	2.38	0.358	0.416
472.200	2.12	0.333	0.53
472.500	2.15	0.334	0.553
472.800	2.62	0.372	0.567
473.100	2.73	0.394	0.528
473.400	2.46	0.407	0.535
473.700	2.77	0.397	0.469
474.000	3.11	0.458	0.706
474.300	2.92	0.366	0.481
474.600	2.8	0.371	0.431
474.900	2.93	0.43	0.468
475.200	2.82	0.387	0.316
475.500	2.74	0.382	0.378
475.800	2.44	0.382	0.492
476.100	2.03	0.341	0.559
476.400	2.68	0.356	0.436
476.700	2.56	0.41	0.482
477.000	2.68	0.505	0.375
477.300	2.52	0.436	0.428
477.600	2.41	0.47	0.421
477.900	2.34	0.428	0.435
478.200	2.36	0.458	0.579
478.500	2.34	0.468	0.346
478.800	2.36	0.494	0.291
479.100	1.95	0.404	0.433
479.400	2.19	0.406	0.613
479.700	2.59	0.65	0.485
480.000	2.68	0.753	0.462
480.300	2.76	0.487	0.354
480.600	2.17	0.484	0.447
480.900	2.72	0.605	0.633
481.200	2.71	0.664	0.524
481.500	2.32	0.47	0.415
481.800	2.5	0.52	0.688
482.100	2.7	0.393	0.815
482.400	2.49	0.396	0.598
482.700	2.3	0.484	0.434
483.000	2.37	0.518	0.379
483.300	2.46	0.586	0.444
483.600	2.84	0.653	0.332
483.900	2.83	0.551	0.5
484.200	2.68	0.578	0.602
484.500	2.82	0.501	0.473
484.800	2.75	0.522	0.432
485.100	2.49	0.525	0.597
485.400	2.65	0.57	0.617
485.700	2.7	0.505	0.635
486.000	2.65	0.535	0.495
486.300	2.48	0.436	0.513
486.600	2.71	0.466	0.565
486.900	2.88	0.484	0.537
487.200	2.26	0.481	0.479
487.500	2.42	0.513	0.597
487.800	2.08	0.523	0.743
488.100	2.08	0.449	0.586
488.400	2.44	0.5	0.657
488.700	2.85	0.582	0.568
489.000	2.87	0.635	0.627
489.300	2.51	0.424	0.571
489.600	2.55	0.473	0.625
489.900	2.09	0.432	1.06
490.200	1.93	0.45	1.06
490.500	3.25	0.682	0.785
490.800	3.56	0.78	0.889
491.100	1.94	0.464	1
491.400	1.89	0.442	0.842
491.700	2.46	0.624	0.734
492.000	2.67	0.722	0.81
492.300	2.69	0.392	0.57
492.600	3.17	0.417	0.727
492.900	2.29	0.452	0.694
493.200	2.13	0.475	0.683
493.500	2.88	0.636	0.59
493.800	3.04	0.697	0.546
494.100	2.19	0.499	0.731
494.400	2.09	0.52	0.782
494.700	2.14	0.474	0.582
495.000	2.21	0.515	0.424
495.300	2.06	0.426	0.571
495.600	2.16	0.439	0.684
495.900	2.64	0.582	0.535
496.200	2.87	0.656	0.495
496.500	2.2	0.519	0.354
496.800	1.91	0.536	0.373
497.100	2.16	0.498	0.334
497.400	2.12	0.502	0.312
497.700	1.72	0.392	0.526
498.000	1.8	0.402	0.572
498.300	3.06	0.651	0.827
498.600	3.62	0.755	0.98
498.900	3.21	0.573	0.591
499.200	2.99	0.598	0.473
499.500	2.92	0.602	0.479
499.800	3	0.645	0.477
500.100	2.5	0.54	0.402
500.400	2.01	0.559	0.455
500.700	2.29	0.451	0.573
501.000	2.36	0.47	0.663
501.300	1.93	0.44	0.538
501.600	1.68	0.432	0.471
501.900	2.29	0.546	0.581
502.200	3.08	0.653	0.672
502.500	3.16	0.643	0.733
502.800	3.4	0.706	0.876
503.100	3.1	0.575	0.579
503.400	2.73	0.597	0.632
503.700	1.81	0.383	0.607
504.000	1.8	0.397	0.59
504.300	2.08	0.452	0.441
504.600	2.49	0.536	0.421
504.900	2.17	0.507	0.386
505.200	2.24	0.552	0.44
505.500	2.37	0.514	0.424
505.800	2.07	0.54	0.532
506.100	2.23	0.495	0.532
506.400	2.16	0.498	0.416
506.700	2.36	0.519	0.331
507.000	2.54	0.564	0.496
507.300	2.52	0.537	0.641
507.600	2.5	0.564	0.52
507.900	3.15	0.613	0.612
508.200	3.49	0.668	0.788
508.500	2.7	0.487	0.791
508.800	2.31	0.512	0.515
509.100	2.58	0.5	0.379
509.400	2.66	0.536	0.37
509.700	2.78	0.523	0.837
510.000	2	0.443	0.68
510.300	2.07	0.471	0.665
510.600	2.08	0.493	0.674
510.900	2.34	0.545	0.605
511.200	2.48	0.603	0.537
511.500	2.34	0.53	0.609
511.800	2.37	0.559	0.564
512.100	1.76	0.417	0.812
512.400	1.73	0.414	0.734
512.700	2.16	0.53	0.587
513.000	2.27	0.606	0.702
513.300	2.17	0.484	0.565
513.600	2.17	0.511	0.615
513.900	2.37	0.527	0.786
514.200	2.78	0.597	0.541
514.500	2.23	0.475	0.621
514.800	1.89	0.486	0.475
515.100	2.43	0.5	0.342
515.400	2.42	0.535	0.472
515.700	1.69	0.406	0.782
516.000	1.47	0.407	0.63
516.300	2.22	0.523	0.532
516.600	2.78	0.598	0.379
516.900	1.78	0.356	0.699
517.200	1.27	0.35	0.754
517.500	2.35	0.474	0.526
517.800	2.6	0.52	0.473
518.100	2.38	0.481	0.45
518.400	2.44	0.501	0.637
518.700	2.43	0.535	0.802
519.000	2.48	0.6	0.743
519.300	2.28	0.562	0.559
519.600	2.27	0.602	0.48
519.900	2.64	0.63	0.66
520.200	2.99	0.68	0.687
520.500	2.9	0.61	0.678
520.800	2.97	0.668	0.703
521.100	2.58	0.525	0.376
521.400	2.62	0.554	0.255
521.700	2.64	0.579	0.433
522.000	2.8	0.623	0.564
522.300	3.01	0.624	0.604
522.600	3.39	0.683	0.712
522.900	3.18	0.586	0.736
523.200	3.01	0.636	0.754
523.500	2.16	0.505	0.823
523.800	2.23	0.535	0.546
524.100	2.64	0.459	0.82
524.400	1.93	0.386	0.712
524.700	2.18	0.477	0.545
525.000	2.68	0.558	0.377
525.300	2.24	0.391	0.71
525.600	2.03	0.392	0.762
525.900	2.21	0.481	0.579
526.200	2.22	0.519	0.534
526.500	2.07	0.457	0.423
526.800	2.78	0.522	0.605
527.100	2.84	0.437	0.919
527.400	2.81	0.473	1.01
527.700	2.92	0.514	0.615
528.000	2.42	0.545	0.409
528.300	2.53	0.573	0.625
528.600	2.95	0.645	0.562
528.900	2.1	0.368	0.487
529.200	2.1	0.372	0.321
529.500	1.98	0.451	0.565
529.800	2.32	0.51	0.599
530.100	2.44	0.481	0.752
530.400	2	0.453	0.667
530.700	2.09	0.452	0.607
531.000	2.35	0.502	0.461
531.300	2.34	0.457	0.438
531.600	2.02	0.486	0.511
531.900	2.76	0.579	0.869
532.200	3.21	0.684	0.971
532.500	2.47	0.566	0.597
532.800	2.09	0.496	0.335
533.100	2.34	0.492	0.441
533.400	2.23	0.559	0.418
533.700	2.49	0.544	0.413
534.000	2.85	0.593	0.303
534.300	2.6	0.542	0.34
534.600	2.9	0.575	0.531
534.900	2.73	0.55	0.523
535.200	2.46	0.584	0.486
535.500	2.65	0.551	0.353
535.800	2.65	0.606	0.558
536.100	2.53	0.547	0.438
536.400	2.3	0.505	0.459
536.700	2.09	0.509	0.415
537.000	2.56	0.595	0.454
537.300	2.69	0.543	0.571
537.600	1.96	0.514	0.897
537.900	2.48	0.616	0.431
538.200	2.83	0.681	0.588
538.500	3.23	0.698	0.501
538.800	3.05	0.712	0.43
539.100	2.78	0.674	0.749
539.400	2.93	0.752	0.876
539.700	2.5	0.64	0.617
540.000	2.64	0.667	0.429
540.300	2.43	0.514	0.63
540.600	2.6	0.401	0.588
540.900	1.95	0.397	0.645
541.200	1.71	0.434	0.811
541.500	2.14	0.496	0.819

541.800	2.89	0.652	0.634
542.100	1.96	0.55	0.487
542.400	2.43	0.615	0.389
542.700	2.87	0.594	0.282
543.000	2.4	0.561	0.494
543.300	2.28	0.505	0.446
543.600	2.24	0.565	0.331
543.900	1.88	0.539	0.557
544.200	2.56	0.654	0.657
544.500	3.24	0.637	0.643
544.800	2.83	0.585	0.516
545.100	2.55	0.519	0.346
545.400	2.37	0.542	0.342
545.700	2.66	0.557	0.406
546.000	3.23	0.667	0.503
546.300	2.83	0.55	0.627
546.600	2.05	0.425	0.707
546.900	2.03	0.443	0.552
547.200	2.81	0.561	0.76
547.500	2.53	0.489	0.665
547.800	2.12	0.48	0.56
548.100	2.02	0.47	0.424
548.400	2.18	0.531	0.309
548.700	2.52	0.571	0.307
549.000	2.48	0.61	0.279
549.300	2.5	0.556	0.277
549.600	2.63	0.599	0.25
549.900	2.67	0.566	0.4
550.200	2.76	0.612	0.487
550.500	2.43	0.54	0.462
550.800	2.31	0.588	0.393
551.100	2.29	0.577	0.534
551.400	2.85	0.659	0.486
551.700	2.64	0.527	0.603
552.000	2.28	0.502	0.654
552.300	2.02	0.447	0.532
552.600	2.39	0.519	0.562
552.900	2.69	0.561	0.483
553.200	2.27	0.571	0.566
553.500	2.31	0.504	0.567
553.800	2.52	0.553	0.507
554.100	2.45	0.491	0.432
554.400	2.34	0.51	0.369
554.700	2.78	0.558	0.636
555.000	2.89	0.601	0.587
555.300	2.25	0.501	0.341
555.600	1.87	0.475	0.36
555.900	2.13	0.45	0.424
556.200	2.31	0.497	0.56
556.500	2.45	0.516	0.408
556.800	2.39	0.539	0.393
557.100	2.55	0.542	0.31
557.400	2.48	0.572	0.309
557.700	2.59	0.538	0.542
558.000	2.8	0.596	0.532
558.300	2.52	0.502	0.367
558.600	2.37	0.51	0.347
558.900	2.52	0.51	0.595
559.200	2.29	0.527	0.346
559.500	2.52	0.521	0.505
559.800	2.64	0.6	0.608
560.100	2.3	0.472	0.753
560.400	1.92	0.424	1.16
560.700	1.98	0.47	0.868
561.000	2.75	0.567	0.348
561.300	2.89	0.531	0.372
561.600	1.99	0.522	0.748
561.900	1.53	0.478	0.893
562.200	2.21	0.625	0.902
562.500	3.1	0.593	0.591
562.800	2.54	0.518	0.479
563.100	2.14	0.498	0.828
563.400	1.8	0.483	1.03
563.700	2.2	0.456	0.594
564.000	2.23	0.533	0.326
564.300	2.08	0.493	0.596
564.600	1.78	0.478	0.781
564.900	1.75	0.447	0.391
565.200	2.59	0.568	0.507
565.500	2.75	0.515	0.586
565.800	2.17	0.423	0.568
566.100	2.36	0.403	0.553
566.400	3.59	0.661	0.611
566.700	3.11	0.582	0.728
567.000	1.86	0.324	0.779
567.300	1.32	0.313	0.704
567.600	1.97	0.499	0.628
567.900	2.07	0.451	0.518
568.200	2.08	0.474	0.505
568.500	2.68	0.471	0.406
568.800	3.34	0.597	0.556
569.100	3.72	0.591	0.723
569.400	2.72	0.533	0.379
569.700	2.69	0.494	0.317
570.000	3.29	0.575	0.486
570.300	2.96	0.51	0.641
570.600	2.65	0.533	0.55
570.900	2.54	0.497	0.422
571.200	2.75	0.55	0.393
571.500	2.85	0.515	0.443
571.800	3.2	0.597	0.555
572.100	3.07	0.537	0.442
572.400	2.69	0.492	0.518
572.700	2.41	0.429	0.479
573.000	2.8	0.577	0.353
573.300	2.5	0.525	0.417
573.600	1.81	0.348	0.666
573.900	1.91	0.333	0.728
574.200	1.92	0.439	0.652
574.500	2.24	0.434	0.429
574.800	2.63	0.536	0.262
575.100	2.76	0.466	0.472
575.400	2.35	0.355	0.622
575.700	2.11	0.346	0.54
576.000	2.24	0.437	0.354
576.300	2.59	0.418	0.276
576.600	2.62	0.445	0.304
576.900	2.5	0.416	0.358
577.200	2.46	0.43	0.37
577.500	2.54	0.412	0.316
577.800	2.81	0.436	0.347
578.100	2.7	0.409	0.501
578.400	2.78	0.502	0.662
578.700	2.49	0.435	0.526
579.000	1.92	0.341	0.56
579.300	1.88	0.335	0.566
579.600	2.56	0.486	0.683
579.900	2.59	0.449	0.637
580.200	2.29	0.433	0.323
580.500	2.42	0.405	0.254
580.800	2.58	0.448	0.274
581.100	2.66	0.428	0.351
581.400	2.86	0.488	0.588
581.700	2.8	0.451	0.576
582.000	2.59	0.439	0.352
582.300	2.42	0.413	0.452
582.600	2.51	0.492	0.638
582.900	2.48	0.451	0.581
583.200	2.5	0.481	0.377
583.500	2.4	0.456	0.383
583.800	1.99	0.432	0.405
584.100	2.07	0.404	0.417
584.400	2.23	0.418	0.427
584.700	2.55	0.396	0.431
585.000	2.64	0.488	0.496
585.300	2.48	0.456	0.408
585.600	2.38	0.443	0.45
585.900	2.41	0.422	0.376
586.200	2.84	0.535	0.516
586.500	2.58	0.481	0.508
586.800	1.91	0.41	0.567
587.100	2.09	0.43	0.574
587.400	2.59	0.553	0.746
587.700	2.7	0.559	0.695
588.000	2.22	0.393	0.335
588.300	2.18	0.401	0.362
588.600	2.1	0.398	0.344
588.900	2.19	0.408	0.345
589.200	2.36	0.437	0.323
589.500	2.32	0.465	0.437
589.800	2.28	0.423	0.386
590.100	2.24	0.45	0.322
590.400	2.39	0.444	0.327
590.700	2.43	0.47	0.322
591.000	2.26	0.419	0.287
591.300	2.47	0.463	0.243
591.600	2.47	0.398	0.354
591.900	2.38	0.413	0.415
592.200	2.26	0.414	0.29
592.500	2.33	0.424	0.252
592.800	2.78	0.494	0.505
593.100	2.79	0.538	0.633
593.400	2.17	0.376	0.455
593.700	2.1	0.4	0.379
594.000	2.82	0.497	0.584
594.300	3.06	0.554	0.721
594.600	2.52	0.414	0.398
594.900	2.43	0.435	0.339
595.200	2.62	0.374	0.512
595.500	2.68	0.381	0.569
595.800	2.69	0.332	0.389
596.100	2.74	0.347	0.439
596.400	2.35	0.253	0.481
596.700	2.07	0.248	0.596
597.000	2.29	0.292	0.597
597.300	2.35	0.309	0.572
597.600	2.38	0.293	0.501
597.900	2.41	0.323	0.362
598.200	2.56	0.316	0.384
598.500	2.48	0.334	0.426
598.800	2.1	0.269	0.318
599.100	2.32	0.289	0.288
599.400	2.52	0.285	0.327
599.700	2.51	0.308	0.366
600.000	2.52	0.301	0.326
600.300	2.22	0.311	0.292
600.600	2	0.292	0.336
600.900	2.05	0.303	0.369
601.200	2.22	0.309	0.39
601.500	2.51	0.346	0.342
601.800	2.67	0.32	0.446
602.100	2.64	0.344	0.44
602.400	2.45	0.29	0.29
602.700	2.54	0.305	0.237
603.000	2.56	0.304	0.245
603.300	2.7	0.331	0.356
603.600	2.4	0.252	0.419
603.900	2.19	0.255	0.411
604.200	2.24	0.244	0.507
604.500	2.23	0.243	0.527
604.800	2.22	0.286	0.449
605.100	2.28	0.303	0.446
605.400	2.08	0.295	0.497
605.700	2.03	0.32	0.483
606.000	1.89	0.211	0.524
606.300	1.92	0.228	0.574
606.600	2.45	0.311	0.401
606.900	2.28	0.329	0.353
607.200	2.19	0.309	0.417
607.500	2.4	0.336	0.329
607.800	2.19	0.271	0.354
608.100	2.15	0.279	0.411
608.400	2.32	0.316	0.381
608.700	2.51	0.341	0.444
609.000	2.36	0.272	0.374
609.300	2.46	0.296	0.392
609.600	2.59	0.338	0.533
609.900	2.63	0.378	0.682
610.200	2.46	0.311	0.349
610.500	2.45	0.325	0.335
610.800	2.47	0.32	0.346
611.100	2.42	0.345	0.403
611.400	2.46	0.336	0.486
611.700	2.25	0.375	0.634
612.000	2.31	0.336	0.571
612.300	2.49	0.344	0.388
612.600	2.08	0.268	0.424
612.900	1.99	0.239	0.459
613.200	2.17	0.275	0.472
613.500	2.57	0.364	0.551
613.800	2.2	0.284	0.356
614.100	2.05	0.259	0.395
614.400	2.29	0.289	0.358
614.700	2.34	0.348	0.434
615.000	2.36	0.32	0.485
615.300	2.29	0.331	0.421
615.600	2.51	0.323	0.459
615.900	2.41	0.454	0.546
616.200	2.31	0.417	0.554
616.500	2.34	0.432	0.493
616.800	2.29	0.367	0.401
617.100	2.16	0.352	0.33
617.400	2.37	0.358	0.31
617.700	2.55	0.422	0.401
618.000	2.2	0.341	0.483

618.300	1.94	0.314	0.5
618.600	1.93	0.37	0.525
618.900	2.29	0.476	0.66
619.200	2.27	0.419	0.544
619.500	2.5	0.433	0.389
619.800	2.27	0.399	0.342
620.100	2.24	0.428	0.327
620.400	2.39	0.396	0.269
620.700	2.37	0.413	0.273
621.000	2.33	0.362	0.232
621.300	2.04	0.37	0.249
621.600	2.01	0.319	0.303
621.900	1.73	0.303	0.256
622.200	1.94	0.323	0.354
622.500	2.17	0.354	0.279
622.800	2.25	0.362	0.293
623.100	2.32	0.346	0.316
623.400	2.61	0.403	0.353
623.700	2.58	0.405	0.394
624.000	2.43	0.363	0.315
624.300	2.29	0.387	0.26
624.600	1.97	0.324	0.44
624.900	1.85	0.311	0.601
625.200	2.15	0.33	0.484
625.500	2.47	0.41	0.55
625.800	2.26	0.383	0.361
626.100	2.37	0.423	0.408
626.400	2.43	0.401	0.3
626.700	2.47	0.419	0.285
627.000	2.23	0.349	0.364
627.300	2.16	0.341	0.397
627.600	2.18	0.329	0.371
627.900	2.15	0.377	0.31
628.200	2.16	0.335	0.407
628.500	2	0.334	0.583
628.800	2.27	0.375	0.496
629.100	2.55	0.467	0.536
629.400	2.59	0.401	0.463
629.700	2.41	0.397	0.293
630.000	1.98	0.31	0.388
630.300	1.77	0.284	0.591
630.600	2.03	0.286	0.479
630.900	2.47	0.343	0.632
631.200	2.21	0.309	0.502
631.500	2.02	0.332	0.381
631.800	2.35	0.331	0.428
632.100	2.67	0.389	0.498
632.400	2.46	0.34	0.4
632.700	2.35	0.353	0.417
633.000	2.45	0.354	0.508
633.300	2.54	0.392	0.47
633.600	2.54	0.368	0.527
633.900	2.04	0.323	0.448
634.200	1.76	0.307	0.388
634.500	2.47	0.382	0.469
634.800	2.84	0.382	0.637
635.100	2.46	0.346	0.462
635.400	2.17	0.322	0.379
635.700	1.99	0.304	0.488
636.000	2.06	0.29	0.537
636.300	1.82	0.292	0.429
636.600	1.9	0.284	0.384
636.900	2.78	0.399	0.673
637.200	2.86	0.37	0.617
637.500	2.71	0.359	0.438
637.800	2.45	0.32	0.389
638.100	2.19	0.335	0.354
638.400	2.17	0.313	0.361
638.700	2.35	0.32	0.292
639.000	2.54	0.314	0.397
639.300	2.27	0.311	0.514
639.600	2.22	0.296	0.667
639.900	2.13	0.301	0.823
640.200	2.07	0.324	0.507
640.500	1.92	0.286	0.516
640.800	1.99	0.3	0.489
641.100	1.97	0.355	0.358
641.400	1.81	0.334	0.372
641.700	2.04	0.342	0.368
642.000	2.18	0.339	0.336
642.300	2.43	0.412	0.374
642.600	2.3	0.371	0.41
642.900	2.17	0.389	0.387
643.200	2.14	0.35	0.329
643.500	1.9	0.321	0.456
643.800	1.9	0.294	0.492
644.100	2.04	0.367	0.325
644.400	2.3	0.351	0.324
644.700	2.57	0.382	0.282
645.000	2.24	0.351	0.383
645.300	2.21	0.383	0.425
645.600	2.68	0.409	0.533
645.900	2.59	0.401	0.45
646.200	2.57	0.381	0.363
646.500	2.53	0.401	0.38
646.800	2.41	0.38	0.339
647.100	2.3	0.377	0.26
647.400	2.42	0.369	0.309
647.700	2.81	0.459	0.741
648.000	2.88	0.433	0.851
648.300	3.34	0.522	1.29
648.600	3.17	0.461	1.05
648.900	2.16	0.342	0.461
649.200	2.19	0.329	0.374
649.500	2.36	0.393	0.418
649.800	2.07	0.356	0.537
650.100	2.04	0.324	0.508
650.400	2.18	0.308	0.357
650.700	2.4	0.335	0.307
651.000	2.44	0.323	0.421
651.300	2.53	0.353	0.452
651.600	2.35	0.324	0.41
651.900	2.33	0.302	0.427
652.200	2.49	0.317	0.474
652.500	2.53	0.319	0.393
652.800	2.39	0.32	0.356
653.100	2.64	0.36	0.5
653.400	2.71	0.344	0.52
653.700	2.19	0.306	0.448
654.000	2.15	0.291	0.43
654.300	2.35	0.318	0.369
654.600	2.38	0.309	0.391
654.900	2.67	0.337	0.501
655.200	2.74	0.354	0.546
655.500	2.63	0.353	0.487
655.800	2.22	0.311	0.381
656.100	2.17	0.34	0.401
656.400	2.3	0.317	0.385
656.700	2.19	0.315	0.377
657.000	2.27	0.309	0.323
657.300	2.53	0.329	0.387
657.600	2.51	0.342	0.457
657.900	2.41	0.333	0.438
658.200	2.34	0.327	0.343
658.500	2.45	0.333	0.311
658.800	2.42	0.329	0.321
659.100	2.4	0.301	0.329
659.400	2.36	0.317	0.288
659.700	2.52	0.331	0.311
660.000	2.61	0.35	0.36
660.300	2.45	0.318	0.349
660.600	2.38	0.322	0.378
660.900	2.37	0.324	0.357
661.200	2.42	0.33	0.31
661.500	2.56	0.317	0.322
661.800	2.53	0.328	0.367
662.100	2.27	0.298	0.42
662.400	2.24	0.29	0.429
662.700	2.3	0.317	0.391
663.000	2.17	0.317	0.412
663.300	2.05	0.284	0.358
663.600	2.13	0.3	0.33
663.900	2.32	0.289	0.43
664.200	2.43	0.318	0.442
664.500	2.52	0.312	0.388
664.800	2.48	0.322	0.305
665.100	2.38	0.286	0.252
665.400	2.3	0.276	0.235
665.700	2.27	0.263	0.283
666.000	2.29	0.274	0.304
666.300	2.32	0.265	0.292
666.600	2.17	0.271	0.27
666.900	2.13	0.251	0.443
667.200	2.17	0.247	0.522
667.500	2.25	0.26	0.418
667.800	2.19	0.26	0.411
668.100	2.48	0.286	0.561
668.400	2.58	0.298	0.551
668.700	2.78	0.29	0.554
669.000	2.47	0.277	0.401
669.300	2.36	0.262	0.366
669.600	2.34	0.263	0.32
669.900	2.41	0.264	0.289
670.200	2.32	0.259	0.325
670.500	2.27	0.249	0.324
670.800	2.3	0.258	0.36
671.100	2.6	0.279	0.418
671.400	2.67	0.287	0.425
671.700	2.44	0.263	0.469
672.000	2.39	0.265	0.462
672.300	2.62	0.278	0.352
672.600	2.95	0.317	0.603
672.900	2.76	0.291	0.608
673.200	2.48	0.271	0.507
673.500	2.58	0.281	0.398
673.800	2.45	0.277	0.393
674.100	2.19	0.265	0.296
674.400	2.24	0.269	0.247
674.700	2.28	0.247	0.276
675.000	2.22	0.259	0.312
675.300	2.26	0.239	0.426
675.600	2.32	0.25	0.376
675.900	2.26	0.259	0.363
676.200	2.19	0.26	0.383
676.500	2.28	0.256	0.342
676.800	2.36	0.267	0.346
677.100	2.37	0.252	0.472
677.400	2.23	0.262	0.551
677.700	1.98	0.239	0.519
678.000	1.99	0.242	0.425
678.300	2.24	0.261	0.435
678.600	2.45	0.264	0.482
678.900	2.49	0.245	0.516
679.200	2.42	0.246	0.476
679.500	2.38	0.234	0.448
679.800	2.26	0.237	0.405
680.100	2.52	0.252	0.343
680.400	2.68	0.265	0.36
680.700	2.65	0.254	0.385
681.000	2.48	0.264	0.405
681.300	2.41	0.248	0.358
681.600	2.53	0.259	0.334
681.900	2.62	0.262	0.319
682.200	2.57	0.272	0.341
682.500	2.38	0.251	0.269
682.800	2.37	0.256	0.273
683.100	2.29	0.234	0.32
683.400	2.23	0.242	0.374
683.700	2.4	0.241	0.411
684.000	2.72	0.267	0.551
684.300	2.61	0.267	0.504
684.600	2.66	0.259	0.424
684.900	2.55	0.257	0.445
685.200	2.44	0.245	0.519
685.500	2.65	0.256	0.571
685.800	3.01	0.3	0.673
686.100	2.77	0.26	0.445
686.400	2.47	0.256	0.293
686.700	2.45	0.254	0.237
687.000	2.63	0.265	0.282
687.300	2.45	0.253	0.397
687.600	2.32	0.239	0.454
687.900	2.38	0.242	0.488
688.200	2.36	0.256	0.479
688.500	2.2	0.235	0.397
688.800	2.4	0.269	0.355
689.100	2.53	0.265	0.416
689.400	2.82	0.29	0.546
689.700	2.88	0.286	0.372
690.000	2.91	0.287	0.324
690.300	2.86	0.273	0.355
690.600	2.67	0.272	0.351
690.900	2.43	0.258	0.429
691.200	2.3	0.269	0.517
691.500	2.33	0.257	0.424
691.800	2.52	0.264	0.261
692.100	2.44	0.252	0.252
692.400	2.37	0.259	0.265
692.700	2.48	0.254	0.288
693.000	2.59	0.27	0.211
693.300	2.55	0.254	0.245
693.600	2.56	0.259	0.318
693.900	2.32	0.232	0.445
694.200	2.24	0.238	0.574
694.500	2.3	0.249	0.566

694.800	2.45	0.275	0.379
695.100	2.62	0.273	0.327
695.400	2.52	0.27	0.343
695.700	2.26	0.25	0.411
696.000	2.19	0.227	0.484
696.300	2.26	0.233	0.471
696.600	2.22	0.242	0.418
696.900	2.22	0.23	0.411
697.200	2.34	0.249	0.402
697.500	2.33	0.237	0.413
697.800	2.05	0.23	0.476
698.100	2.25	0.238	0.366
698.400	2.72	0.259	0.392
698.700	2.65	0.259	0.344
699.000	2.6	0.258	0.332
699.300	2.69	0.24	0.492
699.600	2.63	0.251	0.48
699.900	2.65	0.243	0.351
700.200	2.51	0.257	0.299
700.500	2.39	0.241	0.379
700.800	2.31	0.238	0.379
701.100	2.6	0.25	0.326
701.400	2.74	0.254	0.32
701.700	2.63	0.248	0.277
702.000	2.57	0.252	0.339
702.300	2.5	0.238	0.408
702.600	2.18	0.208	0.452
702.900	2.17	0.208	0.403
703.200	2.31	0.227	0.364
703.500	2.6	0.241	0.398
703.800	2.67	0.257	0.427
704.100	2.48	0.238	0.34
704.400	2.61	0.243	0.333
704.700	2.73	0.243	0.266
705.000	2.71	0.25	0.213
705.300	2.68	0.235	0.262
705.600	2.68	0.256	0.424
705.900	2.68	0.237	0.463
706.200	2.59	0.256	0.413
706.500	2.46	0.235	0.374
706.800	2.4	0.221	0.308
707.100	2.32	0.227	0.3
707.400	2.27	0.22	0.302
707.700	2.17	0.223	0.452
708.000	2.14	0.222	0.423
708.300	2.38	0.25	0.386
708.600	2.62	0.27	0.478
708.900	2.53	0.25	0.485
709.200	2.3	0.249	0.423
709.500	2.33	0.256	0.389
709.800	2.28	0.247	0.381
710.100	2.47	0.259	0.475
710.400	2.58	0.267	0.604
710.700	2.69	0.266	0.567
711.000	2.39	0.281	0.44
711.300	2.19	0.257	0.333
711.600	2.16	0.25	0.251
711.900	2.27	0.265	0.35
712.200	2.28	0.269	0.447
712.500	2.44	0.263	0.39
712.800	2.56	0.285	0.387
713.100	2.56	0.282	0.438
713.400	2.72	0.282	0.501
713.700	2.63	0.266	0.435
714.000	2.46	0.273	0.377
714.300	2.16	0.24	0.301
714.600	2.3	0.268	0.38
714.900	2.48	0.272	0.387
715.200	2.56	0.282	0.376
715.500	2.31	0.247	0.274
715.800	2.33	0.255	0.287
716.100	2.33	0.252	0.31
716.400	2.3	0.241	0.311
716.700	2.22	0.234	0.342
717.000	2.15	0.239	0.337
717.300	2.11	0.213	0.354
717.600	2.14	0.232	0.374
717.900	2.22	0.229	0.399
718.200	2.67	0.271	0.561
718.500	2.5	0.267	0.548
718.800	2.09	0.223	0.493
719.100	1.87	0.199	0.48
719.400	2.16	0.234	0.37
719.700	2.31	0.227	0.356
720.000	2.29	0.241	0.332
720.300	2.4	0.265	0.393
720.600	2.57	0.281	0.545
720.900	2.57	0.274	0.463
721.200	2.39	0.27	0.339
721.500	2.37	0.271	0.322
721.800	2.3	0.258	0.35
722.100	2.17	0.255	0.373
722.400	2.16	0.265	0.332
722.700	2.19	0.249	0.268
723.000	2.27	0.258	0.256
723.300	2.31	0.264	0.246
723.600	2.25	0.254	0.276
723.900	2.26	0.254	0.288
724.200	2.28	0.26	0.378
724.500	2.31	0.25	0.385
724.800	2.39	0.268	0.39
725.100	2.46	0.273	0.402
725.400	2.55	0.274	0.503
725.700	2.29	0.248	0.458
726.000	2.15	0.255	0.414
726.300	2.15	0.247	0.414
726.600	2.27	0.26	0.387
726.900	2.21	0.265	0.394
727.200	2.18	0.252	0.407
727.500	2.09	0.236	0.336
727.800	2.27	0.252	0.332
728.100	2.32	0.246	0.332
728.400	2.25	0.249	0.426
728.700	2.18	0.242	0.457
729.000	1.94	0.221	0.45
729.300	1.99	0.224	0.421
729.600	2.17	0.248	0.414
729.900	2.23	0.241	0.365
730.200	2.13	0.236	0.323
730.500	2.22	0.248	0.377
730.800	2.23	0.244	0.386
731.100	2.36	0.256	0.359
731.400	2.33	0.264	0.342
731.700	2.31	0.256	0.335
732.000	2.3	0.254	0.273
732.300	2.27	0.256	0.232
732.600	2.25	0.25	0.278
732.900	2.13	0.234	0.361
733.200	2.22	0.258	0.449
733.500	2.27	0.25	0.453
733.800	2.3	0.25	0.435
734.100	2.18	0.242	0.372
734.400	2.18	0.236	0.363
734.700	2.28	0.25	0.389
735.000	2.37	0.253	0.387
735.300	2.31	0.24	0.378
735.600	2.06	0.233	0.335
735.900	2.12	0.242	0.368
736.200	2.28	0.247	0.434
736.500	2.37	0.259	0.473
736.800	2.44	0.259	0.604
737.100	2.45	0.253	0.588
737.400	2.3	0.256	0.418
737.700	2.26	0.256	0.431
738.000	2.38	0.262	0.472
738.300	2.31	0.255	0.477
738.600	2.35	0.246	0.481
738.900	2.41	0.253	0.444
739.200	2.42	0.267	0.454
739.500	2.42	0.26	0.406
739.800	2.42	0.255	0.421
740.100	2.25	0.238	0.431
740.400	2.15	0.233	0.404
740.700	2.16	0.231	0.371
741.000	2.36	0.248	0.34
741.300	2.35	0.247	0.353
741.600	2.39	0.246	0.377
741.900	2.26	0.233	0.326
742.200	2.17	0.231	0.332
742.500	2.21	0.238	0.401
742.800	2.35	0.259	0.44
743.100	2.39	0.255	0.408
743.400	2.22	0.239	0.324
743.700	2.19	0.239	0.293
744.000	2.1	0.235	0.301
744.300	2.08	0.232	0.33
744.600	2.01	0.226	0.429
744.900	2.06	0.229	0.472
745.200	2.01	0.215	0.586
745.500	1.82	0.207	0.694
745.800	1.87	0.219	0.598
746.100	2.06	0.22	0.472
746.400	2.17	0.249	0.485
746.700	2.07	0.248	0.522
747.000	2.12	0.238	0.453
747.300	2.32	0.246	0.418
747.600	2.53	0.26	0.44
747.900	2.52	0.252	0.409
748.200	2.46	0.248	0.425
748.500	2.4	0.246	0.436
748.800	2.3	0.245	0.41
749.100	2.27	0.231	0.331
749.400	2.21	0.229	0.321
749.700	2.12	0.222	0.339
750.000	2.11	0.226	0.306
750.300	2.16	0.233	0.375
750.600	2.28	0.241	0.441
750.900	2.45	0.242	0.446
751.200	2.55	0.252	0.382
751.500	2.56	0.251	0.402
751.800	2.4	0.228	0.468
752.100	2.33	0.227	0.479
752.400	2.3	0.228	0.417
752.700	2.23	0.219	0.416
753.000	2.33	0.238	0.429
753.300	2.3	0.23	0.477
753.600	2.56	0.245	0.48
753.900	2.77	0.263	0.432
754.200	2.8	0.27	0.485
754.500	2.54	0.229	0.48
754.800	2.51	0.234	0.503
755.100	2.46	0.232	0.481
755.400	2.33	0.22	0.412
755.700	2.32	0.226	0.433
756.000	2.3	0.23	0.465
756.300	2.3	0.217	0.444
756.600	2.45	0.235	0.355
756.900	2.45	0.232	0.317
757.200	2.29	0.217	0.411
757.500	2.25	0.227	0.478
757.800	2.35	0.232	0.423
758.100	2.32	0.221	0.374
758.400	2.26	0.222	0.413
758.700	2.35	0.23	0.412
759.000	2.48	0.227	0.366
759.300	2.49	0.224	0.351
759.600	2.48	0.232	0.337
759.900	2.43	0.218	0.381
760.200	2.13	0.204	0.43
760.500	2.1	0.208	0.399
760.800	2.27	0.209	0.388
761.100	2.43	0.223	0.37
761.400	2.5	0.236	0.37
761.700	2.53	0.223	0.37
762.000	2.77	0.247	0.464
762.300	2.81	0.251	0.485
762.600	2.67	0.233	0.516
762.900	2.37	0.225	0.472
763.200	2.38	0.233	0.427
763.500	2.49	0.228	0.419
763.800	2.41	0.225	0.462
764.100	2.44	0.234	0.533
764.400	2.45	0.225	0.528
764.700	2.61	0.23	0.47
765.000	2.63	0.246	0.418
765.300	2.52	0.234	0.404
765.600	2.41	0.223	0.457
765.900	2.57	0.235	0.487
766.200	2.67	0.224	0.437
766.500	2.7	0.221	0.395
766.800	2.63	0.225	0.364
767.100	2.64	0.217	0.37
767.400	2.55	0.215	0.372
767.700	2.44	0.215	0.395
768.000	2.47	0.212	0.471
768.300	2.51	0.215	0.496
768.600	2.62	0.231	0.395
768.900	2.45	0.214	0.378
769.200	2.46	0.215	0.423
769.500	2.6	0.231	0.487
769.800	2.73	0.239	0.574
770.100	2.63	0.231	0.592
770.400	2.56	0.237	0.5
770.700	2.62	0.229	0.459
771.000	2.58	0.23	0.439

771.300	2.52	0.231	0.384
771.600	2.55	0.219	0.392
771.900	2.54	0.217	0.404
772.200	2.41	0.216	0.456
772.500	2.34	0.209	0.489
772.800	2.34	0.208	0.454
773.100	2.44	0.195	0.385
773.400	2.48	0.196	0.371
773.700	2.48	0.198	0.371
774.000	2.44	0.202	0.483
774.300	2.42	0.202	0.518
774.600	2.39	0.201	0.546
774.900	2.49	0.201	0.507
775.200	2.66	0.207	0.458
775.500	2.73	0.211	0.435
775.800	2.68	0.21	0.384
776.100	2.47	0.186	0.371
776.400	2.42	0.191	0.376
776.700	2.38	0.186	0.412
777.000	2.42	0.189	0.419
777.300	2.51	0.2	0.365
777.600	2.64	0.202	0.314
777.900	2.59	0.197	0.449
778.200	2.61	0.2	0.508
778.500	2.64	0.193	0.533
778.800	2.62	0.201	0.453
779.100	2.62	0.196	0.449
779.400	2.63	0.193	0.534
779.700	2.4	0.182	0.486
780.000	2.51	0.186	0.614
780.300	2.46	0.175	0.432
780.600	2.7	0.191	0.533
780.900	2.72	0.195	0.506
781.200	2.77	0.188	0.539
781.500	2.64	0.178	0.496
781.800	2.64	0.185	0.476
782.100	2.7	0.179	0.486
782.400	2.7	0.181	0.506
782.700	2.73	0.196	0.542
783.000	2.73	0.19	0.532
783.300	2.87	0.196	0.5
783.600	2.79	0.191	0.444
783.900	2.65	0.18	0.465
784.200	2.47	0.177	0.509
784.500	2.49	0.178	0.544
784.800	2.49	0.185	0.488
785.100	2.46	0.191	0.461
785.400	2.62	0.198	0.515
785.700	2.72	0.189	0.552
786.000	2.77	0.19	0.599
786.300	2.72	0.193	0.599
786.600	2.75	0.191	0.544
786.900	2.63	0.185	0.564
787.200	2.48	0.187	0.491
787.500	2.46	0.178	0.469
787.800	2.56	0.183	0.506
788.100	2.54	0.186	0.481
788.400	2.61	0.183	0.489
788.700	2.58	0.19	0.496
789.000	2.56	0.194	0.479
789.300	2.68	0.19	0.578
789.600	2.65	0.193	0.506
789.900	2.59	0.179	0.495
790.200	2.63	0.18	0.435
790.500	2.64	0.181	0.462
790.800	2.61	0.182	0.578
791.100	2.42	0.173	0.53
791.400	2.25	0.169	0.455
791.700	2.33	0.17	0.442
792.000	2.57	0.179	0.517
792.300	2.69	0.186	0.536
792.600	2.58	0.181	0.456
792.900	2.55	0.18	0.456
793.200	2.69	0.183	0.539
793.500	2.48	0.174	0.457
793.800	2.4	0.173	0.485
794.100	2.45	0.18	0.445
794.400	2.49	0.175	0.456
794.700	2.49	0.177	0.5
795.000	2.46	0.177	0.489
795.300	2.46	0.176	0.476
795.600	2.37	0.179	0.411
795.900	2.25	0.165	0.401
796.200	2.23	0.167	0.386
796.500	2.2	0.164	0.388
796.800	2.19	0.163	0.38
797.100	2.2	0.164	0.39
797.400	2.22	0.165	0.379
797.700	2.21	0.159	0.402
798.000	2.24	0.165	0.377
798.300	2.36	0.171	0.435
798.600	2.45	0.171	0.451
798.900	2.39	0.171	0.401
799.200	2.24	0.171	0.394
799.500	2.18	0.163	0.423
799.800	2.09	0.153	0.408
800.100	2.18	0.152	0.441
800.400	2.13	0.149	0.466
800.700	2.18	0.153	0.467
801.000	2.21	0.152	0.497
801.300	2.32	0.159	0.505
801.600	2.29	0.161	0.499
801.900	2.37	0.16	0.458
802.200	2.37	0.158	0.466
802.500	2.36	0.162	0.409
802.800	2.32	0.154	0.377
803.100	2.26	0.153	0.373
803.400	2.19	0.152	0.403
803.700	2.16	0.149	0.431
804.000	2.15	0.15	0.409
804.300	2.18	0.148	0.401
804.600	2.26	0.155	0.431
804.900	2.37	0.166	0.393
805.200	2.42	0.166	0.378
805.500	2.5	0.173	0.558
805.800	2.59	0.185	0.745
806.100	2.54	0.184	0.714
806.400	2.53	0.183	0.72
806.700	2.34	0.162	0.474
807.000	2.38	0.165	0.462
807.300	2.35	0.16	0.431
807.600	2.35	0.158	0.382
807.900	2.34	0.164	0.416
808.200	2.34	0.161	0.401
808.500	2.24	0.163	0.385
808.800	2.23	0.157	0.32
809.100	2.3	0.161	0.377
809.400	2.24	0.154	0.398
809.700	2.14	0.151	0.354
810.000	2.18	0.146	0.433
810.300	2.17	0.148	0.46
810.600	2.21	0.155	0.494
810.900	2.32	0.157	0.427
811.200	2.31	0.169	0.532
811.500	2.36	0.165	0.536
811.800	2.32	0.167	0.582
812.100	2.22	0.155	0.546
812.400	2.12	0.146	0.479
812.700	2.18	0.153	0.449
813.000	2.26	0.154	0.412
813.300	2.27	0.153	0.372
813.600	2.19	0.154	0.389
813.900	2.21	0.155	0.346
814.200	2.13	0.153	0.385
814.500	2.2	0.154	0.399
814.800	2.28	0.159	0.41
815.100	2.25	0.157	0.411
815.400	2.16	0.154	0.442
815.700	2.13	0.148	0.431
816.000	2.19	0.156	0.482
816.300	2.33	0.161	0.49
816.600	2.3	0.155	0.491
816.900	2.29	0.153	0.436
817.200	2.21	0.152	0.406
817.500	2.21	0.152	0.388
817.800	2.13	0.143	0.377
818.100	2.14	0.151	0.414
818.400	2.17	0.161	0.433
818.700	2.2	0.16	0.432
819.000	2.37	0.171	0.468
819.300	2.44	0.174	0.504
819.600	2.41	0.172	0.496
819.900	2.52	0.174	0.498
820.200	2.3	0.167	0.484
820.500	2.32	0.166	0.517
820.800	2.34	0.165	0.522
821.100	2.38	0.163	0.492
821.400	2.36	0.163	0.462
821.700	2.36	0.16	0.468
822.000	2.31	0.16	0.419
822.300	2.38	0.162	0.405
822.600	2.32	0.16	0.4
822.900	2.32	0.161	0.404
823.200	2.27	0.157	0.396
823.500	2.32	0.168	0.459
823.800	2.31	0.165	0.482
824.100	2.29	0.167	0.487
824.400	2.32	0.167	0.468
824.700	2.51	0.173	0.438
825.000	2.6	0.172	0.502
825.300	2.47	0.178	0.409
825.600	2.38	0.175	0.44
825.900	2.4	0.176	0.441
826.200	2.34	0.169	0.429
826.500	2.24	0.167	0.424
826.800	2.22	0.162	0.423
827.100	2.31	0.165	0.433
827.400	2.38	0.168	0.459
827.700	2.32	0.17	0.479
828.000	2.26	0.171	0.501
828.300	2.31	0.171	0.473
828.600	2.34	0.171	0.443
828.900	2.34	0.167	0.416
829.200	2.34	0.165	0.42
829.500	2.35	0.162	0.482
829.800	2.31	0.17	0.543
830.100	2.27	0.167	0.501
830.400	2.4	0.172	0.473
830.700	2.38	0.162	0.434
831.000	2.35	0.16	0.426
831.300	2.48	0.164	0.495
831.600	2.43	0.164	0.407
831.900	2.42	0.162	0.429
832.200	2.37	0.15	0.408
832.500	2.39	0.151	0.428
832.800	2.38	0.154	0.449
833.100	2.31	0.15	0.443
833.400	2.32	0.149	0.421
833.700	2.27	0.149	0.401
834.000	2.29	0.144	0.389
834.300	2.24	0.142	0.431
834.600	2.22	0.148	0.405
834.900	2.22	0.151	0.397
835.200	2.29	0.149	0.417
835.500	2.35	0.148	0.422
835.800	2.36	0.146	0.421
836.100	2.38	0.148	0.44
836.400	2.33	0.14	0.484
836.700	2.19	0.131	0.523
837.000	2.19	0.131	0.466
837.300	2.18	0.128	0.447
837.600	2.27	0.139	0.447
837.900	2.48	0.155	0.49
838.200	2.53	0.156	0.494
838.500	2.47	0.154	0.492
838.800	2.32	0.144	0.447
839.100	2.25	0.139	0.427
839.400	2.36	0.142	0.445
839.700	2.41	0.145	0.452
840.000	2.42	0.137	0.422
840.300	2.34	0.138	0.392
840.600	2.35	0.139	0.434
840.900	2.24	0.136	0.426
841.200	2.27	0.139	0.406
841.500	2.47	0.148	0.448
841.800	2.47	0.15	0.442
842.100	2.44	0.147	0.433
842.400	2.29	0.135	0.413
842.700	2.26	0.135	0.404
843.000	2.18	0.134	0.391
843.300	2.17	0.129	0.378
843.600	2.24	0.139	0.397
843.900	2.26	0.136	0.407
844.200	2.26	0.135	0.435
844.500	2.26	0.127	0.391
844.800	2.17	0.126	0.373
845.100	2.14	0.126	0.376
845.400	2.1	0.124	0.383
845.700	2.14	0.121	0.383
846.000	2.1	0.128	0.345
846.300	2.04	0.126	0.332
846.600	2.06	0.127	0.367
846.900	2.14	0.13	0.434
847.200	2.19	0.138	0.414
847.500	2.24	0.139	0.405

847.800	2.16	0.131	0.4
848.100	2.12	0.132	0.403
848.400	2.12	0.131	0.393
848.700	2.21	0.132	0.404
849.000	2.32	0.134	0.399
849.300	2.32	0.137	0.405
849.600	2.29	0.134	0.379
849.900	2.22	0.131	0.386
850.200	2.26	0.127	0.403
850.500	2.26	0.131	0.397
850.800	2.24	0.132	0.368
851.100	2.22	0.128	0.355
851.400	2.25	0.129	0.405
851.700	2.2	0.132	0.41
852.000	2.18	0.129	0.403
852.300	2.17	0.126	0.385
852.600	2.24	0.13	0.341
852.900	2.18	0.129	0.348
853.200	2.13	0.128	0.365
853.500	2.11	0.126	0.383
853.800	2.21	0.131	0.385
854.100	2.23	0.133	0.431
854.400	2.25	0.134	0.455
854.700	2.15	0.126	0.44
855.000	2.09	0.122	0.388
855.300	2.16	0.122	0.371
855.600	2.22	0.121	0.386
855.900	2.27	0.128	0.42
856.200	2.32	0.131	0.415
856.500	2.24	0.127	0.476
856.800	2.28	0.126	0.53
857.100	2.17	0.122	0.489
857.400	2.24	0.124	0.432
857.700	2.23	0.125	0.421
858.000	2.18	0.122	0.433
858.300	2.19	0.121	0.425
858.600	2.13	0.121	0.421
858.900	2.13	0.12	0.417
859.200	2.08	0.114	0.343
859.500	2.18	0.121	0.371
859.800	2.23	0.127	0.408
860.100	2.22	0.127	0.407
860.400	2.21	0.125	0.419
860.700	2.27	0.127	0.375
861.000	2.26	0.126	0.345
861.300	2.23	0.124	0.359
861.600	2.24	0.128	0.437
861.900	2.25	0.129	0.435
862.200	2.29	0.126	0.43
862.500	2.24	0.117	0.395
862.800	2.23	0.115	0.425
863.100	2.22	0.115	0.395
863.400	2.24	0.114	0.386
863.700	2.25	0.117	0.347
864.000	2.22	0.117	0.412
864.300	2.31	0.122	0.383
864.600	2.16	0.115	0.371
864.900	2.1	0.116	0.376
865.200	2.04	0.111	0.359
865.500	2.01	0.112	0.383
865.800	2.04	0.114	0.374
866.100	2.12	0.117	0.312
866.400	2.18	0.115	0.311
866.700	2.15	0.114	0.326
867.000	2.12	0.111	0.334
867.300	2.12	0.111	0.333
867.600	2.06	0.11	0.349
867.900	2.06	0.109	0.352
868.200	2.14	0.115	0.321
868.500	2.13	0.117	0.294
868.800	2.1	0.114	0.303
869.100	2.12	0.114	0.332
869.400	2.15	0.119	0.377
869.700	2.19	0.117	0.381
870.000	2.24	0.12	0.394
870.300	2.17	0.111	0.382
870.600	2.12	0.112	0.378
870.900	2.05	0.113	0.415
871.200	2.06	0.112	0.467
871.500	2.09	0.118	0.421
871.800	2.21	0.119	0.376
872.100	2.19	0.115	0.392
872.400	2.13	0.116	0.395
872.700	2.08	0.112	0.381
873.000	2.06	0.113	0.382
873.300	2.11	0.117	0.339
873.600	2.12	0.113	0.36
873.900	2.15	0.119	0.359
874.200	2.17	0.12	0.384
874.500	2.14	0.12	0.375
874.800	2.15	0.12	0.368
875.100	2.08	0.123	0.423
875.400	2.12	0.118	0.401
875.700	2.11	0.116	0.367
876.000	2.17	0.119	0.398
876.300	2.18	0.12	0.407
876.600	2.18	0.117	0.402
876.900	2.15	0.113	0.4
877.200	2.14	0.111	0.385
877.500	2.13	0.112	0.391
877.800	2.21	0.116	0.388
878.100	2.19	0.116	0.353
878.400	2.21	0.114	0.387
878.700	2.05	0.109	0.377
879.000	2.08	0.111	0.435
879.300	2.17	0.112	0.43
879.600	2.21	0.116	0.369
879.900	2.26	0.115	0.35
880.200	2.18	0.114	0.331
880.500	2.19	0.114	0.347
880.800	2.19	0.11	0.368
881.100	2.17	0.11	0.372
881.400	2.2	0.11	0.403
881.700	2.18	0.109	0.38
882.000	2.13	0.109	0.354
882.300	2.19	0.115	0.355
882.600	2.24	0.116	0.38
882.900	2.19	0.114	0.36
883.200	2.21	0.118	0.374
883.500	2.23	0.117	0.372
883.800	2.24	0.12	0.37
884.100	2.24	0.117	0.398
884.400	2.25	0.117	0.425
884.700	2.24	0.114	0.427
885.000	2.25	0.116	0.426
885.300	2.2	0.111	0.376
885.600	2.09	0.109	0.384
885.900	2.08	0.104	0.375
886.200	2.11	0.106	0.384
886.500	2.24	0.112	0.369
886.800	2.24	0.114	0.338
887.100	2.24	0.114	0.37
887.400	2.26	0.113	0.405
887.700	2.25	0.115	0.37
888.000	2.21	0.112	0.36
888.300	2.26	0.117	0.379
888.600	2.22	0.114	0.39
888.900	2.18	0.112	0.413
889.200	2.14	0.108	0.396
889.500	2.14	0.104	0.368
889.800	2.15	0.106	0.365
890.100	2.11	0.106	0.354
890.400	2.11	0.103	0.372
890.700	2.15	0.108	0.399
891.000	2.18	0.106	0.384
891.300	2.18	0.106	0.36
891.600	2.21	0.101	0.33
891.900	2.18	0.104	0.307
892.200	2.2	0.105	0.3
892.500	2.15	0.105	0.31
892.800	2.16	0.103	0.313
893.100	2.19	0.104	0.339
893.400	2.19	0.105	0.348
893.700	2.21	0.104	0.349
894.000	2.21	0.107	0.335
894.300	2.25	0.106	0.338
894.600	2.19	0.105	0.348
894.900	2.15	0.1	0.334
895.200	2.09	0.102	0.361
895.500	2.11	0.101	0.393
895.800	2.04	0.0982	0.418
896.100	2.13	0.1	0.418
896.400	2.1	0.0987	0.41
896.700	2.18	0.101	0.407
897.000	2.19	0.104	0.386
897.300	2.14	0.103	0.397
897.600	2.21	0.102	0.389
897.900	2.19	0.101	0.358
898.200	2.23	0.103	0.391
898.500	2.29	0.106	0.359
898.800	2.28	0.106	0.373
899.100	2.25	0.107	0.343
899.400	2.15	0.104	0.341
899.700	2.18	0.105	0.342
900.000	2.25	0.109	0.359
900.300	2.27	0.101	0.392
900.600	2.23	0.0991	0.405
900.900	2.18	0.0985	0.402
901.200	2.08	0.0965	0.421
901.500	2.18	0.1	0.383
901.800	2.19	0.1	0.365
902.100	2.28	0.0995	0.343
902.400	2.2	0.0999	0.34
902.700	2.19	0.0979	0.33
903.000	2.17	0.095	0.344
903.300	2.14	0.0953	0.396
903.600	2.23	0.0975	0.386
903.900	2.23	0.0972	0.416
904.200	2.29	0.0996	0.441
904.500	2.28	0.1	0.425
904.800	2.29	0.101	0.387
905.100	2.26	0.104	0.38
905.400	2.31	0.102	0.376
905.700	2.31	0.105	0.358
906.000	2.23	0.0981	0.339
906.300	2.26	0.0977	0.346
906.600	2.23	0.0979	0.347
906.900	2.21	0.0987	0.377
907.200	2.2	0.0949	0.38
907.500	2.28	0.0973	0.373
907.800	2.3	0.0973	0.338
908.100	2.25	0.0955	0.316
908.400	2.16	0.0965	0.374
908.700	2.12	0.0953	0.411
909.000	2.14	0.101	0.405
909.300	2.17	0.0984	0.414
909.600	2.28	0.104	0.37
909.900	2.26	0.101	0.357
910.200	2.24	0.1	0.337
910.500	2.23	0.0986	0.348
910.800	2.24	0.0977	0.38
911.100	2.17	0.0941	0.371
911.400	2.2	0.0968	0.381
911.700	2.23	0.096	0.358
912.000	2.26	0.0972	0.38
912.300	2.31	0.103	0.429
912.600	2.34	0.103	0.433
912.900	2.29	0.0983	0.415
913.200	2.24	0.0974	0.391
913.500	2.16	0.0961	0.39
913.800	2.2	0.0943	0.341
914.100	2.26	0.0956	0.357
914.400	2.28	0.0939	0.372
914.700	2.32	0.0973	0.397
915.000	2.34	0.0991	0.413
915.300	2.34	0.101	0.397
915.600	2.3	0.0992	0.416
915.900	2.22	0.0987	0.398
916.200	2.23	0.0934	0.367
916.500	2.22	0.0923	0.369
916.800	2.2	0.0937	0.364
917.100	2.2	0.0915	0.38
917.400	2.25	0.0915	0.375
917.700	2.25	0.0958	0.355
918.000	2.23	0.0932	0.368
918.300	2.21	0.0912	0.357
918.600	2.19	0.0899	0.383
918.900	2.18	0.0904	0.361
919.200	2.23	0.0919	0.354
919.500	2.23	0.092	0.365
919.800	2.23	0.0954	0.374
920.100	2.2	0.0942	0.397
920.400	2.19	0.0956	0.398
920.700	2.27	0.0981	0.395
921.000	2.24	0.0958	0.42
921.300	2.29	0.0965	0.417
921.600	2.26	0.096	0.408
921.900	2.3	0.0948	0.373
922.200	2.27	0.0938	0.387
922.500	2.26	0.0915	0.356
922.800	2.25	0.0918	0.348
923.100	2.31	0.0962	0.399
923.400	2.4	0.098	0.374
923.700	2.41	0.0964	0.353
924.000	2.35	0.0941	0.364

924.300	2.35	0.0926	0.378
924.600	2.25	0.0916	0.321
924.900	2.22	0.0905	0.294
925.200	2.26	0.0913	0.336
925.500	2.32	0.0903	0.343
925.800	2.33	0.0928	0.317
926.100	2.33	0.0916	0.324
926.400	2.36	0.0935	0.327
926.700	2.35	0.0922	0.338
927.000	2.3	0.0923	0.338
927.300	2.37	0.0913	0.337
927.600	2.34	0.0924	0.336
927.900	2.36	0.0889	0.387
928.200	2.25	0.0869	0.425
928.500	2.2	0.0826	0.418
928.800	2.17	0.0853	0.413
929.100	2.27	0.0871	0.396
929.400	2.31	0.0879	0.372
929.700	2.34	0.0913	0.373
930.000	2.33	0.0887	0.36
930.300	2.26	0.0885	0.355
930.600	2.24	0.0891	0.324
930.900	2.31	0.0908	0.314
931.200	2.29	0.0861	0.324
931.500	2.3	0.0874	0.326
931.800	2.26	0.0845	0.336
932.100	2.21	0.0818	0.376
932.400	2.21	0.0845	0.383
932.700	2.2	0.0884	0.383
933.000	2.3	0.0889	0.337
933.300	2.33	0.0903	0.343
933.600	2.34	0.088	0.339
933.900	2.35	0.0865	0.341
934.200	2.35	0.0891	0.349
934.500	2.31	0.0874	0.366
934.800	2.26	0.0839	0.389
935.100	2.29	0.0849	0.38
935.400	2.38	0.0884	0.377
935.700	2.38	0.088	0.363
936.000	2.38	0.0895	0.37
936.300	2.4	0.09	0.37
936.600	2.43	0.0902	0.389
936.900	2.38	0.0872	0.39
937.200	2.23	0.086	0.414
937.500	2.24	0.0827	0.37
937.800	2.32	0.0858	0.345
938.100	2.36	0.0874	0.344
938.400	2.33	0.0864	0.336
938.700	2.35	0.0873	0.374
939.000	2.3	0.0887	0.386
939.300	2.31	0.0875	0.395
939.600	2.24	0.0861	0.389
939.900	2.26	0.0851	0.364
940.200	2.3	0.0861	0.362
940.500	2.31	0.0847	0.332
940.800	2.38	0.0856	0.323
941.100	2.3	0.0869	0.313
941.400	2.26	0.0849	0.335
941.700	2.24	0.0819	0.366
942.000	2.27	0.0837	0.38
942.300	2.33	0.0852	0.371
942.600	2.4	0.0874	0.389
942.900	2.39	0.0876	0.348
943.200	2.42	0.0892	0.322
943.500	2.42	0.0894	0.35
943.800	2.35	0.0863	0.37
944.100	2.33	0.0837	0.387
944.400	2.3	0.0845	0.428
944.700	2.28	0.0835	0.437
945.000	2.29	0.0844	0.439
945.300	2.31	0.0858	0.387
945.600	2.33	0.0848	0.333
945.900	2.41	0.0871	0.375
946.200	2.36	0.0838	0.346
946.500	2.35	0.0847	0.352
946.800	2.26	0.0811	0.322
947.100	2.3	0.0852	0.355
947.400	2.35	0.0833	0.386
947.700	2.36	0.0841	0.388
948.000	2.34	0.087	0.374
948.300	2.38	0.0861	0.358
948.600	2.43	0.0865	0.361
948.900	2.46	0.0892	0.338
949.200	2.42	0.0876	0.321
949.500	2.34	0.0845	0.346
949.800	2.31	0.0817	0.362
950.100	2.3	0.0854	0.363
950.400	2.32	0.0871	0.376
950.700	2.34	0.0865	0.333
951.000	2.36	0.0913	0.358
951.300	2.32	0.089	0.375
951.600	2.27	0.0873	0.374
951.900	2.29	0.084	0.339
952.200	2.28	0.0821	0.324
952.500	2.3	0.0848	0.313
952.800	2.29	0.0865	0.316
953.100	2.33	0.0877	0.323
953.400	2.29	0.0866	0.337
953.700	2.27	0.0868	0.357
954.000	2.23	0.0873	0.364
954.300	2.2	0.0814	0.329
954.600	2.18	0.0825	0.298
954.900	2.19	0.0828	0.316
955.200	2.24	0.0828	0.345
955.500	2.29	0.0857	0.36
955.800	2.29	0.0847	0.358
956.100	2.23	0.0823	0.352
956.400	2.23	0.0841	0.335
956.700	2.2	0.0833	0.324
957.000	2.21	0.0799	0.324
957.300	2.24	0.0838	0.336
957.600	2.28	0.0819	0.347
957.900	2.27	0.079	0.379
958.200	2.19	0.0798	0.359
958.500	2.22	0.0811	0.356
958.800	2.23	0.0816	0.356
959.100	2.28	0.0841	0.373
959.400	2.31	0.0861	0.382
959.700	2.32	0.0859	0.374
960.000	2.34	0.0844	0.345
960.300	2.27	0.0803	0.367
960.600	2.28	0.0818	0.326
960.900	2.28	0.0807	0.313
961.200	2.27	0.0825	0.34
961.500	2.35	0.0838	0.339
961.800	2.31	0.0825	0.305
962.100	2.38	0.0826	0.333
962.400	2.44	0.0838	0.404
962.700	2.4	0.0831	0.365
963.000	2.3	0.081	0.356
963.300	2.29	0.0818	0.33
963.600	2.26	0.0791	0.31
963.900	2.32	0.0809	0.297
964.200	2.32	0.0826	0.293
964.500	2.31	0.0821	0.297
964.800	2.33	0.0801	0.304
965.100	2.33	0.0798	0.335
965.400	2.28	0.0788	0.402
965.700	2.28	0.0783	0.408
966.000	2.29	0.0804	0.444
966.300	2.26	0.0779	0.401
966.600	2.28	0.0781	0.395
966.900	2.24	0.0779	0.402
967.200	2.29	0.0794	0.39
967.500	2.35	0.0797	0.41
967.800	2.33	0.0792	0.369
968.100	2.38	0.0806	0.354
968.400	2.4	0.0812	0.361
968.700	2.45	0.0811	0.349
969.000	2.49	0.0842	0.396
969.300	2.44	0.0806	0.397
969.600	2.36	0.0804	0.379
969.900	2.37	0.0805	0.394
970.200	2.38	0.0761	0.351
970.500	2.41	0.0759	0.354
970.800	2.4	0.0758	0.341
971.100	2.49	0.0771	0.308
971.400	2.45	0.0776	0.327
971.700	2.43	0.0769	0.373
972.000	2.41	0.0754	0.375
972.300	2.44	0.075	0.361
972.600	2.39	0.0738	0.363
972.900	2.45	0.0776	0.379
973.200	2.49	0.0749	0.355
973.500	2.51	0.0759	0.383
973.800	2.48	0.075	0.398
974.100	2.47	0.0757	0.388
974.400	2.48	0.0727	0.377
974.700	2.54	0.0758	0.403
975.000	2.5	0.0733	0.386
975.300	2.49	0.0709	0.378
975.600	2.48	0.0713	0.359
975.900	2.48	0.072	0.341
976.200	2.53	0.0722	0.313
976.500	2.56	0.0723	0.321
976.800	2.5	0.073	0.308
977.100	2.5	0.0713	0.328
977.400	2.51	0.0723	0.317
977.700	2.6	0.0738	0.353
978.000	2.64	0.0757	0.377
978.300	2.58	0.075	0.314
978.600	2.52	0.0736	0.403
978.900	2.49	0.0711	0.325
979.200	2.52	0.0717	0.351
979.500	2.53	0.0732	0.366
979.800	2.51	0.0726	0.327
980.100	2.48	0.0715	0.34
980.400	2.51	0.0727	0.342
980.700	2.55	0.073	0.38
981.000	2.57	0.0703	0.379
981.300	2.52	0.0694	0.344
981.600	2.43	0.0692	0.34
981.900	2.4	0.0681	0.32
982.200	2.41	0.067	0.31
982.500	2.39	0.0667	0.293
982.800	2.45	0.067	0.311
983.100	2.4	0.067	0.352
983.400	2.36	0.0657	0.349
983.700	2.39	0.0669	0.362
984.000	2.45	0.0689	0.366
984.300	2.48	0.0696	0.377
984.600	2.41	0.0681	0.395
984.900	2.4	0.0677	0.4
985.200	2.4	0.0664	0.398
985.500	2.48	0.0673	0.37
985.800	2.53	0.0677	0.357
986.100	2.54	0.0689	0.361
986.400	2.6	0.07	0.361
986.700	2.63	0.0695	0.394
987.000	2.54	0.0678	0.404
987.300	2.57	0.0691	0.38
987.600	2.52	0.0675	0.361
987.900	2.54	0.0675	0.358
988.200	2.54	0.0663	0.367
988.500	2.52	0.0666	0.385
988.800	2.53	0.0654	0.39
989.100	2.46	0.0643	0.358
989.400	2.37	0.064	0.343
989.700	2.44	0.0652	0.316
990.000	2.52	0.0639	0.334
990.300	2.49	0.0639	0.348
990.600	2.54	0.0642	0.383
990.900	2.45	0.0634	0.39
991.200	2.51	0.0631	0.387
991.500	2.57	0.0622	0.397
991.800	2.55	0.0627	0.382
992.100	2.5	0.0628	0.338
992.400	2.53	0.0608	0.369
992.700	2.53	0.061	0.351
993.000	2.52	0.0624	0.388
993.300	2.51	0.061	0.389
993.600	2.46	0.0617	0.365
993.900	2.47	0.062	0.38
994.200	2.51	0.0623	0.364
994.500	2.52	0.0617	0.357
994.800	2.47	0.0613	0.34
995.100	2.5	0.0618	0.368
995.400	2.51	0.0622	0.365
995.700	2.51	0.062	0.351
996.000	2.56	0.0642	0.366
996.300	2.5	0.063	0.342
996.600	2.55	0.0638	0.333
996.900	2.51	0.0621	0.335
997.200	2.52	0.0625	0.355
997.500	2.45	0.0621	0.354
997.800	2.46	0.0611	0.353
998.100	2.45	0.0604	0.4
998.400	2.41	0.0593	0.362
998.700	2.43	0.0598	0.356
999.000	2.42	0.059	0.326
999.300	2.42	0.0599	0.319
999.600	2.47	0.0615	0.312
999.900	2.5	0.0617	0.322
1000.200	2.4	0.0609	0.338
1000.500	2.41	0.0598	0.356

1000.800	2.42	0.0596	0.376
1001.100	2.35	0.0585	0.399
1001.400	2.32	0.0582	0.407
1001.700	2.32	0.0559	0.331
1002.000	2.4	0.0568	0.33
1002.300	2.39	0.0563	0.359
1002.600	2.38	0.0559	0.381
1002.900	2.37	0.0557	0.387
1003.200	2.37	0.0562	0.365
1003.500	2.37	0.0559	0.378
1003.800	2.34	0.0557	0.362
1004.100	2.38	0.0554	0.343
1004.400	2.41	0.0574	0.352
1004.700	2.45	0.0575	0.355
1005.000	2.45	0.0582	0.357
1005.300	2.5	0.0605	0.359
1005.600	2.48	0.0588	0.34
1005.900	2.49	0.0592	0.336
1006.200	2.52	0.0591	0.357
1006.500	2.46	0.0579	0.373
1006.800	2.42	0.0572	0.362
1007.100	2.39	0.0571	0.349
1007.400	2.36	0.0549	0.383
1007.700	2.44	0.0567	0.337
1008.000	2.5	0.0574	0.318
1008.300	2.44	0.0561	0.361
1008.600	2.48	0.0575	0.344
1008.900	2.5	0.0569	0.331
1009.200	2.55	0.0567	0.311
1009.500	2.52	0.057	0.336
1009.800	2.48	0.0571	0.362
1010.100	2.5	0.0567	0.387
1010.400	2.5	0.0569	0.377
1010.700	2.47	0.0566	0.399
1011.000	2.45	0.0569	0.423
1011.300	2.5	0.0576	0.432
1011.600	2.5	0.0575	0.41
1011.900	2.43	0.0559	0.461
1012.200	2.46	0.0561	0.489
1012.500	2.55	0.0561	0.448
1012.800	2.51	0.0556	0.407
1013.100	2.49	0.0572	0.419
1013.400	2.47	0.0575	0.468
1013.700	2.53	0.059	0.479
1014.000	2.61	0.0591	0.444
1014.300	2.69	0.06	0.412
1014.600	2.67	0.0589	0.386
1014.900	2.62	0.059	0.423
1015.200	2.6	0.0589	0.433
1015.500	2.54	0.0571	0.483
1015.800	2.5	0.0556	0.523
1016.100	2.54	0.0565	0.523
1016.400	2.48	0.0548	0.519
1016.700	2.56	0.0567	0.48
1017.000	2.58	0.0569	0.468
1017.300	2.61	0.0572	0.465
1017.600	2.63	0.0573	0.463
1017.900	2.67	0.058	0.468
1018.200	2.68	0.0578	0.498
1018.500	2.76	0.059	0.486
1018.800	2.81	0.0592	0.451
1019.100	2.8	0.0582	0.474
1019.400	2.8	0.0598	0.503
1019.700	2.74	0.0591	0.526
1020.000	2.75	0.0591	0.657
1020.300	2.82	0.0602	0.779
1020.600	2.92	0.0623	0.758
1020.900	2.86	0.0595	0.608
1021.200	2.84	0.0593	0.556
1021.500	2.81	0.0587	0.58
1021.800	2.85	0.0586	0.523
1022.100	2.9	0.06	0.5
1022.400	2.89	0.0592	0.557
1022.700	2.91	0.058	0.561
1023.000	2.97	0.0591	0.513
1023.300	3.02	0.0606	0.507
1023.600	3	0.0593	0.51
1023.900	3.02	0.0592	0.557
1024.200	3.08	0.0615	0.536
1024.500	3.07	0.0606	0.547
1024.800	3.03	0.059	0.571
1025.100	3.06	0.0617	0.558
1025.400	3.04	0.0609	0.533
1025.700	3.07	0.0593	0.503
1026.000	3.11	0.0619	0.556
1026.300	3.12	0.062	0.494
1026.600	3.2	0.0619	0.512
1026.900	3.23	0.0618	0.471
1027.200	3.29	0.0622	0.5
1027.500	3.3	0.063	0.527
1027.800	3.33	0.0631	0.559
1028.100	3.28	0.0621	0.494
1028.400	3.34	0.0631	0.529
1028.700	3.36	0.0632	0.517
1029.000	3.46	0.0637	0.526
1029.300	3.48	0.0641	0.532
1029.600	3.41	0.0629	0.523
1029.900	3.49	0.0633	0.552
1030.200	3.46	0.0622	0.586
1030.500	3.37	0.0605	0.533
1030.800	3.47	0.0616	0.59
1031.100	3.54	0.0624	0.635
1031.400	3.55	0.0645	0.651
1031.700	3.49	0.0645	0.645
1032.000	3.56	0.0656	0.721
1032.300	3.53	0.0701	0.696
1032.600	3.51	0.0676	0.696
1032.900	3.55	0.0692	0.748
1033.200	3.55	0.0685	0.765
1033.500	3.54	0.0701	0.788
1033.800	3.5	0.0692	0.742
1034.100	3.43	0.0688	0.711
1034.400	3.43	0.0699	0.661
1034.700	3.46	0.0688	0.69
1035.000	3.45	0.0691	0.674
1035.300	3.45	0.0688	0.673
1035.600	3.48	0.0686	0.73
1035.900	3.44	0.0669	0.718
1036.200	3.44	0.0692	0.733
1036.500	3.37	0.0658	0.646
1036.800	3.4	0.066	0.657
1037.100	3.36	0.0665	0.703
1037.400	3.3	0.0645	0.704
1037.700	3.27	0.0629	0.664
1038.000	3.21	0.0638	0.614
1038.300	3.26	0.0633	0.642
1038.600	3.21	0.0612	0.604
1038.900	3.23	0.0614	0.612
1039.200	3.17	0.0605	0.607
1039.500	3.12	0.0604	0.627
1039.800	3.12	0.0594	0.602
1040.100	3.03	0.0595	0.573
1040.400	2.97	0.0582	0.515
1040.700	2.91	0.057	0.483
1041.000	2.95	0.0575	0.523
1041.300	2.91	0.0575	0.55
1041.600	2.85	0.0563	0.468
1041.900	2.85	0.0561	0.455
1042.200	2.86	0.055	0.44
1042.500	2.92	0.0563	0.488
1042.800	2.92	0.0563	0.493
1043.100	2.9	0.0561	0.536
1043.400	2.81	0.0558	0.499
1043.700	2.82	0.0562	0.477
1044.000	2.81	0.0547	0.431
1044.300	2.7	0.0541	0.423
1044.600	2.74	0.0551	0.453
1044.900	2.75	0.0556	0.434
1045.200	2.76	0.0561	0.454
1045.500	2.68	0.0554	0.439
1045.800	2.65	0.055	0.447
1046.100	2.68	0.0536	0.446
1046.400	2.66	0.0558	0.438
1046.700	2.71	0.0551	0.45
1047.000	2.67	0.0555	0.48
1047.300	2.62	0.0545	0.46
1047.600	2.59	0.0566	0.42
1047.900	2.63	0.063	0.503
1048.200	2.55	0.0579	0.358
1048.500	2.58	0.0614	0.399
1048.800	2.58	0.0595	0.386
1049.100	2.58	0.0583	0.37
1049.400	2.65	0.0606	0.4
1049.700	2.55	0.0568	0.394
1050.000	2.5	0.0553	0.354
1050.300	2.54	0.0557	0.335
1050.600	2.52	0.0555	0.35
1050.900	2.57	0.0574	0.405
1051.200	2.49	0.0558	0.375
1051.500	2.42	0.0532	0.37
1051.800	2.42	0.0544	0.381
1052.100	2.47	0.053	0.378
1052.400	2.47	0.0531	0.378
1052.700	2.45	0.053	0.343
1053.000	2.42	0.0515	0.344
1053.300	2.42	0.0521	0.332
1053.600	2.49	0.0516	0.337
1053.900	2.46	0.0513	0.324
1054.200	2.41	0.0508	0.342
1054.500	2.4	0.0509	0.367
1054.800	2.43	0.0511	0.387
1055.100	2.37	0.0519	0.353
1055.400	2.41	0.0514	0.35
1055.700	2.37	0.0497	0.325
1056.000	2.43	0.0503	0.307
1056.300	2.47	0.0504	0.334
1056.600	2.47	0.051	0.356
1056.900	2.46	0.05	0.317
1057.200	2.43	0.0492	0.341
1057.500	2.43	0.0501	0.338
1057.800	2.43	0.0498	0.352
1058.100	2.43	0.0485	0.333
1058.400	2.46	0.0488	0.329
1058.700	2.42	0.0498	0.306
1059.000	2.42	0.0491	0.327
1059.300	2.45	0.0497	0.345
1059.600	2.43	0.0482	0.344
1059.900	2.43	0.0481	0.341
1060.200	2.44	0.0479	0.366
1060.500	2.46	0.0484	0.357
1060.800	2.44	0.0486	0.365
1061.100	2.41	0.0483	0.358
1061.400	2.38	0.0468	0.349
1061.700	2.42	0.0477	0.362
1062.000	2.41	0.0481	0.331
1062.300	2.43	0.0469	0.325
1062.600	2.49	0.0485	0.329
1062.900	2.48	0.0468	0.327
1063.200	2.49	0.0478	0.339
1063.500	2.5	0.0478	0.329
1063.800	2.48	0.0481	0.322
1064.100	2.5	0.048	0.33
1064.400	2.47	0.0472	0.317
1064.700	2.44	0.0473	0.322
1065.000	2.41	0.0465	0.314
1065.300	2.46	0.0485	0.333
1065.600	2.54	0.0501	0.381
1065.900	2.55	0.0511	0.371
1066.200	2.5	0.0497	0.36
1066.500	2.47	0.0484	0.359
1066.800	2.48	0.0473	0.349
1067.100	2.47	0.0489	0.346
1067.400	2.48	0.0494	0.312
1067.700	2.54	0.0513	0.368
1068.000	2.49	0.0513	0.378
1068.300	2.5	0.0533	0.397
1068.600	2.45	0.0523	0.339
1068.900	2.45	0.0511	0.353
1069.200	2.47	0.0531	0.389
1069.500	2.46	0.0522	0.372
1069.800	2.39	0.0503	0.392
1070.100	2.44	0.0492	0.377
1070.400	2.47	0.0498	0.374
1070.700	2.42	0.0493	0.329
1071.000	2.41	0.0487	0.345
1071.300	2.41	0.0482	0.371
1071.600	2.39	0.05	0.399
1071.900	2.41	0.0494	0.326
1072.200	2.45	0.0491	0.381
1072.500	2.43	0.0489	0.361
1072.800	2.4	0.0488	0.347
1073.100	2.47	0.0486	0.381
1073.400	2.39	0.0478	0.34
1073.700	2.38	0.0471	0.32
1074.000	2.35	0.0469	0.318
1074.300	2.35	0.0473	0.34
1074.600	2.37	0.0473	0.347
1074.900	2.34	0.0463	0.347
1075.200	2.33	0.0462	0.356
1075.500	2.42	0.0474	0.351
1075.800	2.43	0.0468	0.324
1076.100	2.38	0.0451	0.325
1076.400	2.36	0.0453	0.352
1076.700	2.32	0.0443	0.352
1077.000	2.36	0.0446	0.356

1077.300	2.35	0.0449	0.352
1077.600	2.28	0.0439	0.332
1077.900	2.32	0.0435	0.323
1078.200	2.29	0.0424	0.33
1078.500	2.27	0.0431	0.329
1078.800	2.27	0.0421	0.332
1079.100	2.31	0.0438	0.309
1079.400	2.36	0.0438	0.327
1079.700	2.36	0.0436	0.323
1080.000	2.34	0.0439	0.312
1080.300	2.31	0.0422	0.339
1080.600	2.28	0.0415	0.339
1080.900	2.33	0.0432	0.343
1081.200	2.32	0.0424	0.327
1081.500	2.38	0.0434	0.343
1081.800	2.35	0.0432	0.313
1082.100	2.32	0.043	0.333
1082.400	2.33	0.042	0.348
1082.700	2.31	0.0421	0.346
1083.000	2.23	0.0416	0.322
1083.300	2.29	0.0418	0.332
1083.600	2.31	0.0425	0.33
1083.900	2.28	0.0433	0.318
1084.200	2.29	0.0427	0.319
1084.500	2.31	0.0435	0.321
1084.800	2.29	0.042	0.295
1085.100	2.22	0.0414	0.304
1085.400	2.2	0.041	0.334
1085.700	2.22	0.0411	0.345
1086.000	2.25	0.0418	0.341
1086.300	2.34	0.0429	0.345
1086.600	2.3	0.042	0.332
1086.900	2.29	0.0416	0.322
1087.200	2.24	0.0419	0.317
1087.500	2.2	0.0406	0.315
1087.800	2.22	0.0417	0.325
1088.100	2.2	0.0413	0.3
1088.400	2.21	0.0414	0.305
1088.700	2.27	0.0418	0.307
1089.000	2.25	0.043	0.312
1089.300	2.21	0.0421	0.284
1089.600	2.18	0.0412	0.301
1089.900	2.19	0.0414	0.319
1090.200	2.17	0.0413	0.304
1090.500	2.16	0.0405	0.327
1090.800	2.1	0.0423	0.334
1091.100	2.15	0.0429	0.336
1091.400	2.16	0.0422	0.33
1091.700	2.18	0.0431	0.329
1092.000	2.14	0.0425	0.327
1092.300	2.21	0.0425	0.341
1092.600	2.18	0.0416	0.35
1092.900	2.19	0.0426	0.317
1093.200	2.18	0.0422	0.319
1093.500	2.22	0.0422	0.327
1093.800	2.16	0.0425	0.332
1094.100	2.11	0.0414	0.33
1094.400	2.16	0.0414	0.331
1094.700	2.15	0.0421	0.304
1095.000	2.18	0.0415	0.292
1095.300	2.18	0.0418	0.292
1095.600	2.19	0.0413	0.301
1095.900	2.21	0.0421	0.351
1096.200	2.21	0.0415	0.322
1096.500	2.18	0.0406	0.3
1096.800	2.15	0.0407	0.33
1097.100	2.19	0.041	0.318
1097.400	2.15	0.0409	0.31
1097.700	2.17	0.0412	0.312
1098.000	2.18	0.0415	0.315
1098.300	2.08	0.0401	0.303
1098.600	2.07	0.039	0.292
1098.900	2.14	0.0399	0.288
1099.200	2.11	0.0397	0.281
1099.500	2.08	0.04	0.293
1099.800	2.08	0.0396	0.277
1100.100	2.1	0.0393	0.286
1100.400	2.12	0.0402	0.301
1100.700	2.11	0.0397	0.307
1101.000	2.15	0.0386	0.3
1101.300	2.13	0.0401	0.283
1101.600	2.13	0.0397	0.322
1101.900	2.13	0.0397	0.289
1102.200	2.15	0.0397	0.288
1102.500	2.15	0.0403	0.303
1102.800	2.14	0.0407	0.31
1103.100	2.17	0.04	0.304
1103.400	2.11	0.0399	0.281
1103.700	2.13	0.0439	0.3
1104.000	2.13	0.044	0.303
1104.300	2.16	0.0451	0.318
1104.600	2.21	0.0443	0.334
1104.900	2.14	0.0445	0.306
1105.200	2.09	0.0422	0.364
1105.500	2.12	0.042	0.389
1105.800	2.17	0.0426	0.349
1106.100	2.13	0.0402	0.308
1106.400	2.17	0.0434	0.344
1106.700	2.19	0.0432	0.368
1107.000	2.21	0.0431	0.352
1107.300	2.13	0.0406	0.307
1107.600	2.13	0.0411	0.3
1107.900	2.14	0.0407	0.345
1108.200	2.12	0.0409	0.338
1108.500	2.17	0.0415	0.364
1108.800	2.19	0.042	0.408
1109.100	2.15	0.0418	0.346
1109.400	2.14	0.0405	0.316
1109.700	2.13	0.0401	0.316
1110.000	2.16	0.0408	0.286
1110.300	2.17	0.0397	0.288
1110.600	2.17	0.0395	0.313
1110.900	2.2	0.0398	0.314
1111.200	2.16	0.0393	0.302
1111.500	2.17	0.039	0.297
1111.800	2.17	0.0392	0.308
1112.100	2.15	0.0395	0.308
1112.400	2.11	0.0377	0.317
1112.700	2.08	0.0381	0.318
1113.000	2.11	0.0386	0.329
1113.300	2.11	0.0385	0.329
1113.600	2.1	0.0378	0.32
1113.900	2.13	0.0383	0.327
1114.200	2.13	0.0383	0.331
1114.500	2.18	0.039	0.322
1114.800	2.13	0.0386	0.329
1115.100	2.09	0.0381	0.341
1115.400	2.16	0.0392	0.349
1115.700	2.21	0.0394	0.317
1116.000	2.19	0.0384	0.297
1116.300	2.17	0.0389	0.306
1116.600	2.14	0.0381	0.341
1116.900	2.14	0.0377	0.344
1117.200	2.15	0.039	0.342
1117.500	2.12	0.0392	0.319
1117.800	2.15	0.039	0.296
1118.100	2.19	0.0396	0.285
1118.400	2.18	0.0383	0.284
1118.700	2.16	0.0381	0.29
1119.000	2.19	0.0395	0.288
1119.300	2.19	0.0383	0.292
1119.600	2.15	0.0383	0.302
1119.900	2.15	0.0382	0.305
1120.200	2.22	0.0388	0.325
1120.500	2.15	0.0372	0.319
1120.800	2.16	0.0382	0.329
1121.100	2.17	0.0389	0.326
1121.400	2.15	0.0377	0.331
1121.700	2.2	0.0385	0.335
1122.000	2.17	0.0392	0.338
1122.300	2.17	0.0382	0.335
1122.600	2.18	0.0388	0.347
1122.900	2.17	0.0389	0.31
1123.200	2.17	0.0389	0.327
1123.500	2.18	0.039	0.322
1123.800	2.15	0.0396	0.327
1124.100	2.16	0.0385	0.34
1124.400	2.17	0.0392	0.331
1124.700	2.15	0.039	0.335
1125.000	2.16	0.0388	0.364
1125.300	2.12	0.0383	0.351
1125.600	2.1	0.0387	0.347
1125.900	2.11	0.0374	0.321
1126.200	2.12	0.0377	0.323
1126.500	2.19	0.0402	0.329
1126.800	2.18	0.039	0.324
1127.100	2.13	0.0387	0.3
1127.400	2.13	0.0379	0.306
1127.700	2.13	0.0381	0.32
1128.000	2.12	0.0369	0.313
1128.300	2.11	0.0375	0.314
1128.600	2.05	0.0365	0.313
1128.900	2.09	0.0368	0.325
1129.200	2.09	0.0378	0.325
1129.500	2.12	0.0381	0.316
1129.800	2.1	0.0374	0.296
1130.100	2.1	0.0376	0.282
1130.400	2.09	0.0375	0.28
1130.700	2.17	0.0381	0.329
1131.000	2.11	0.0376	0.315
1131.300	2.11	0.0376	0.301
1131.600	2.1	0.0376	0.298
1131.900	2.11	0.0378	0.283
1132.200	2.1	0.0366	0.292
1132.500	2.13	0.0418	0.301
1132.800	2.13	0.0419	0.308
1133.100	2.09	0.0403	0.293
1133.400	2.17	0.0456	0.35
1133.700	2.14	0.0413	0.319
1134.000	2.14	0.042	0.314
1134.300	2.08	0.0401	0.316
1134.600	2.05	0.0414	0.318
1134.900	1.99	0.0378	0.323
1135.200	2.04	0.0407	0.311
1135.500	2.05	0.0385	0.291
1135.800	2.08	0.039	0.27
1136.100	2.05	0.0376	0.284
1136.400	2.03	0.0375	0.303
1136.700	2.06	0.0373	0.303
1137.000	2.12	0.0416	0.316
1137.300	2.1	0.0405	0.304
1137.600	2.1	0.0397	0.287
1137.900	2.13	0.0411	0.29
1138.200	2.1	0.0409	0.302
1138.500	2.12	0.0424	0.294
1138.800	2.12	0.0413	0.297
1139.100	2.13	0.0408	0.301
1139.400	2.11	0.0406	0.287
1139.700	2.12	0.0399	0.298
1140.000	2.16	0.0416	0.297
1140.300	2.06	0.0385	0.271
1140.600	2.07	0.0397	0.309
1140.900	2.1	0.041	0.329
1141.200	2.09	0.0389	0.304
1141.500	2.06	0.0385	0.303
1141.800	2.08	0.0393	0.29
1142.100	2.08	0.0401	0.294
1142.400	2.03	0.0387	0.296
1142.700	2.08	0.0395	0.321
1143.000	2.06	0.0388	0.317
1143.300	2.05	0.0394	0.346
1143.600	2.07	0.0436	0.371
1143.900	2.09	0.0428	0.394
1144.200	2.08	0.0396	0.325
1144.500	2.12	0.0432	0.33
1144.800	2.06	0.0416	0.324
1145.100	2.1	0.0422	0.317
1145.400	2.09	0.0415	0.302
1145.700	2.07	0.04	0.306
1146.000	2.08	0.0389	0.287
1146.300	2.06	0.0385	0.275
1146.600	2.05	0.0384	0.305
1146.900	2.07	0.0389	0.309
1147.200	2.13	0.0394	0.311
1147.500	2.03	0.0378	0.315
1147.800	2.04	0.038	0.339
1148.100	2.07	0.0378	0.319
1148.400	2.1	0.0381	0.332
1148.700	2.08	0.039	0.326
1149.000	2.11	0.0393	0.295
1149.300	2.13	0.0377	0.298
1149.600	2.14	0.0391	0.298
1149.900	2.09	0.0377	0.312
1150.200	2.12	0.0382	0.298
1150.500	2.1	0.037	0.305
1150.800	2.12	0.0377	0.293
1151.100	2.11	0.0375	0.291
1151.400	2.1	0.0371	0.286
1151.700	2.09	0.0362	0.275
1152.000	2.16	0.0374	0.289
1152.300	2.15	0.0375	0.289
1152.600	2.13	0.0368	0.301
1152.900	2.16	0.0368	0.303
1153.200	2.1	0.0358	0.31
1153.500	2.11	0.0359	0.297

1153.800	2.1	0.0365	0.303
1154.100	2.1	0.0358	0.295
1154.400	2.09	0.036	0.308
1154.700	2.06	0.0358	0.329
1155.000	2.06	0.0362	0.321
1155.300	2.09	0.0363	0.316
1155.600	2.09	0.0365	0.285
1155.900	2.08	0.0361	0.291
1156.200	2.09	0.0353	0.296
1156.500	2.12	0.0373	0.317
1156.800	2.12	0.0373	0.338
1157.100	2.17	0.0379	0.341
1157.400	2.16	0.0374	0.333
1157.700	2.17	0.0376	0.324
1158.000	2.14	0.0369	0.317
1158.300	2.15	0.037	0.301
1158.600	2.16	0.0369	0.306
1158.900	2.16	0.0362	0.312
1159.200	2.12	0.0361	0.316
1159.500	2.15	0.0362	0.297
1159.800	2.17	0.0361	0.301
1160.100	2.13	0.0364	0.314
1160.400	2.16	0.0371	0.306
1160.700	2.18	0.0371	0.307
1161.000	2.14	0.036	0.331
1161.300	2.23	0.0374	0.315
1161.600	2.25	0.038	0.295
1161.900	2.19	0.0368	0.318
1162.200	2.22	0.0371	0.304
1162.500	2.22	0.0371	0.29
1162.800	2.21	0.0371	0.286
1163.100	2.18	0.0369	0.33
1163.400	2.19	0.0371	0.329
1163.700	2.18	0.0367	0.337
1164.000	2.19	0.0368	0.351
1164.300	2.22	0.0374	0.351
1164.600	2.2	0.0382	0.357
1164.900	2.21	0.0383	0.373
1165.200	2.23	0.0381	0.345
1165.500	2.22	0.0374	0.361
1165.800	2.27	0.0375	0.333
1166.100	2.29	0.0373	0.334
1166.400	2.27	0.0374	0.338
1166.700	2.26	0.037	0.332
1167.000	2.28	0.0398	0.345
1167.300	2.32	0.043	0.471
1167.600	2.25	0.038	0.365
1167.900	2.32	0.0402	0.387
1168.200	2.28	0.04	0.378
1168.500	2.22	0.0384	0.408
1168.800	2.27	0.0391	0.389
1169.100	2.3	0.0394	0.369
1169.400	2.37	0.0415	0.427
1169.700	2.36	0.0396	0.379
1170.000	2.34	0.0398	0.361
1170.300	2.37	0.0404	0.329
1170.600	2.38	0.0408	0.351
1170.900	2.42	0.0404	0.339
1171.200	2.41	0.0401	0.346
1171.500	2.45	0.0401	0.303
1171.800	2.45	0.0397	0.293
1172.100	2.48	0.0415	0.355
1172.400	2.47	0.0402	0.36
1172.700	2.47	0.0407	0.342
1173.000	2.45	0.0401	0.304
1173.300	2.48	0.0702	0.381
1173.600	2.51	0.088	0.609
1173.900	2.51	0.0854	0.667
1174.200	2.51	0.0828	0.651
1174.500	2.47	0.0735	0.455
1174.800	2.49	0.0661	0.362
1175.100	2.48	0.0513	0.44
1175.400	2.52	0.0643	0.38
1175.700	2.61	0.0599	0.51
1176.000	2.59	0.0598	0.425
1176.300	2.59	0.0579	0.446
1176.600	2.6	0.0581	0.471
1176.900	2.57	0.0545	0.365
1177.200	2.57	0.0513	0.351
1177.500	2.56	0.0494	0.333
1177.800	2.57	0.0527	0.344
1178.100	2.58	0.0519	0.376
1178.400	2.6	0.0516	0.438
1178.700	2.61	0.05	0.399
1179.000	2.59	0.049	0.421
1179.300	2.61	0.0495	0.43
1179.600	2.67	0.0501	0.436
1179.900	2.66	0.0476	0.455
1180.200	2.56	0.0442	0.418
1180.500	2.62	0.0449	0.417
1180.800	2.65	0.043	0.447
1181.100	2.63	0.0434	0.399
1181.400	2.66	0.0468	0.429
1181.700	2.6	0.0441	0.447
1182.000	2.67	0.0446	0.461
1182.300	2.68	0.0465	0.451
1182.600	2.68	0.0458	0.463
1182.900	2.67	0.0437	0.48
1183.200	2.7	0.045	0.489
1183.500	2.72	0.0459	0.494
1183.800	2.73	0.0446	0.515
1184.100	2.69	0.0422	0.545
1184.400	2.75	0.0426	0.487
1184.700	2.76	0.0441	0.503
1185.000	2.78	0.0451	0.532
1185.300	2.79	0.0439	0.55
1185.600	2.74	0.0441	0.547
1185.900	2.77	0.044	0.566
1186.200	2.75	0.0437	0.535
1186.500	2.77	0.0431	0.573
1186.800	2.81	0.043	0.566
1187.100	2.81	0.043	0.604
1187.400	2.84	0.043	0.63
1187.700	2.88	0.0441	0.621
1188.000	2.89	0.0448	0.631
1188.300	2.88	0.0441	0.622
1188.600	2.9	0.0429	0.631
1188.900	2.98	0.0439	0.623
1189.200	3	0.045	0.642
1189.500	2.96	0.0443	0.649
1189.800	3.01	0.043	0.643
1190.100	3.03	0.0433	0.679
1190.400	3.04	0.0435	0.692
1190.700	3.12	0.0438	0.656
1191.000	3.1	0.043	0.711
1191.300	3.14	0.0437	0.716
1191.600	3.11	0.0435	0.725
1191.900	3.12	0.0436	0.702
1192.200	3.18	0.0493	0.744
1192.500	3.29	0.0647	0.71
1192.800	3.27	0.0659	0.785
1193.100	3.25	0.0637	0.813
1193.400	3.36	0.0625	0.776
1193.700	3.44	0.0694	0.906
1194.000	3.43	0.0657	0.899
1194.300	3.39	0.0594	0.916
1194.600	3.42	0.0593	0.909
1194.900	3.39	0.0563	0.939
1195.200	3.57	0.0563	0.897
1195.500	3.55	0.0495	0.942
1195.800	3.59	0.0485	0.94
1196.100	3.63	0.048	0.968
1196.400	3.65	0.048	1.02
1196.700	3.68	0.0482	1.06
1197.000	3.65	0.0477	1.12
1197.300	3.7	0.0477	1.12
1197.600	3.72	0.0484	1.16
1197.900	3.75	0.0486	1.19
1198.200	3.8	0.0489	1.22
1198.500	3.82	0.0492	1.28
1198.800	3.93	0.0492	1.3
1199.100	3.93	0.0483	1.34
1199.400	3.96	0.0494	1.41
1199.700	3.99	0.0493	1.47
1200.000	4.05	0.0501	1.53
1200.300	4	0.0489	1.64
1200.600	4.07	0.0499	1.69
1200.900	4.12	0.0496	1.74
1201.200	4.22	0.0507	1.8
1201.500	4.27	0.0495	1.89
1201.800	4.33	0.0507	1.93
1202.100	4.38	0.0516	2
1202.400	4.41	0.0501	2.07
1202.700	4.51	0.052	2.09
1203.000	4.6	0.0522	2.2
1203.300	4.63	0.0524	2.21
1203.600	4.66	0.0515	2.3
1203.900	4.79	0.0527	2.31
1204.200	4.86	0.0525	2.39
1204.500	4.86	0.0519	2.48
1204.800	4.98	0.053	2.55
1205.100	5.08	0.0537	2.6
1205.400	5.2	0.0553	2.61
1205.700	5.3	0.0556	2.63
1206.000	5.32	0.0546	2.65
1206.300	5.4	0.0558	2.69
1206.600	5.48	0.056	2.63
1206.900	5.59	0.0556	2.51
1207.200	5.74	0.0557	2.49
1207.500	5.84	0.0573	2.36
1207.800	5.9	0.0568	2.29
1208.100	6.1	0.0582	2.12
1208.400	6.2	0.0584	1.98
1208.700	6.31	0.0594	1.87
1209.000	6.54	0.0598	1.76
1209.300	6.57	0.0599	1.67
1209.600	6.82	0.0605	1.59
1209.900	6.98	0.0617	1.5
1210.200	7.15	0.0614	1.49
1210.500	7.3	0.0608	1.44
1210.800	7.49	0.0635	1.57
1211.100	7.61	0.0629	1.58
1211.400	7.79	0.0638	1.68
1211.700	7.97	0.0637	1.81
1212.000	8.01	0.0642	1.85
1212.300	8.15	0.0648	2
1212.600	8.31	0.0646	2.16
1212.900	8.5	0.0648	2.27
1213.200	8.68	0.0658	2.49
1213.500	8.9	0.0661	2.72
1213.800	8.96	0.0668	2.82
1214.100	9.16	0.0682	3.04
1214.400	9.27	0.0686	3.18
1214.700	9.29	0.0676	3.32
1215.000	9.42	0.0698	3.61
1215.300	9.31	0.0685	3.51
1215.600	9.28	0.067	3.53
1215.900	9.32	0.0684	3.64
1216.200	9.16	0.0664	3.4
1216.500	9.08	0.0659	3.35
1216.800	8.89	0.065	3.16
1217.100	8.76	0.0649	3.12
1217.400	8.6	0.064	3.1
1217.700	8.5	0.0623	3.07
1218.000	8.32	0.0624	2.95
1218.300	8.11	0.0612	2.82
1218.600	7.88	0.0603	2.66
1218.900	7.75	0.0597	2.51
1219.200	7.57	0.059	2.4
1219.500	7.43	0.0592	2.3
1219.800	7.28	0.0576	2.22
1220.100	7.11	0.0569	2.16
1220.400	6.96	0.0567	2
1220.700	6.84	0.0567	1.9
1221.000	6.67	0.0551	1.82
1221.300	6.51	0.0542	1.77
1221.600	6.4	0.0544	1.7
1221.900	6.21	0.0535	1.6
1222.200	6.17	0.0534	1.59
1222.500	6.05	0.0533	1.51
1222.800	5.88	0.0527	1.44
1223.100	5.78	0.0516	1.39
1223.400	5.62	0.0502	1.32
1223.700	5.5	0.0505	1.22
1224.000	5.43	0.05	1.18
1224.300	5.35	0.0498	1.15
1224.600	5.24	0.0484	1.12
1224.900	5.21	0.0487	1.08
1225.200	5.16	0.0488	0.99
1225.500	5.12	0.0483	0.968
1225.800	5.01	0.0471	0.942
1226.100	4.92	0.0477	0.892
1226.400	4.91	0.0473	0.891
1226.700	4.81	0.0463	0.852
1227.000	4.74	0.0465	0.805
1227.300	4.73	0.0463	0.773
1227.600	4.7	0.0465	0.77
1227.900	4.66	0.0454	0.757
1228.200	4.69	0.0464	0.788
1228.500	4.62	0.0464	0.749
1228.800	4.59	0.0456	0.76
1229.100	4.59	0.0457	0.744
1229.400	4.57	0.0457	0.713
1229.700	4.53	0.0456	0.685
1230.000	4.48	0.0453	0.678

1230.300	4.46	0.0446	0.648
1230.600	4.39	0.0449	0.615
1230.900	4.38	0.045	0.646
1231.200	4.38	0.0449	0.636
1231.500	4.32	0.0438	0.631
1231.800	4.29	0.0445	0.611
1232.100	4.26	0.0438	0.609
1232.400	4.3	0.0434	0.618
1232.700	4.27	0.0435	0.621
1233.000	4.26	0.0441	0.597
1233.300	4.21	0.0431	0.583
1233.600	4.19	0.0439	0.563
1233.900	4.19	0.0436	0.594
1234.200	4.2	0.0431	0.609
1234.500	4.09	0.0434	0.561
1234.800	4.06	0.0429	0.554
1235.100	4.08	0.0428	0.563
1235.400	4.08	0.0432	0.59
1235.700	4.13	0.0441	0.643
1236.000	4.13	0.0424	0.619
1236.300	4.11	0.0433	0.641
1236.600	4.11	0.0436	0.656
1236.900	4.09	0.0429	0.634
1237.200	4.01	0.042	0.626
1237.500	3.96	0.0418	0.639
1237.800	4.01	0.0418	0.649
1238.100	4.02	0.0418	0.648
1238.400	3.96	0.0417	0.627
1238.700	3.96	0.0419	0.637
1239.000	4.02	0.0424	0.676
1239.300	4.03	0.0417	0.69
1239.600	4	0.0416	0.67
1239.900	3.98	0.0418	0.666
1240.200	3.95	0.0416	0.672
1240.500	3.91	0.0409	0.677
1240.800	3.88	0.0411	0.679
1241.100	3.84	0.0413	0.645
1241.400	3.83	0.0414	0.629
1241.700	3.81	0.0409	0.633
1242.000	3.77	0.0411	0.612
1242.300	3.8	0.0412	0.648
1242.600	3.79	0.0414	0.667
1242.900	3.79	0.0405	0.679
1243.200	3.7	0.0402	0.662
1243.500	3.68	0.0403	0.643
1243.800	3.62	0.0393	0.61
1244.100	3.59	0.0391	0.603
1244.400	3.57	0.0402	0.622
1244.700	3.56	0.0402	0.607
1245.000	3.5	0.0387	0.593
1245.300	3.49	0.0392	0.604
1245.600	3.46	0.0395	0.594
1245.900	3.38	0.038	0.556
1246.200	3.33	0.0381	0.554
1246.500	3.32	0.038	0.575
1246.800	3.31	0.0376	0.572
1247.100	3.28	0.037	0.563
1247.400	3.24	0.0376	0.516
1247.700	3.23	0.0371	0.523
1248.000	3.22	0.0373	0.519
1248.300	3.18	0.0376	0.521
1248.600	3.17	0.0375	0.528
1248.900	3.13	0.037	0.518
1249.200	3.11	0.0369	0.509
1249.500	3.08	0.0371	0.513
1249.800	3.09	0.036	0.524
1250.100	3.08	0.0366	0.54
1250.400	3.05	0.0361	0.539
1250.700	3.05	0.0361	0.54
1251.000	2.99	0.0358	0.525
1251.300	2.95	0.0351	0.508
1251.600	2.96	0.0348	0.487
1251.900	2.94	0.0354	0.48
1252.200	2.94	0.0349	0.488
1252.500	2.94	0.035	0.513
1252.800	2.9	0.0354	0.515
1253.100	2.89	0.0353	0.523
1253.400	2.89	0.0343	0.508
1253.700	2.89	0.0355	0.502
1254.000	2.84	0.0356	0.502
1254.300	2.85	0.0349	0.494
1254.600	2.85	0.0353	0.516
1254.900	2.8	0.035	0.524
1255.200	2.79	0.0346	0.489
1255.500	2.8	0.0344	0.496
1255.800	2.83	0.0372	0.697
1256.100	2.86	0.0382	0.787
1256.400	2.84	0.0376	0.795
1256.700	2.87	0.0383	0.801
1257.000	2.76	0.0347	0.553
1257.300	2.73	0.0338	0.499
1257.600	2.69	0.034	0.441
1257.900	2.71	0.0334	0.436
1258.200	2.7	0.0339	0.442
1258.500	2.68	0.0343	0.444
1258.800	2.68	0.0345	0.431
1259.100	2.66	0.0335	0.443
1259.400	2.63	0.0333	0.445
1259.700	2.62	0.0336	0.442
1260.000	2.62	0.0326	0.442
1260.300	2.6	0.0324	0.427
1260.600	2.61	0.0327	0.379
1260.900	2.58	0.0323	0.37
1261.200	2.57	0.0324	0.382
1261.500	2.61	0.0331	0.401
1261.800	2.57	0.0327	0.413
1262.100	2.55	0.0322	0.412
1262.400	2.55	0.0327	0.427
1262.700	2.53	0.0317	0.409
1263.000	2.57	0.0325	0.414
1263.300	2.51	0.0329	0.404
1263.600	2.55	0.0326	0.38
1263.900	2.57	0.0326	0.395
1264.200	2.54	0.0329	0.384
1264.500	2.48	0.0325	0.363
1264.800	2.5	0.0324	0.368
1265.100	2.49	0.032	0.355
1265.400	2.51	0.032	0.355
1265.700	2.5	0.0322	0.353
1266.000	2.5	0.0321	0.359
1266.300	2.44	0.0309	0.357
1266.600	2.41	0.0313	0.333
1266.900	2.37	0.0311	0.328
1267.200	2.38	0.0307	0.324
1267.500	2.39	0.0324	0.332
1267.800	2.4	0.0325	0.332
1268.100	2.38	0.0316	0.348
1268.400	2.34	0.0306	0.328
1268.700	2.36	0.0306	0.337
1269.000	2.32	0.0308	0.329
1269.300	2.34	0.0306	0.335
1269.600	2.35	0.0306	0.341
1269.900	2.35	0.0313	0.334
1270.200	2.36	0.0313	0.337
1270.500	2.31	0.0308	0.336
1270.800	2.28	0.0301	0.311
1271.100	2.29	0.0302	0.315
1271.400	2.27	0.0304	0.305
1271.700	2.27	0.03	0.291
1272.000	2.27	0.0302	0.297
1272.300	2.26	0.0308	0.299
1272.600	2.24	0.0305	0.3
1272.900	2.23	0.0293	0.302
1273.200	2.2	0.0298	0.303
1273.500	2.2	0.0299	0.296
1273.800	2.23	0.0296	0.296
1274.100	2.24	0.0297	0.291
1274.400	2.2	0.0298	0.282
1274.700	2.23	0.0298	0.299
1275.000	2.2	0.0294	0.307
1275.300	2.23	0.03	0.313
1275.600	2.18	0.0296	0.292
1275.900	2.21	0.0303	0.293
1276.200	2.21	0.0301	0.295
1276.500	2.2	0.0294	0.302
1276.800	2.19	0.0303	0.304
1277.100	2.2	0.0299	0.29
1277.400	2.18	0.0292	0.28
1277.700	2.18	0.0294	0.292
1278.000	2.15	0.0302	0.309
1278.300	2.15	0.0295	0.312
1278.600	2.16	0.0296	0.3
1278.900	2.14	0.0296	0.287
1279.200	2.17	0.0292	0.283
1279.500	2.15	0.0297	0.273
1279.800	2.12	0.0297	0.27
1280.100	2.13	0.0295	0.281
1280.400	2.08	0.0288	0.273
1280.700	2.11	0.0294	0.279
1281.000	2.14	0.0295	0.291
1281.300	2.1	0.0297	0.29
1281.600	2.07	0.0298	0.293
1281.900	2.1	0.0301	0.29
1282.200	2.12	0.0297	0.28
1282.500	2.13	0.0309	0.275
1282.800	2.11	0.0304	0.267
1283.100	2.1	0.0301	0.269
1283.400	2.12	0.0308	0.27
1283.700	2.12	0.031	0.271
1284.000	2.11	0.0311	0.264
1284.300	2.1	0.0317	0.279
1284.600	2.11	0.0315	0.274
1284.900	2.12	0.0309	0.253
1285.200	2.1	0.031	0.251
1285.500	2.07	0.0304	0.25
1285.800	2.1	0.0301	0.272
1286.100	2.07	0.0305	0.278
1286.400	2.04	0.0301	0.266
1286.700	2.07	0.0299	0.259
1287.000	2.08	0.0312	0.283
1287.300	2.07	0.0313	0.286
1287.600	2.05	0.0306	0.281
1287.900	2.09	0.0309	0.262
1288.200	2.08	0.0307	0.262
1288.500	2.08	0.0304	0.265
1288.800	2.03	0.0305	0.264
1289.100	2.04	0.0302	0.282
1289.400	2.05	0.0305	0.278
1289.700	2.03	0.0306	0.274
1290.000	2.07	0.0287	0.265
1290.300	2.09	0.029	0.276
1290.600	2.07	0.0287	0.257
1290.900	2.09	0.0288	0.261
1291.200	2.05	0.0286	0.252
1291.500	2.06	0.0285	0.263
1291.800	2.06	0.0288	0.246
1292.100	2.07	0.0285	0.254
1292.400	2.07	0.0284	0.257
1292.700	2.08	0.0284	0.254
1293.000	2.09	0.0288	0.249
1293.300	2.1	0.0285	0.251
1293.600	2.07	0.0283	0.243
1293.900	2.06	0.0282	0.243
1294.200	2.08	0.0284	0.24
1294.500	2.06	0.0281	0.235
1294.800	2.1	0.0283	0.243
1295.100	2.1	0.0284	0.242
1295.400	2.07	0.0284	0.242
1295.700	2.11	0.0287	0.255
1296.000	2.1	0.0289	0.252
1296.300	2.1	0.0293	0.256
1296.600	2.05	0.0287	0.244
1296.900	2.07	0.0285	0.243
1297.200	2.12	0.0294	0.253
1297.500	2.12	0.0292	0.235
1297.800	2.16	0.0292	0.228
1298.100	2.13	0.0294	0.22
1298.400	2.12	0.0289	0.218
1298.700	2.14	0.029	0.236
1299.000	2.18	0.0293	0.242
1299.300	2.15	0.0292	0.239
1299.600	2.17	0.0288	0.239
1299.900	2.12	0.0283	0.236
1300.200	2.12	0.0288	0.248
1300.500	2.14	0.0288	0.236
1300.800	2.16	0.0299	0.275
1301.100	2.19	0.0306	0.289
1301.400	2.18	0.0306	0.264
1301.700	2.18	0.0298	0.263
1302.000	2.14	0.0278	0.247
1302.300	2.13	0.0284	0.231
1302.600	2.15	0.0283	0.243
1302.900	2.13	0.0277	0.232
1303.200	2.14	0.0278	0.24
1303.500	2.13	0.0281	0.238
1303.800	2.18	0.0283	0.262
1304.100	2.17	0.028	0.257
1304.400	2.14	0.0277	0.252
1304.700	2.16	0.0281	0.258
1305.000	2.12	0.0274	0.243
1305.300	2.13	0.0272	0.253
1305.600	2.14	0.0276	0.267
1305.900	2.16	0.028	0.269
1306.200	2.16	0.0277	0.281
1306.500	2.15	0.0277	0.264

1306.800	2.15	0.0283	0.25
1307.100	2.13	0.0278	0.249
1307.400	2.13	0.0277	0.246
1307.700	2.13	0.0273	0.251
1308.000	2.12	0.0275	0.26
1308.300	2.12	0.0273	0.263
1308.600	2.14	0.0273	0.273
1308.900	2.12	0.0274	0.261
1309.200	2.14	0.0277	0.265
1309.500	2.13	0.0278	0.271
1309.800	2.12	0.0273	0.263
1310.100	2.12	0.0273	0.262
1310.400	2.08	0.0272	0.241
1310.700	2.05	0.0267	0.248
1311.000	2.06	0.0269	0.243
1311.300	2.04	0.0266	0.235
1311.600	2.04	0.0267	0.251
1311.900	2.05	0.0268	0.274
1312.200	2.04	0.0269	0.263
1312.500	2	0.0264	0.244
1312.800	2.02	0.0268	0.267
1313.100	2.03	0.0268	0.255
1313.400	2.02	0.0262	0.268
1313.700	2.02	0.0272	0.281
1314.000	1.97	0.0269	0.266
1314.300	1.97	0.0265	0.265
1314.600	2	0.0271	0.268
1314.900	1.94	0.0267	0.252
1315.200	1.98	0.0266	0.254
1315.500	1.96	0.0265	0.233
1315.800	2	0.0267	0.229
1316.100	2	0.0269	0.24
1316.400	2	0.0268	0.243
1316.700	2	0.0264	0.253
1317.000	1.95	0.0261	0.24
1317.300	1.96	0.0265	0.243
1317.600	1.94	0.0265	0.245
1317.900	1.95	0.0266	0.239
1318.200	1.93	0.0273	0.241
1318.500	1.95	0.0269	0.259
1318.800	1.97	0.0269	0.251
1319.100	1.96	0.028	0.258
1319.400	1.98	0.0284	0.265
1319.700	1.97	0.0281	0.265
1320.000	1.98	0.0278	0.256
1320.300	1.94	0.0276	0.252
1320.600	1.91	0.0272	0.25
1320.900	1.94	0.0275	0.246
1321.200	1.93	0.0272	0.247
1321.500	1.92	0.0267	0.253
1321.800	1.94	0.027	0.244
1322.100	1.89	0.0268	0.248
1322.400	1.89	0.0262	0.252
1322.700	1.89	0.0265	0.232
1323.000	1.9	0.0265	0.242
1323.300	1.91	0.0265	0.242
1323.600	1.92	0.0265	0.243
1323.900	1.95	0.0267	0.236
1324.200	1.97	0.0276	0.231
1324.500	1.94	0.0272	0.249
1324.800	1.95	0.0273	0.247
1325.100	1.92	0.0267	0.249
1325.400	1.91	0.0263	0.269
1325.700	1.94	0.0267	0.276
1326.000	1.92	0.0269	0.262
1326.300	1.92	0.0265	0.256
1326.600	1.9	0.027	0.257
1326.900	1.93	0.0267	0.252
1327.200	1.96	0.0272	0.251
1327.500	1.95	0.0273	0.263
1327.800	1.92	0.027	0.271
1328.100	1.94	0.0267	0.269
1328.400	1.93	0.027	0.258
1328.700	1.92	0.0272	0.255
1329.000	1.92	0.0266	0.256
1329.300	1.96	0.0273	0.258
1329.600	1.96	0.0272	0.256
1329.900	1.94	0.027	0.246
1330.200	1.95	0.027	0.244
1330.500	1.95	0.0273	0.248
1330.800	1.95	0.0276	0.27
1331.100	1.95	0.0272	0.266
1331.400	1.96	0.0275	0.276
1331.700	1.94	0.0272	0.27
1332.000	1.93	0.0272	0.284
1332.300	1.98	0.0278	0.281
1332.600	1.95	0.0273	0.268
1332.900	1.96	0.0269	0.252
1333.200	1.97	0.0275	0.27
1333.500	1.95	0.0275	0.264
1333.800	1.95	0.0277	0.264
1334.100	1.97	0.0276	0.272
1334.400	1.99	0.0267	0.259
1334.700	1.98	0.0269	0.255
1335.000	1.97	0.0264	0.244
1335.300	1.95	0.0267	0.259
1335.600	1.98	0.0265	0.27
1335.900	1.99	0.0267	0.259
1336.200	1.96	0.0266	0.25
1336.500	1.97	0.0264	0.252
1336.800	1.96	0.0261	0.257
1337.100	1.96	0.0258	0.26
1337.400	1.94	0.0259	0.252
1337.700	1.94	0.0259	0.253
1338.000	1.93	0.0263	0.254
1338.300	1.93	0.026	0.252
1338.600	1.91	0.0261	0.248
1338.900	1.93	0.0256	0.26
1339.200	1.91	0.0256	0.252
1339.500	1.93	0.0263	0.248
1339.800	1.93	0.0257	0.262
1340.100	1.91	0.0253	0.276
1340.400	1.94	0.0259	0.269
1340.700	1.94	0.0259	0.254
1341.000	1.91	0.0259	0.252
1341.300	1.92	0.025	0.255
1341.600	1.92	0.0253	0.258
1341.900	1.93	0.0251	0.275
1342.200	1.92	0.0251	0.275
1342.500	1.97	0.0258	0.267
1342.800	1.95	0.0258	0.258
1343.100	1.95	0.0261	0.242
1343.400	1.94	0.0258	0.253
1343.700	1.95	0.0263	0.268
1344.000	1.93	0.0264	0.269
1344.300	1.94	0.0259	0.275
1344.600	1.96	0.0257	0.288
1344.900	1.95	0.0258	0.293
1345.200	1.93	0.026	0.264
1345.500	1.93	0.0258	0.259
1345.800	1.93	0.0252	0.259
1346.100	1.93	0.0256	0.27
1346.400	1.89	0.0248	0.257
1346.700	1.9	0.0252	0.274
1347.000	1.92	0.0251	0.281
1347.300	1.92	0.0297	0.271
1347.600	1.93	0.0285	0.262
1347.900	1.9	0.0284	0.261
1348.200	1.91	0.0275	0.251
1348.500	1.9	0.0277	0.249
1348.800	1.89	0.0276	0.274
1349.100	1.91	0.0269	0.25
1349.400	1.88	0.0255	0.237
1349.700	1.88	0.0258	0.242
1350.000	1.91	0.0269	0.261
1350.300	1.88	0.026	0.258
1350.600	1.88	0.0249	0.26
1350.900	1.87	0.0258	0.25
1351.200	1.93	0.0259	0.258
1351.500	1.91	0.0253	0.26
1351.800	1.91	0.0265	0.291
1352.100	1.91	0.0249	0.258
1352.400	1.87	0.0243	0.255
1352.700	1.86	0.0242	0.262
1353.000	1.89	0.0246	0.267
1353.300	1.88	0.0241	0.268
1353.600	1.89	0.0252	0.259
1353.900	1.86	0.0248	0.254
1354.200	1.86	0.025	0.243
1354.500	1.88	0.0253	0.228
1354.800	1.9	0.0255	0.232
1355.100	1.89	0.0251	0.26
1355.400	1.9	0.025	0.25
1355.700	1.86	0.0243	0.245
1356.000	1.87	0.0246	0.256
1356.300	1.9	0.025	0.258
1356.600	1.9	0.026	0.239
1356.900	1.86	0.0249	0.26
1357.200	1.89	0.025	0.266
1357.500	1.91	0.026	0.24
1357.800	1.9	0.0256	0.271
1358.100	1.9	0.0263	0.271
1358.400	1.87	0.0249	0.266
1358.700	1.9	0.0266	0.272
1359.000	1.88	0.0253	0.264
1359.300	1.86	0.026	0.262
1359.600	1.88	0.0256	0.256
1359.900	1.87	0.0259	0.255
1360.200	1.85	0.0255	0.247
1360.500	1.87	0.0257	0.254
1360.800	1.92	0.0267	0.261
1361.100	1.92	0.0268	0.255
1361.400	1.9	0.0261	0.241
1361.700	1.9	0.026	0.247
1362.000	1.91	0.0261	0.264
1362.300	1.91	0.0262	0.257
1362.600	1.89	0.0265	0.258
1362.900	1.9	0.0266	0.261
1363.200	1.89	0.0261	0.275
1363.500	1.88	0.026	0.271
1363.800	1.89	0.0262	0.253
1364.100	1.88	0.0268	0.244
1364.400	1.91	0.0266	0.252
1364.700	1.9	0.0267	0.251
1365.000	1.9	0.027	0.248
1365.300	1.91	0.0269	0.233
1365.600	1.91	0.0271	0.238
1365.900	1.92	0.0269	0.26
1366.200	1.92	0.0268	0.253
1366.500	1.89	0.0267	0.245
1366.800	1.9	0.0272	0.232
1367.100	1.89	0.0265	0.242
1367.400	1.89	0.0267	0.243
1367.700	1.91	0.0273	0.245
1368.000	1.92	0.0274	0.256
1368.300	1.94	0.0273	0.252
1368.600	1.89	0.0266	0.253
1368.900	1.88	0.0264	0.255
1369.200	1.89	0.027	0.256
1369.500	1.91	0.0276	0.244
1369.800	1.9	0.0272	0.232
1370.100	1.87	0.027	0.252
1370.400	1.9	0.0273	0.257
1370.700	1.88	0.0263	0.276
1371.000	1.88	0.0268	0.256
1371.300	1.9	0.0263	0.259
1371.600	1.9	0.0269	0.247
1371.900	1.93	0.0277	0.241
1372.200	1.92	0.0272	0.25
1372.500	1.9	0.027	0.258
1372.800	1.87	0.0262	0.273
1373.100	1.91	0.0266	0.256
1373.400	1.95	0.0271	0.245
1373.700	1.97	0.0273	0.261
1374.000	1.95	0.028	0.261
1374.300	1.96	0.028	0.26
1374.600	1.93	0.028	0.255
1374.900	1.95	0.028	0.259
1375.200	1.91	0.0268	0.277
1375.500	1.89	0.0268	0.265
1375.800	1.91	0.0267	0.257
1376.100	1.96	0.0273	0.245
1376.400	1.94	0.0273	0.24
1376.700	1.91	0.0269	0.247
1377.000	1.9	0.0255	0.268
1377.300	1.9	0.0251	0.279
1377.600	1.91	0.0263	0.273
1377.900	1.94	0.027	0.255
1378.200	1.96	0.0269	0.255
1378.500	1.95	0.027	0.274
1378.800	1.98	0.0259	0.294
1379.100	1.97	0.0277	0.298
1379.400	1.96	0.0259	0.294
1379.700	1.99	0.0271	0.295
1380.000	1.95	0.027	0.283
1380.300	1.99	0.0264	0.27
1380.600	1.96	0.0262	0.281
1380.900	2.02	0.0281	0.279
1381.200	2.01	0.0282	0.301
1381.500	1.95	0.026	0.296
1381.800	1.96	0.0263	0.31
1382.100	1.95	0.0264	0.304
1382.400	1.96	0.0266	0.304
1382.700	1.98	0.0269	0.283
1383.000	2.01	0.0283	0.27

1383.300	1.96	0.0275	0.285
1383.600	1.99	0.0269	0.294
1383.900	1.99	0.0269	0.293
1384.200	2.04	0.0275	0.286
1384.500	2	0.0271	0.283
1384.800	2.05	0.0285	0.271
1385.100	2.04	0.0276	0.287
1385.400	2.03	0.0268	0.286
1385.700	2.06	0.028	0.274
1386.000	2.03	0.0278	0.277
1386.300	2.05	0.0277	0.268
1386.600	2.04	0.0281	0.283
1386.900	2.08	0.0278	0.278
1387.200	2.1	0.0273	0.28
1387.500	2.08	0.0268	0.271
1387.800	2.09	0.0274	0.277
1388.100	2.1	0.027	0.283
1388.400	2.1	0.0273	0.278
1388.700	2.14	0.028	0.255
1389.000	2.1	0.0273	0.263
1389.300	2.11	0.0274	0.273
1389.600	2.13	0.0271	0.281
1389.900	2.14	0.0274	0.279
1390.200	2.16	0.0273	0.287
1390.500	2.17	0.0275	0.276
1390.800	2.16	0.0272	0.267
1391.100	2.16	0.0274	0.289
1391.400	2.15	0.0267	0.288
1391.700	2.16	0.0265	0.284
1392.000	2.19	0.0275	0.282
1392.300	2.21	0.0271	0.263
1392.600	2.23	0.0278	0.256
1392.900	2.22	0.0271	0.246
1393.200	2.19	0.0277	0.26
1393.500	2.2	0.0276	0.269
1393.800	2.21	0.0277	0.263
1394.100	2.21	0.0284	0.251
1394.400	2.22	0.0276	0.246
1394.700	2.21	0.0279	0.241
1395.000	2.26	0.0277	0.241
1395.300	2.23	0.028	0.237
1395.600	2.25	0.0285	0.263
1395.900	2.25	0.0286	0.257
1396.200	2.25	0.0279	0.247
1396.500	2.31	0.0284	0.245
1396.800	2.33	0.0298	0.26
1397.100	2.3	0.0291	0.255
1397.400	2.29	0.0281	0.263
1397.700	2.27	0.0284	0.267
1398.000	2.29	0.029	0.249
1398.300	2.26	0.0281	0.247
1398.600	2.25	0.0278	0.255
1398.900	2.28	0.0286	0.26
1399.200	2.29	0.0284	0.273
1399.500	2.27	0.0273	0.286
1399.800	2.32	0.0295	0.284
1400.100	2.31	0.029	0.295
1400.400	2.3	0.0285	0.301
1400.700	2.28	0.0285	0.292
1401.000	2.3	0.0292	0.289
1401.300	2.27	0.028	0.283
1401.600	2.25	0.0284	0.279
1401.900	2.26	0.0286	0.282
1402.200	2.24	0.0283	0.278
1402.500	2.21	0.0284	0.269
1402.800	2.22	0.0279	0.257
1403.100	2.22	0.0284	0.253
1403.400	2.24	0.0282	0.27
1403.700	2.21	0.028	0.28
1404.000	2.2	0.0281	0.27
1404.300	2.23	0.029	0.283
1404.600	2.23	0.0285	0.283
1404.900	2.19	0.0283	0.266
1405.200	2.2	0.0283	0.285
1405.500	2.19	0.0283	0.277
1405.800	2.19	0.028	0.293
1406.100	2.19	0.0285	0.297
1406.400	2.13	0.0269	0.277
1406.700	2.16	0.0281	0.286
1407.000	2.19	0.0285	0.292
1407.300	2.13	0.0271	0.258
1407.600	2.11	0.0269	0.257
1407.900	2.13	0.0275	0.263
1408.200	2.12	0.027	0.282
1408.500	2.09	0.0268	0.259
1408.800	2.06	0.027	0.256
1409.100	2.08	0.0271	0.254
1409.400	2.07	0.0267	0.249
1409.700	2.06	0.0266	0.236
1410.000	2.04	0.0262	0.246
1410.300	2.02	0.0265	0.239
1410.600	2.06	0.0272	0.231
1410.900	2.04	0.0261	0.243
1411.200	2.05	0.0265	0.247
1411.500	2.05	0.0263	0.249
1411.800	2.02	0.026	0.238
1412.100	2.01	0.0258	0.247
1412.400	2.02	0.0264	0.256
1412.700	1.99	0.0254	0.252
1413.000	1.99	0.0256	0.256
1413.300	1.98	0.0255	0.243
1413.600	1.96	0.0251	0.244
1413.900	1.94	0.0245	0.244
1414.200	1.96	0.0252	0.236
1414.500	1.93	0.0248	0.242
1414.800	1.96	0.0252	0.245
1415.100	1.93	0.0248	0.24
1415.400	1.9	0.0256	0.226
1415.700	1.94	0.0258	0.25
1416.000	1.93	0.0258	0.243
1416.300	1.93	0.0255	0.234
1416.600	1.91	0.0253	0.241
1416.900	1.95	0.0262	0.246
1417.200	1.93	0.0256	0.245
1417.500	1.92	0.0258	0.242
1417.800	1.92	0.026	0.25
1418.100	1.92	0.0259	0.246
1418.400	1.9	0.025	0.241
1418.700	1.93	0.0257	0.246
1419.000	1.91	0.026	0.247
1419.300	1.91	0.0253	0.252
1419.600	1.86	0.0244	0.241
1419.900	1.87	0.0254	0.232
1420.200	1.87	0.0258	0.231
1420.500	1.87	0.0255	0.236
1420.800	1.87	0.0247	0.251
1421.100	1.84	0.0254	0.23
1421.400	1.86	0.0256	0.234
1421.700	1.84	0.0251	0.239
1422.000	1.88	0.0264	0.242
1422.300	1.86	0.0261	0.238
1422.600	1.88	0.0267	0.246
1422.900	1.86	0.0262	0.244
1423.200	1.85	0.0252	0.241
1423.500	1.85	0.0253	0.253
1423.800	1.86	0.0261	0.248
1424.100	1.89	0.0261	0.25
1424.400	1.88	0.0263	0.259
1424.700	1.89	0.0262	0.245
1425.000	1.87	0.0262	0.24
1425.300	1.84	0.0258	0.231
1425.600	1.82	0.0253	0.231
1425.900	1.82	0.0252	0.241
1426.200	1.82	0.0255	0.244
1426.500	1.85	0.0255	0.236
1426.800	1.82	0.0258	0.233
1427.100	1.82	0.0257	0.237
1427.400	1.83	0.0261	0.248
1427.700	1.84	0.0263	0.258
1428.000	1.84	0.0262	0.236
1428.300	1.84	0.0263	0.225
1428.600	1.83	0.0261	0.238
1428.900	1.85	0.0256	0.246
1429.200	1.81	0.0258	0.25
1429.500	1.79	0.0255	0.242
1429.800	1.8	0.0254	0.234
1430.100	1.79	0.0254	0.26
1430.400	1.84	0.0277	0.251
1430.700	1.79	0.0258	0.245
1431.000	1.8	0.0256	0.237
1431.300	1.79	0.0268	0.238
1431.600	1.77	0.0257	0.244
1431.900	1.77	0.0256	0.237
1432.200	1.78	0.0258	0.22
1432.500	1.76	0.0253	0.22
1432.800	1.78	0.0253	0.221
1433.100	1.77	0.0254	0.225
1433.400	1.79	0.0254	0.232
1433.700	1.78	0.0258	0.228
1434.000	1.79	0.0259	0.229
1434.300	1.78	0.0255	0.222
1434.600	1.79	0.0254	0.22
1434.900	1.77	0.0254	0.228
1435.200	1.77	0.0247	0.229
1435.500	1.78	0.025	0.217
1435.800	1.76	0.0246	0.209
1436.100	1.76	0.0249	0.214
1436.400	1.77	0.0243	0.225
1436.700	1.77	0.0247	0.23
1437.000	1.77	0.0249	0.226
1437.300	1.75	0.0244	0.229
1437.600	1.77	0.0242	0.237
1437.900	1.77	0.024	0.243
1438.200	1.76	0.0245	0.233
1438.500	1.75	0.0248	0.249
1438.800	1.78	0.0246	0.244
1439.100	1.76	0.024	0.236
1439.400	1.73	0.0239	0.235
1439.700	1.73	0.0237	0.234
1440.000	1.72	0.0237	0.226
1440.300	1.72	0.0238	0.227
1440.600	1.77	0.0245	0.221
1440.900	1.74	0.0237	0.223
1441.200	1.77	0.0241	0.241
1441.500	1.74	0.0241	0.228
1441.800	1.75	0.0239	0.244
1442.100	1.76	0.0237	0.253
1442.400	1.77	0.025	0.265
1442.700	1.73	0.0237	0.246
1443.000	1.7	0.0231	0.241
1443.300	1.73	0.023	0.25
1443.600	1.76	0.0244	0.248
1443.900	1.75	0.0233	0.243
1444.200	1.77	0.0236	0.238
1444.500	1.74	0.0235	0.234
1444.800	1.74	0.0243	0.238
1445.100	1.73	0.0234	0.239
1445.400	1.75	0.0234	0.242
1445.700	1.72	0.0237	0.236
1446.000	1.72	0.0237	0.239
1446.300	1.74	0.0238	0.232
1446.600	1.74	0.0239	0.233
1446.900	1.75	0.0247	0.242
1447.200	1.7	0.0231	0.235
1447.500	1.73	0.0237	0.246
1447.800	1.75	0.024	0.248
1448.100	1.75	0.0248	0.251
1448.400	1.72	0.0243	0.238
1448.700	1.74	0.0242	0.253
1449.000	1.74	0.024	0.259
1449.300	1.73	0.024	0.249
1449.600	1.75	0.0243	0.25
1449.900	1.71	0.0239	0.239
1450.200	1.7	0.0237	0.221
1450.500	1.7	0.0238	0.212
1450.800	1.73	0.0233	0.224
1451.100	1.73	0.0236	0.224
1451.400	1.71	0.0233	0.227
1451.700	1.72	0.0238	0.226
1452.000	1.71	0.0239	0.23
1452.300	1.72	0.0238	0.235
1452.600	1.71	0.0243	0.236
1452.900	1.68	0.0235	0.248
1453.200	1.7	0.0236	0.249
1453.500	1.71	0.0243	0.248
1453.800	1.75	0.0245	0.244
1454.100	1.72	0.0241	0.235
1454.400	1.71	0.0242	0.227
1454.700	1.7	0.0234	0.223
1455.000	1.71	0.0242	0.224
1455.300	1.71	0.0243	0.236
1455.600	1.72	0.0243	0.243
1455.900	1.74	0.0247	0.24
1456.200	1.72	0.0248	0.237
1456.500	1.69	0.0242	0.226
1456.800	1.69	0.0236	0.221
1457.100	1.67	0.0227	0.228
1457.400	1.66	0.0221	0.227
1457.700	1.68	0.0222	0.234
1458.000	1.71	0.0239	0.234
1458.300	1.67	0.0228	0.235
1458.600	1.66	0.0232	0.238
1458.900	1.66	0.0229	0.258
1459.200	1.69	0.0229	0.249
1459.500	1.72	0.0237	0.252

1459.800	1.71	0.0237	0.231
1460.100	1.69	0.0237	0.233
1460.400	1.68	0.0234	0.227
1460.700	1.68	0.0234	0.23
1461.000	1.68	0.0235	0.227
1461.300	1.71	0.0247	0.238
1461.600	1.74	0.025	0.244
1461.900	1.73	0.0247	0.244
1462.200	1.73	0.0238	0.256
1462.500	1.72	0.0241	0.26
1462.800	1.72	0.0242	0.246
1463.100	1.7	0.0239	0.242
1463.400	1.69	0.0236	0.234
1463.700	1.68	0.0238	0.225
1464.000	1.66	0.0232	0.229
1464.300	1.7	0.0231	0.222
1464.600	1.69	0.0232	0.209
1464.900	1.7	0.0236	0.22
1465.200	1.71	0.0233	0.221
1465.500	1.68	0.0234	0.224
1465.800	1.66	0.0229	0.224
1466.100	1.68	0.0233	0.225
1466.400	1.68	0.0234	0.226
1466.700	1.68	0.0227	0.24
1467.000	1.7	0.0244	0.255
1467.300	1.68	0.0234	0.241
1467.600	1.7	0.0233	0.238
1467.900	1.7	0.0232	0.237
1468.200	1.7	0.0233	0.237
1468.500	1.69	0.0238	0.232
1468.800	1.69	0.0236	0.221
1469.100	1.7	0.0238	0.22
1469.400	1.7	0.0245	0.218
1469.700	1.71	0.0241	0.222
1470.000	1.7	0.0247	0.236
1470.300	1.71	0.0245	0.228
1470.600	1.68	0.0243	0.236
1470.900	1.7	0.0239	0.228
1471.200	1.72	0.0236	0.232
1471.500	1.71	0.0237	0.231
1471.800	1.7	0.0237	0.231
1472.100	1.73	0.0235	0.216
1472.400	1.73	0.0242	0.25
1472.700	1.7	0.023	0.245
1473.000	1.71	0.0237	0.239
1473.300	1.7	0.023	0.226
1473.600	1.68	0.0224	0.229
1473.900	1.7	0.0234	0.234
1474.200	1.68	0.0225	0.257
1474.500	1.71	0.0243	0.254
1474.800	1.71	0.0246	0.255
1475.100	1.72	0.024	0.254
1475.400	1.71	0.0237	0.237
1475.700	1.73	0.0242	0.233
1476.000	1.71	0.0238	0.226
1476.300	1.7	0.0238	0.229
1476.600	1.7	0.0225	0.24
1476.900	1.72	0.0236	0.24
1477.200	1.75	0.0243	0.235
1477.500	1.76	0.0246	0.227
1477.800	1.74	0.0241	0.215
1478.100	1.76	0.0246	0.226
1478.400	1.75	0.024	0.226
1478.700	1.73	0.0234	0.224
1479.000	1.72	0.0226	0.225
1479.300	1.73	0.0229	0.23
1479.600	1.73	0.0227	0.223
1479.900	1.76	0.0226	0.236
1480.200	1.8	0.0254	0.232
1480.500	1.77	0.0236	0.209
1480.800	1.79	0.0238	0.209
1481.100	1.77	0.0229	0.216
1481.400	1.77	0.0226	0.221
1481.700	1.75	0.0225	0.216
1482.000	1.79	0.0233	0.204
1482.300	1.78	0.0236	0.207
1482.600	1.81	0.0243	0.22
1482.900	1.79	0.0231	0.207
1483.200	1.81	0.0238	0.218
1483.500	1.78	0.0222	0.218
1483.800	1.77	0.023	0.223
1484.100	1.77	0.0229	0.219
1484.400	1.81	0.0236	0.209
1484.700	1.79	0.0225	0.209
1485.000	1.8	0.0237	0.203
1485.300	1.79	0.024	0.2
1485.600	1.81	0.0235	0.195
1485.900	1.79	0.023	0.201
1486.200	1.77	0.0229	0.204
1486.500	1.76	0.0223	0.21
1486.800	1.79	0.0228	0.221
1487.100	1.81	0.0237	0.222
1487.400	1.79	0.0233	0.219
1487.700	1.8	0.0234	0.207
1488.000	1.81	0.0231	0.215
1488.300	1.79	0.0228	0.226
1488.600	1.81	0.0226	0.238
1488.900	1.82	0.0235	0.223
1489.200	1.77	0.0229	0.233
1489.500	1.79	0.0231	0.224
1489.800	1.78	0.0227	0.229
1490.100	1.77	0.0222	0.253
1490.400	1.81	0.023	0.234
1490.700	1.81	0.023	0.228
1491.000	1.82	0.0234	0.226
1491.300	1.8	0.0232	0.212
1491.600	1.81	0.0233	0.211
1491.900	1.82	0.0233	0.206
1492.200	1.8	0.0231	0.211
1492.500	1.82	0.0237	0.21
1492.800	1.85	0.0241	0.205
1493.100	1.86	0.0241	0.206
1493.400	1.81	0.0229	0.221
1493.700	1.8	0.0227	0.228
1494.000	1.8	0.0233	0.227
1494.300	1.81	0.0231	0.229
1494.600	1.84	0.0234	0.22
1494.900	1.83	0.0238	0.217
1495.200	1.8	0.0233	0.229
1495.500	1.84	0.0241	0.236
1495.800	1.82	0.0231	0.236
1496.100	1.82	0.0242	0.22
1496.400	1.81	0.0236	0.228
1496.700	1.87	0.024	0.217
1497.000	1.84	0.0228	0.217
1497.300	1.86	0.0231	0.21
1497.600	1.86	0.0232	0.209
1497.900	1.84	0.0228	0.206
1498.200	1.82	0.0226	0.228
1498.500	1.84	0.0231	0.219
1498.800	1.83	0.0225	0.219
1499.100	1.84	0.0228	0.225
1499.400	1.88	0.0232	0.215
1499.700	1.85	0.0233	0.21
1500.000	1.86	0.023	0.216
1500.300	1.83	0.0222	0.246
1500.600	1.83	0.0221	0.257
1500.900	1.87	0.0232	0.227
1501.200	1.85	0.0227	0.222
1501.500	1.84	0.0232	0.227
1501.800	1.88	0.0235	0.226
1502.100	1.9	0.0232	0.226
1502.400	1.88	0.0233	0.227
1502.700	1.91	0.0239	0.217
1503.000	1.92	0.0235	0.216
1503.300	1.9	0.023	0.212
1503.600	1.88	0.0227	0.213
1503.900	1.91	0.0233	0.23
1504.200	1.88	0.0231	0.23
1504.500	1.86	0.0229	0.235
1504.800	1.87	0.0227	0.242
1505.100	1.9	0.023	0.243
1505.400	1.92	0.023	0.254
1505.700	1.9	0.023	0.257
1506.000	1.87	0.023	0.255
1506.300	1.83	0.0227	0.274
1506.600	1.83	0.0225	0.275
1506.900	1.9	0.0236	0.249
1507.200	1.89	0.0228	0.249
1507.500	1.89	0.0236	0.251
1507.800	1.86	0.0229	0.276
1508.100	1.86	0.0227	0.267
1508.400	1.9	0.0233	0.284
1508.700	1.93	0.0236	0.26
1509.000	1.94	0.0239	0.247
1509.300	1.95	0.0232	0.266
1509.600	1.94	0.0233	0.268
1509.900	1.94	0.0231	0.267
1510.200	1.95	0.0232	0.275
1510.500	1.97	0.0241	0.268
1510.800	1.97	0.0242	0.257
1511.100	1.97	0.0242	0.262
1511.400	1.98	0.0239	0.267
1511.700	1.96	0.0236	0.276
1512.000	1.97	0.0234	0.29
1512.300	1.98	0.0229	0.29
1512.600	1.99	0.0244	0.287
1512.900	2.01	0.024	0.29
1513.200	2.02	0.025	0.303
1513.500	1.97	0.0232	0.316
1513.800	2.01	0.0239	0.295
1514.100	2	0.0235	0.295
1514.400	2.03	0.0237	0.303
1514.700	2.04	0.0238	0.299
1515.000	2.05	0.023	0.311
1515.300	2.04	0.024	0.317
1515.600	2.05	0.024	0.311
1515.900	2.05	0.0236	0.324
1516.200	2.06	0.0234	0.313
1516.500	2.08	0.024	0.315
1516.800	2.1	0.0239	0.331
1517.100	2.13	0.0242	0.33
1517.400	2.1	0.0237	0.326
1517.700	2.12	0.0242	0.332
1518.000	2.13	0.0242	0.319
1518.300	2.12	0.024	0.328
1518.600	2.15	0.0247	0.32
1518.900	2.16	0.0245	0.325
1519.200	2.16	0.0242	0.324
1519.500	2.13	0.0249	0.352
1519.800	2.18	0.0248	0.352
1520.100	2.17	0.0241	0.356
1520.400	2.18	0.0242	0.344
1520.700	2.21	0.0245	0.351
1521.000	2.21	0.0248	0.35
1521.300	2.24	0.0248	0.345
1521.600	2.23	0.0245	0.351
1521.900	2.27	0.0247	0.351
1522.200	2.27	0.025	0.353
1522.500	2.25	0.024	0.386
1522.800	2.26	0.0238	0.397
1523.100	2.28	0.0239	0.405
1523.400	2.29	0.0241	0.395
1523.700	2.33	0.0243	0.366
1524.000	2.34	0.0248	0.385
1524.300	2.34	0.025	0.382
1524.600	2.39	0.0253	0.395
1524.900	2.34	0.0248	0.418
1525.200	2.41	0.0255	0.395
1525.500	2.42	0.0259	0.406
1525.800	2.43	0.0255	0.42
1526.100	2.4	0.0253	0.434
1526.400	2.44	0.0258	0.454
1526.700	2.42	0.0254	0.481
1527.000	2.45	0.0263	0.462
1527.300	2.46	0.0266	0.47
1527.600	2.44	0.0265	0.503
1527.900	2.45	0.0258	0.516
1528.200	2.5	0.0261	0.503
1528.500	2.53	0.0266	0.506
1528.800	2.51	0.0262	0.55
1529.100	2.53	0.026	0.562
1529.400	2.59	0.0268	0.539
1529.700	2.58	0.027	0.563
1530.000	2.57	0.0268	0.598
1530.300	2.59	0.0269	0.595
1530.600	2.61	0.0278	0.597
1530.900	2.64	0.0281	0.603
1531.200	2.68	0.0277	0.61
1531.500	2.69	0.0281	0.63
1531.800	2.7	0.0279	0.646
1532.100	2.7	0.0277	0.682
1532.400	2.69	0.0269	0.724
1532.700	2.74	0.028	0.721
1533.000	2.77	0.0289	0.727
1533.300	2.82	0.0289	0.731
1533.600	2.82	0.0281	0.734
1533.900	2.82	0.0284	0.737
1534.200	2.89	0.03	0.736
1534.500	2.89	0.0298	0.753
1534.800	2.91	0.0289	0.793
1535.100	2.98	0.0299	0.77
1535.400	2.98	0.0293	0.808
1535.700	2.98	0.0292	0.861
1536.000	3	0.0294	0.862

1536.300	3.05	0.0286	0.871
1536.600	3.08	0.0297	0.908
1536.900	3.09	0.0295	0.914
1537.200	3.15	0.0301	0.889
1537.500	3.22	0.0301	0.89
1537.800	3.22	0.0298	0.928
1538.100	3.26	0.0306	0.928
1538.400	3.32	0.0315	0.925
1538.700	3.34	0.031	0.922
1539.000	3.34	0.0313	0.921
1539.300	3.37	0.031	0.967
1539.600	3.41	0.031	0.971
1539.900	3.46	0.0314	0.958
1540.200	3.49	0.032	0.948
1540.500	3.55	0.0321	0.92
1540.800	3.62	0.0327	0.923
1541.100	3.67	0.034	0.878
1541.400	3.72	0.0336	0.85
1541.700	3.76	0.034	0.852
1542.000	3.78	0.034	0.842
1542.300	3.78	0.0351	0.824
1542.600	3.82	0.0344	0.806
1542.900	3.86	0.0337	0.745
1543.200	3.91	0.0323	0.73
1543.500	3.95	0.0327	0.701
1543.800	3.98	0.0335	0.687
1544.100	4.06	0.0334	0.693
1544.400	4.13	0.0344	0.687
1544.700	4.15	0.0333	0.699
1545.000	4.21	0.0339	0.723
1545.300	4.3	0.0346	0.767
1545.600	4.29	0.0348	0.799
1545.900	4.31	0.034	0.798
1546.200	4.38	0.0346	0.838
1546.500	4.46	0.0353	0.922
1546.800	4.49	0.036	0.968
1547.100	4.51	0.036	0.996
1547.400	4.53	0.0356	1.02
1547.700	4.54	0.0356	1
1548.000	4.64	0.0363	1.12
1548.300	4.67	0.036	1.16
1548.600	4.67	0.0369	1.15
1548.900	4.63	0.0365	1.17
1549.200	4.67	0.0364	1.23
1549.500	4.69	0.0375	1.22
1549.800	4.64	0.0373	1.23
1550.100	4.62	0.0366	1.24
1550.400	4.66	0.0377	1.29
1550.700	4.63	0.0379	1.33
1551.000	4.57	0.037	1.31
1551.300	4.51	0.0373	1.28
1551.600	4.4	0.0376	1.24
1551.900	4.39	0.0368	1.23
1552.200	4.35	0.0369	1.2
1552.500	4.28	0.0363	1.2
1552.800	4.27	0.0362	1.22
1553.100	4.21	0.0352	1.18
1553.400	4.17	0.0349	1.18
1553.700	4.15	0.0344	1.22
1554.000	4.05	0.0338	1.13
1554.300	3.94	0.0326	1.04
1554.600	3.92	0.0328	1.06
1554.900	3.87	0.0335	1.06
1555.200	3.82	0.0328	1.02
1555.500	3.75	0.0327	0.976
1555.800	3.74	0.0322	0.994
1556.100	3.7	0.0325	0.963
1556.400	3.67	0.0322	0.928
1556.700	3.57	0.0317	0.894
1557.000	3.6	0.0318	0.893
1557.300	3.54	0.0316	0.882
1557.600	3.51	0.0314	0.874
1557.900	3.43	0.0307	0.826
1558.200	3.4	0.0305	0.805
1558.500	3.35	0.0309	0.766
1558.800	3.35	0.0304	0.769
1559.100	3.31	0.0309	0.749
1559.400	3.24	0.0309	0.708
1559.700	3.24	0.0317	0.739
1560.000	3.19	0.0317	0.72
1560.300	3.16	0.0305	0.686
1560.600	3.11	0.0297	0.668
1560.900	3.07	0.0296	0.648
1561.200	3.07	0.0296	0.66
1561.500	3.04	0.0296	0.634
1561.800	3	0.0297	0.636
1562.100	2.96	0.0288	0.581
1562.400	2.9	0.0279	0.554
1562.700	2.89	0.0281	0.555
1563.000	2.94	0.0293	0.586
1563.300	2.92	0.0288	0.554
1563.600	2.86	0.0278	0.529
1563.900	2.85	0.028	0.532
1564.200	2.85	0.0284	0.539
1564.500	2.82	0.0283	0.523
1564.800	2.85	0.0285	0.528
1565.100	2.75	0.0275	0.51
1565.400	2.74	0.0275	0.505
1565.700	2.74	0.0277	0.516
1566.000	2.69	0.0271	0.479
1566.300	2.66	0.027	0.447
1566.600	2.66	0.0281	0.435
1566.900	2.68	0.0273	0.45
1567.200	2.69	0.028	0.464
1567.500	2.64	0.028	0.438
1567.800	2.65	0.0278	0.451
1568.100	2.59	0.0271	0.435
1568.400	2.56	0.0264	0.417
1568.700	2.57	0.027	0.385
1569.000	2.57	0.0282	0.425
1569.300	2.53	0.0273	0.42
1569.600	2.49	0.0276	0.402
1569.900	2.5	0.0273	0.409
1570.200	2.46	0.0265	0.384
1570.500	2.46	0.027	0.376
1570.800	2.44	0.0267	0.362
1571.100	2.47	0.0273	0.369
1571.400	2.46	0.0273	0.375
1571.700	2.41	0.0269	0.368
1572.000	2.44	0.0271	0.364
1572.300	2.43	0.0271	0.351
1572.600	2.36	0.0258	0.325
1572.900	2.36	0.0256	0.337
1573.200	2.38	0.0257	0.341
1573.500	2.35	0.0258	0.321
1573.800	2.34	0.0259	0.324
1574.100	2.31	0.0258	0.329
1574.400	2.3	0.0252	0.343
1574.700	2.33	0.0256	0.325
1575.000	2.31	0.0256	0.321
1575.300	2.33	0.0267	0.315
1575.600	2.28	0.0254	0.314
1575.900	2.24	0.0247	0.293
1576.200	2.26	0.025	0.289
1576.500	2.28	0.0256	0.296
1576.800	2.25	0.0258	0.3
1577.100	2.27	0.0261	0.312
1577.400	2.29	0.0276	0.365
1577.700	2.27	0.0268	0.343
1578.000	2.22	0.0256	0.318
1578.300	2.22	0.0257	0.317
1578.600	2.19	0.0258	0.306
1578.900	2.21	0.0251	0.322
1579.200	2.2	0.0249	0.285
1579.500	2.22	0.0259	0.296
1579.800	2.21	0.0263	0.318
1580.100	2.2	0.026	0.298
1580.400	2.21	0.0257	0.284
1580.700	2.19	0.0255	0.291
1581.000	2.2	0.0252	0.294
1581.300	2.19	0.0254	0.304
1581.600	2.16	0.0256	0.288
1581.900	2.22	0.0265	0.313
1582.200	2.21	0.0263	0.313
1582.500	2.17	0.0257	0.297
1582.800	2.12	0.0246	0.283
1583.100	2.1	0.0247	0.261
1583.400	2.13	0.0251	0.279
1583.700	2.13	0.0249	0.265
1584.000	2.12	0.0246	0.266
1584.300	2.13	0.0245	0.264
1584.600	2.11	0.0249	0.257
1584.900	2.12	0.0254	0.258
1585.200	2.07	0.0252	0.255
1585.500	2.09	0.0254	0.254
1585.800	2.12	0.0255	0.269
1586.100	2.11	0.0258	0.269
1586.400	2.07	0.0251	0.269
1586.700	2.08	0.0251	0.269
1587.000	2.08	0.0256	0.27
1587.300	2.05	0.0255	0.266
1587.600	2.04	0.0252	0.252
1587.900	2.06	0.0253	0.259
1588.200	2.03	0.025	0.25
1588.500	2.03	0.0252	0.244
1588.800	2.07	0.0261	0.261
1589.100	2.05	0.0257	0.249
1589.400	2.04	0.025	0.254
1589.700	2.06	0.0256	0.26
1590.000	2.03	0.0255	0.25
1590.300	2.01	0.0247	0.245
1590.600	2	0.0243	0.239
1590.900	2.01	0.0252	0.252
1591.200	2.01	0.0254	0.248
1591.500	1.98	0.0249	0.239
1591.800	1.99	0.0243	0.268
1592.100	1.98	0.0244	0.262
1592.400	1.97	0.0244	0.259
1592.700	2	0.0258	0.265
1593.000	1.99	0.0253	0.245
1593.300	1.98	0.0246	0.249
1593.600	1.99	0.0247	0.246
1593.900	1.97	0.0247	0.256
1594.200	1.96	0.024	0.274
1594.500	1.94	0.0244	0.252
1594.800	1.99	0.0253	0.238
1595.100	1.99	0.0255	0.254
1595.400	1.97	0.0253	0.238
1595.700	1.95	0.0253	0.22
1596.000	1.95	0.0247	0.225
1596.300	1.93	0.0248	0.226
1596.600	1.95	0.025	0.228
1596.900	1.95	0.025	0.227
1597.200	1.94	0.0245	0.236
1597.500	1.94	0.0248	0.222
1597.800	1.92	0.0237	0.227
1598.100	1.93	0.0244	0.22
1598.400	1.92	0.0246	0.227
1598.700	1.91	0.0244	0.218
1599.000	1.97	0.025	0.236
1599.300	1.97	0.0256	0.232
1599.600	1.91	0.0245	0.216
1599.900	1.92	0.024	0.219
1600.200	1.92	0.0238	0.218
1600.500	1.9	0.0247	0.218
1600.800	1.88	0.0236	0.227
1601.100	1.92	0.0241	0.22
1601.400	1.92	0.0238	0.225
1601.700	1.91	0.024	0.235
1602.000	1.9	0.0249	0.212
1602.300	1.88	0.0238	0.217
1602.600	1.89	0.0232	0.231
1602.900	1.87	0.024	0.222
1603.200	1.9	0.0248	0.224
1603.500	1.91	0.0247	0.224
1603.800	1.89	0.0244	0.223
1604.100	1.92	0.025	0.238
1604.400	1.87	0.0241	0.212
1604.700	1.86	0.0238	0.204
1605.000	1.86	0.0245	0.203
1605.300	1.9	0.0254	0.206
1605.600	1.9	0.0251	0.207
1605.900	1.91	0.025	0.219
1606.200	1.89	0.0252	0.226
1606.500	1.88	0.0253	0.219
1606.800	1.88	0.0249	0.219
1607.100	1.88	0.0256	0.206
1607.400	1.89	0.0271	0.2
1607.700	1.88	0.0256	0.231
1608.000	1.87	0.026	0.213
1608.300	1.86	0.0253	0.209
1608.600	1.89	0.0265	0.206
1608.900	1.86	0.0258	0.205
1609.200	1.85	0.0259	0.215
1609.500	1.85	0.0263	0.202
1609.800	1.86	0.026	0.213
1610.100	1.87	0.0261	0.208
1610.400	1.84	0.0266	0.195
1610.700	1.84	0.0283	0.198
1611.000	1.85	0.0264	0.19
1611.300	1.84	0.0262	0.182
1611.600	1.89	0.0278	0.201
1611.900	1.88	0.0264	0.212
1612.200	1.86	0.024	0.208
1612.500	1.85	0.0239	0.211

1612.800	1.84	0.0239	0.201
1613.100	1.84	0.0244	0.186
1613.400	1.88	0.0251	0.196
1613.700	1.88	0.0247	0.197
1614.000	1.86	0.0246	0.208
1614.300	1.84	0.0233	0.237
1614.600	1.86	0.0235	0.205
1614.900	1.86	0.0235	0.201
1615.200	1.87	0.024	0.205
1615.500	1.91	0.0253	0.198
1615.800	1.88	0.0249	0.196
1616.100	1.85	0.0245	0.195
1616.400	1.82	0.0233	0.202
1616.700	1.82	0.024	0.209
1617.000	1.83	0.0247	0.205
1617.300	1.86	0.0241	0.199
1617.600	1.87	0.0246	0.193
1617.900	1.88	0.0253	0.21
1618.200	1.89	0.0251	0.22
1618.500	1.88	0.024	0.226
1618.800	1.84	0.0236	0.209
1619.100	1.87	0.024	0.205
1619.400	1.84	0.024	0.195
1619.700	1.85	0.0245	0.201
1620.000	1.86	0.0243	0.189
1620.300	1.87	0.0247	0.193
1620.600	1.87	0.0247	0.193
1620.900	1.86	0.0245	0.181
1621.200	1.83	0.024	0.18
1621.500	1.83	0.0242	0.192
1621.800	1.82	0.0239	0.197
1622.100	1.85	0.0237	0.192
1622.400	1.83	0.024	0.193
1622.700	1.83	0.024	0.183
1623.000	1.86	0.025	0.212
1623.300	1.83	0.0245	0.202
1623.600	1.83	0.0241	0.201
1623.900	1.84	0.0239	0.198
1624.200	1.83	0.0231	0.208
1624.500	1.84	0.0236	0.198
1624.800	1.87	0.0235	0.198
1625.100	1.84	0.0234	0.208
1625.400	1.85	0.0235	0.199
1625.700	1.87	0.0241	0.201
1626.000	1.87	0.0246	0.206
1626.300	1.85	0.0238	0.194
1626.600	1.85	0.024	0.194
1626.900	1.84	0.024	0.207
1627.200	1.85	0.0244	0.195
1627.500	1.87	0.0245	0.193
1627.800	1.84	0.024	0.196
1628.100	1.86	0.0235	0.213
1628.400	1.85	0.0236	0.215
1628.700	1.87	0.0244	0.202
1629.000	1.85	0.0248	0.2
1629.300	1.82	0.0242	0.215
1629.600	1.86	0.0252	0.217
1629.900	1.85	0.0238	0.213
1630.200	1.86	0.0257	0.227
1630.500	1.86	0.024	0.221
1630.800	1.87	0.0237	0.202
1631.100	1.88	0.0246	0.206
1631.400	1.84	0.0236	0.211
1631.700	1.86	0.0243	0.195
1632.000	1.85	0.0233	0.198
1632.300	1.85	0.0225	0.208
1632.600	1.86	0.0249	0.211
1632.900	1.91	0.026	0.214
1633.200	1.9	0.0237	0.206
1633.500	1.92	0.0243	0.195
1633.800	1.96	0.0245	0.2
1634.100	1.95	0.0243	0.211
1634.400	1.92	0.0232	0.216
1634.700	1.93	0.0239	0.218
1635.000	1.9	0.0238	0.212
1635.300	1.93	0.0244	0.218
1635.600	1.92	0.0242	0.216
1635.900	1.92	0.0244	0.203
1636.200	1.92	0.0249	0.183
1636.500	1.93	0.0248	0.204
1636.800	1.95	0.0243	0.211
1637.100	1.9	0.0241	0.215
1637.400	1.92	0.0238	0.22
1637.700	1.95	0.0242	0.22
1638.000	1.95	0.0243	0.213
1638.300	1.91	0.0242	0.222
1638.600	1.95	0.0255	0.213
1638.900	1.97	0.0255	0.205
1639.200	1.99	0.0252	0.223
1639.500	1.95	0.0243	0.219
1639.800	1.96	0.0254	0.218
1640.100	1.94	0.0242	0.215
1640.400	1.93	0.0254	0.223
1640.700	1.91	0.0241	0.221
1641.000	1.92	0.0231	0.243
1641.300	1.96	0.025	0.234
1641.600	1.94	0.0252	0.216
1641.900	1.94	0.0255	0.208
1642.200	1.93	0.0262	0.241
1642.500	1.85	0.0236	0.218
1642.800	1.88	0.0238	0.225
1643.100	1.89	0.0238	0.225
1643.400	1.89	0.0233	0.223
1643.700	1.9	0.0241	0.222
1644.000	1.91	0.025	0.215
1644.300	1.93	0.0254	0.226
1644.600	1.93	0.0253	0.226
1644.900	1.88	0.0247	0.202
1645.200	1.87	0.0245	0.204
1645.500	1.83	0.0236	0.212
1645.800	1.82	0.0229	0.228
1646.100	1.85	0.0246	0.202
1646.400	1.86	0.0249	0.192
1646.700	1.85	0.0254	0.198
1647.000	1.84	0.0247	0.203
1647.300	1.81	0.0237	0.206
1647.600	1.85	0.0249	0.224
1647.900	1.85	0.0252	0.21
1648.200	1.84	0.0249	0.198
1648.500	1.84	0.0253	0.184
1648.800	1.83	0.0248	0.19
1649.100	1.83	0.0248	0.209
1649.400	1.82	0.0257	0.222
1649.700	1.86	0.0265	0.222
1650.000	1.84	0.0257	0.205
1650.300	1.85	0.0253	0.209
1650.600	1.86	0.0246	0.223
1650.900	1.85	0.0248	0.233
1651.200	1.84	0.025	0.216
1651.500	1.85	0.0251	0.215
1651.800	1.84	0.0248	0.223
1652.100	1.84	0.0251	0.21
1652.400	1.85	0.0258	0.217
1652.700	1.83	0.0248	0.19
1653.000	1.8	0.0255	0.185
1653.300	1.87	0.026	0.393
1653.600	1.83	0.0254	0.255
1653.900	1.83	0.0259	0.211
1654.200	1.82	0.0264	0.196
1654.500	1.8	0.0263	0.201
1654.800	1.8	0.0252	0.222
1655.100	1.79	0.027	0.202
1655.400	1.82	0.028	0.204
1655.700	1.82	0.0275	0.199
1656.000	1.8	0.0242	0.195
1656.300	1.81	0.0251	0.184
1656.600	1.81	0.0243	0.189
1656.900	1.79	0.0243	0.19
1657.200	1.81	0.0248	0.185
1657.500	1.8	0.0259	0.183
1657.800	1.78	0.0256	0.178
1658.100	1.78	0.0252	0.19
1658.400	1.78	0.0254	0.193
1658.700	1.82	0.0267	0.193
1659.000	1.83	0.0234	0.197
1659.300	1.83	0.0241	0.201
1659.600	1.85	0.0238	0.194
1659.900	1.83	0.0235	0.196
1660.200	1.83	0.0234	0.196
1660.500	1.8	0.0228	0.191
1660.800	1.83	0.0234	0.176
1661.100	1.83	0.0234	0.176
1661.400	1.83	0.0226	0.19
1661.700	1.82	0.022	0.19
1662.000	1.81	0.0228	0.186
1662.300	1.83	0.0237	0.206
1662.600	1.82	0.0239	0.203
1662.900	1.82	0.0242	0.219
1663.200	1.77	0.0225	0.224
1663.500	1.76	0.0218	0.225
1663.800	1.83	0.0242	0.231
1664.100	1.87	0.0248	0.225
1664.400	1.83	0.0248	0.204
1664.700	1.82	0.024	0.205
1665.000	1.83	0.024	0.199
1665.300	1.81	0.0236	0.195
1665.600	1.84	0.025	0.218
1665.900	1.79	0.0226	0.196
1666.200	1.81	0.023	0.2
1666.500	1.82	0.0249	0.224
1666.800	1.81	0.0241	0.213
1667.100	1.83	0.0243	0.221
1667.400	1.84	0.0244	0.228
1667.700	1.84	0.024	0.228
1668.000	1.8	0.0239	0.217
1668.300	1.82	0.0245	0.224
1668.600	1.79	0.0232	0.204
1668.900	1.79	0.0231	0.212
1669.200	1.8	0.0229	0.211
1669.500	1.77	0.0227	0.206
1669.800	1.74	0.0218	0.208
1670.100	1.75	0.0218	0.209
1670.400	1.8	0.0241	0.223
1670.700	1.76	0.023	0.214
1671.000	1.76	0.0231	0.195
1671.300	1.79	0.0235	0.202
1671.600	1.75	0.0231	0.207
1671.900	1.76	0.0243	0.213
1672.200	1.74	0.0229	0.216
1672.500	1.69	0.0213	0.231
1672.800	1.72	0.0233	0.215
1673.100	1.76	0.0237	0.207
1673.400	1.71	0.0228	0.193
1673.700	1.69	0.0225	0.18
1674.000	1.71	0.0225	0.186
1674.300	1.7	0.0234	0.194
1674.600	1.72	0.0238	0.207
1674.900	1.7	0.0235	0.208
1675.200	1.71	0.0233	0.194
1675.500	1.69	0.0232	0.19
1675.800	1.69	0.0233	0.196
1676.100	1.69	0.0229	0.188
1676.400	1.67	0.0226	0.185
1676.700	1.69	0.0226	0.186
1677.000	1.7	0.0232	0.192
1677.300	1.67	0.0227	0.196
1677.600	1.67	0.0229	0.198
1677.900	1.65	0.022	0.201
1678.200	1.64	0.021	0.208
1678.500	1.69	0.0235	0.198
1678.800	1.64	0.0218	0.203
1679.100	1.6	0.0213	0.206
1679.400	1.6	0.0217	0.191
1679.700	1.65	0.0239	0.209
1680.000	1.64	0.0233	0.197
1680.300	1.64	0.023	0.19
1680.600	1.67	0.0238	0.199
1680.900	1.63	0.0227	0.182
1681.200	1.63	0.0227	0.191
1681.500	1.64	0.0228	0.196
1681.800	1.63	0.0229	0.184
1682.100	1.65	0.0238	0.2
1682.400	1.65	0.0233	0.19
1682.700	1.62	0.0236	0.195
1683.000	1.63	0.022	0.199
1683.300	1.61	0.0219	0.193
1683.600	1.64	0.0235	0.2
1683.900	1.65	0.023	0.196
1684.200	1.59	0.0219	0.184
1684.500	1.59	0.0217	0.188
1684.800	1.58	0.0223	0.19
1685.100	1.58	0.0233	0.184
1685.400	1.59	0.0234	0.173
1685.700	1.58	0.023	0.174
1686.000	1.6	0.0239	0.193
1686.300	1.62	0.024	0.207
1686.600	1.6	0.0234	0.182
1686.900	1.58	0.0237	0.181
1687.200	1.57	0.0222	0.19
1687.500	1.56	0.0205	0.217
1687.800	1.59	0.0227	0.187
1688.100	1.55	0.0234	0.202
1688.400	1.55	0.0213	0.207
1688.700	1.53	0.0217	0.187
1689.000	1.53	0.0214	0.197

1689.300	1.55	0.0222	0.192
1689.600	1.54	0.0231	0.199
1689.900	1.54	0.0223	0.201
1690.200	1.56	0.024	0.202
1690.500	1.54	0.0224	0.188
1690.800	1.56	0.0225	0.181
1691.100	1.59	0.0244	0.194
1691.400	1.56	0.0228	0.191
1691.700	1.56	0.0225	0.182
1692.000	1.55	0.0216	0.194
1692.300	1.55	0.021	0.193
1692.600	1.55	0.0224	0.197
1692.900	1.54	0.0227	0.197
1693.200	1.55	0.0217	0.191
1693.500	1.56	0.0223	0.2
1693.800	1.52	0.0225	0.197
1694.100	1.53	0.0216	0.204
1694.400	1.5	0.0219	0.212
1694.700	1.54	0.0228	0.215
1695.000	1.55	0.023	0.223
1695.300	1.56	0.0234	0.217
1695.600	1.55	0.0221	0.196
1695.900	1.56	0.0235	0.21
1696.200	1.56	0.0225	0.2
1696.500	1.52	0.0212	0.192
1696.800	1.56	0.0211	0.196
1697.100	1.53	0.0212	0.18
1697.400	1.52	0.0235	0.19
1697.700	1.51	0.022	0.18
1698.000	1.55	0.0225	0.179
1698.300	1.55	0.0229	0.183
1698.600	1.54	0.022	0.191
1698.900	1.54	0.0226	0.193
1699.200	1.52	0.0226	0.204
1699.500	1.54	0.0224	0.193
1699.800	1.56	0.0229	0.191
1700.100	1.53	0.0225	0.188
1700.400	1.57	0.0232	0.188
1700.700	1.55	0.0231	0.192
1701.000	1.52	0.0221	0.193
1701.300	1.5	0.0227	0.179
1701.600	1.53	0.0234	0.191
1701.900	1.53	0.0229	0.19
1702.200	1.52	0.0224	0.197
1702.500	1.53	0.0223	0.181
1702.800	1.52	0.0225	0.186
1703.100	1.51	0.0219	0.197
1703.400	1.52	0.0228	0.212
1703.700	1.52	0.0217	0.216
1704.000	1.56	0.0248	0.234
1704.300	1.55	0.0238	0.21
1704.600	1.53	0.0221	0.202
1704.900	1.52	0.0224	0.186
1705.200	1.52	0.0225	0.19
1705.500	1.53	0.0229	0.195
1705.800	1.5	0.0214	0.198
1706.100	1.51	0.0218	0.184
1706.400	1.55	0.0228	0.188
1706.700	1.55	0.0223	0.194
1707.000	1.49	0.0221	0.191
1707.300	1.48	0.0212	0.199
1707.600	1.52	0.0223	0.188
1707.900	1.55	0.0236	0.194
1708.200	1.5	0.0211	0.184
1708.500	1.52	0.0223	0.175
1708.800	1.51	0.0218	0.181
1709.100	1.51	0.0216	0.183
1709.400	1.5	0.0215	0.189
1709.700	1.53	0.0221	0.196
1710.000	1.51	0.0221	0.198
1710.300	1.51	0.0223	0.203
1710.600	1.53	0.0222	0.203
1710.900	1.51	0.0222	0.192
1711.200	1.51	0.0222	0.178
1711.500	1.52	0.0221	0.177
1711.800	1.52	0.0222	0.185
1712.100	1.52	0.0214	0.207
1712.400	1.49	0.0221	0.191
1712.700	1.5	0.0232	0.202
1713.000	1.52	0.0207	0.216
1713.300	1.55	0.0228	0.201
1713.600	1.52	0.0224	0.199
1713.900	1.5	0.0223	0.199
1714.200	1.53	0.0228	0.188
1714.500	1.51	0.0214	0.188
1714.800	1.52	0.0222	0.187
1715.100	1.53	0.0228	0.192
1715.400	1.55	0.0239	0.215
1715.700	1.53	0.0226	0.195
1716.000	1.54	0.0239	0.204
1716.300	1.5	0.0211	0.193
1716.600	1.53	0.0233	0.195
1716.900	1.53	0.0221	0.193
1717.200	1.51	0.0228	0.192
1717.500	1.52	0.0232	0.196
1717.800	1.54	0.0233	0.202
1718.100	1.52	0.0224	0.197
1718.400	1.51	0.0224	0.197
1718.700	1.49	0.0225	0.198
1719.000	1.53	0.0226	0.188
1719.300	1.52	0.0225	0.18
1719.600	1.52	0.022	0.186
1719.900	1.51	0.0216	0.202
1720.200	1.5	0.0234	0.195
1720.500	1.48	0.0227	0.191
1720.800	1.47	0.0228	0.193
1721.100	1.46	0.0243	0.198
1721.400	1.48	0.0229	0.206
1721.700	1.5	0.0238	0.2
1722.000	1.51	0.024	0.197
1722.300	1.47	0.0242	0.192
1722.600	1.48	0.025	0.195
1722.900	1.49	0.0237	0.198
1723.200	1.52	0.0235	0.197
1723.500	1.48	0.0225	0.188
1723.800	1.46	0.022	0.181
1724.100	1.5	0.0247	0.193
1724.400	1.52	0.0248	0.202
1724.700	1.51	0.0248	0.199
1725.000	1.52	0.0239	0.192
1725.300	1.51	0.0245	0.2
1725.600	1.5	0.0242	0.203
1725.900	1.51	0.0237	0.205
1726.200	1.5	0.0234	0.199
1726.500	1.53	0.0234	0.199
1726.800	1.53	0.0237	0.197
1727.100	1.5	0.023	0.194
1727.400	1.5	0.0229	0.19
1727.700	1.51	0.0231	0.194
1728.000	1.51	0.0228	0.18
1728.300	1.48	0.0227	0.17
1728.600	1.5	0.0238	0.18
1728.900	1.53	0.0239	0.182
1729.200	1.49	0.0238	0.188
1729.500	1.48	0.0222	0.18
1729.800	1.51	0.0223	0.182
1730.100	1.49	0.0238	0.179
1730.400	1.51	0.0232	0.172
1730.700	1.54	0.0228	0.19
1731.000	1.5	0.0226	0.189
1731.300	1.45	0.0227	0.179
1731.600	1.45	0.0216	0.198
1731.900	1.47	0.0233	0.204
1732.200	1.45	0.0229	0.201
1732.500	1.45	0.023	0.202
1732.800	1.48	0.0232	0.207
1733.100	1.48	0.0249	0.217
1733.400	1.47	0.0223	0.207
1733.700	1.48	0.0228	0.191
1734.000	1.5	0.0237	0.186
1734.300	1.51	0.0223	0.199
1734.600	1.48	0.0219	0.201
1734.900	1.49	0.0218	0.187
1735.200	1.53	0.0227	0.184
1735.500	1.53	0.0238	0.195
1735.800	1.52	0.0236	0.183
1736.100	1.51	0.0232	0.203
1736.400	1.53	0.0232	0.187
1736.700	1.51	0.0225	0.189
1737.000	1.5	0.0233	0.199
1737.300	1.49	0.0224	0.211
1737.600	1.52	0.0242	0.212
1737.900	1.47	0.0212	0.222
1738.200	1.47	0.022	0.205
1738.500	1.48	0.0231	0.193
1738.800	1.5	0.0243	0.191
1739.100	1.5	0.0227	0.189
1739.400	1.52	0.0256	0.189
1739.700	1.51	0.0246	0.178
1740.000	1.5	0.0244	0.175
1740.300	1.51	0.0228	0.195
1740.600	1.51	0.0236	0.188
1740.900	1.5	0.023	0.183
1741.200	1.51	0.0235	0.193
1741.500	1.54	0.0243	0.198
1741.800	1.54	0.0263	0.205
1742.100	1.52	0.0248	0.192
1742.400	1.5	0.0235	0.187
1742.700	1.51	0.0247	0.187
1743.000	1.53	0.026	0.202
1743.300	1.52	0.0258	0.195
1743.600	1.52	0.0255	0.191
1743.900	1.49	0.0239	0.19
1744.200	1.51	0.0244	0.197
1744.500	1.55	0.0252	0.195
1744.800	1.51	0.024	0.189
1745.100	1.51	0.023	0.181
1745.400	1.55	0.0231	0.18
1745.700	1.48	0.0218	0.187
1746.000	1.53	0.0247	0.191
1746.300	1.55	0.0233	0.182
1746.600	1.53	0.0237	0.174
1746.900	1.52	0.0222	0.175
1747.200	1.5	0.0227	0.182
1747.500	1.5	0.0229	0.188
1747.800	1.54	0.0227	0.189
1748.100	1.54	0.0239	0.189
1748.400	1.51	0.023	0.189
1748.700	1.52	0.0227	0.192
1749.000	1.5	0.0236	0.182
1749.300	1.54	0.0259	0.217
1749.600	1.53	0.0256	0.222
1749.900	1.52	0.0233	0.192
1750.200	1.5	0.0234	0.177
1750.500	1.48	0.0235	0.163
1750.800	1.52	0.0246	0.174
1751.100	1.54	0.0255	0.198
1751.400	1.52	0.0244	0.19
1751.700	1.51	0.0243	0.178
1752.000	1.48	0.0235	0.171
1752.300	1.48	0.0229	0.174
1752.600	1.51	0.0238	0.172
1752.900	1.54	0.0248	0.19
1753.200	1.53	0.0246	0.196
1753.500	1.49	0.0221	0.191
1753.800	1.51	0.0237	0.189
1754.100	1.51	0.024	0.191
1754.400	1.49	0.0221	0.188
1754.700	1.48	0.0225	0.175
1755.000	1.49	0.023	0.181
1755.300	1.5	0.025	0.199
1755.600	1.49	0.024	0.187
1755.900	1.5	0.0239	0.184
1756.200	1.47	0.0231	0.183
1756.500	1.43	0.0212	0.188
1756.800	1.43	0.0229	0.186
1757.100	1.47	0.0227	0.184
1757.400	1.45	0.0223	0.176
1757.700	1.46	0.0222	0.176
1758.000	1.47	0.0236	0.166
1758.300	1.49	0.0229	0.173
1758.600	1.48	0.0233	0.178
1758.900	1.47	0.0232	0.177
1759.200	1.48	0.0236	0.178
1759.500	1.47	0.0232	0.176
1759.800	1.45	0.0227	0.166
1760.100	1.46	0.0239	0.176
1760.400	1.48	0.0239	0.178
1760.700	1.47	0.023	0.177
1761.000	1.48	0.0241	0.19
1761.300	1.48	0.0243	0.19
1761.600	1.45	0.0227	0.168
1761.900	1.43	0.0237	0.163
1762.200	1.4	0.0225	0.168
1762.500	1.42	0.0225	0.167
1762.800	1.43	0.0218	0.172
1763.100	1.44	0.0218	0.179
1763.400	1.46	0.024	0.182
1763.700	1.46	0.023	0.174
1764.000	1.45	0.0236	0.167
1764.300	1.48	0.0248	0.175
1764.600	1.48	0.0245	0.192
1764.900	1.43	0.0219	0.183
1765.200	1.45	0.0234	0.173
1765.500	1.43	0.0246	0.19

1765.800	1.39	0.0211	0.191
1766.100	1.39	0.0231	0.188
1766.400	1.44	0.0248	0.194
1766.700	1.42	0.0229	0.185
1767.000	1.39	0.0215	0.189
1767.300	1.41	0.0224	0.183
1767.600	1.42	0.0237	0.178
1767.900	1.44	0.0232	0.174
1768.200	1.42	0.0228	0.186
1768.500	1.42	0.0228	0.175
1768.800	1.43	0.0226	0.174
1769.100	1.46	0.0242	0.186
1769.400	1.45	0.0244	0.189
1769.700	1.43	0.0227	0.177
1770.000	1.43	0.0224	0.18
1770.300	1.44	0.0235	0.177
1770.600	1.47	0.0249	0.183
1770.900	1.47	0.0243	0.173
1771.200	1.46	0.0236	0.176
1771.500	1.43	0.0243	0.185
1771.800	1.39	0.0211	0.195
1772.100	1.42	0.022	0.184
1772.400	1.43	0.0233	0.174
1772.700	1.42	0.0219	0.181
1773.000	1.41	0.0213	0.188
1773.300	1.42	0.022	0.186
1773.600	1.45	0.0243	0.186
1773.900	1.42	0.0221	0.18
1774.200	1.43	0.0224	0.181
1774.500	1.44	0.022	0.181
1774.800	1.43	0.024	0.181
1775.100	1.4	0.0227	0.178
1775.400	1.39	0.0202	0.207
1775.700	1.41	0.0223	0.203
1776.000	1.47	0.0254	0.206
1776.300	1.44	0.0243	0.199
1776.600	1.41	0.024	0.196
1776.900	1.42	0.0233	0.198
1777.200	1.42	0.0229	0.199
1777.500	1.42	0.0234	0.204
1777.800	1.43	0.0229	0.203
1778.100	1.42	0.0233	0.194
1778.400	1.44	0.0235	0.194
1778.700	1.44	0.0227	0.187
1779.000	1.43	0.0225	0.199
1779.300	1.47	0.0258	0.224
1779.600	1.43	0.0244	0.207
1779.900	1.44	0.0239	0.187
1780.200	1.43	0.0221	0.191
1780.500	1.44	0.0245	0.194
1780.800	1.43	0.0231	0.179
1781.100	1.41	0.0227	0.18
1781.400	1.41	0.0222	0.18
1781.700	1.43	0.0238	0.185
1782.000	1.44	0.0241	0.187
1782.300	1.43	0.0232	0.193
1782.600	1.5	0.0263	0.297
1782.900	1.44	0.0227	0.226
1783.200	1.42	0.0215	0.198
1783.500	1.4	0.0231	0.178
1783.800	1.4	0.0228	0.173
1784.100	1.42	0.023	0.185
1784.400	1.43	0.0231	0.178
1784.700	1.43	0.0229	0.181
1785.000	1.36	0.0218	0.173
1785.300	1.4	0.0231	0.172
1785.600	1.45	0.0244	0.187
1785.900	1.44	0.0237	0.189
1786.200	1.47	0.0238	0.191
1786.500	1.44	0.0233	0.184
1786.800	1.43	0.0227	0.178
1787.100	1.45	0.0229	0.183
1787.400	1.39	0.0223	0.175
1787.700	1.43	0.0228	0.17
1788.000	1.45	0.0242	0.18
1788.300	1.43	0.0221	0.172
1788.600	1.45	0.0245	0.178
1788.900	1.42	0.0237	0.173
1789.200	1.43	0.0238	0.174
1789.500	1.43	0.0238	0.166
1789.800	1.43	0.0232	0.158
1790.100	1.43	0.0219	0.168
1790.400	1.42	0.0223	0.185
1790.700	1.43	0.0225	0.194
1791.000	1.4	0.0229	0.179
1791.300	1.41	0.023	0.174
1791.600	1.37	0.022	0.169
1791.900	1.41	0.024	0.174
1792.200	1.39	0.0228	0.173
1792.500	1.41	0.0227	0.178
1792.800	1.4	0.023	0.193
1793.100	1.43	0.0241	0.196
1793.400	1.42	0.0234	0.183
1793.700	1.4	0.0227	0.173
1794.000	1.39	0.0222	0.176
1794.300	1.42	0.023	0.175
1794.600	1.43	0.0232	0.177
1794.900	1.42	0.0232	0.168
1795.200	1.43	0.0239	0.175
1795.500	1.41	0.0221	0.178
1795.800	1.42	0.0242	0.191
1796.100	1.43	0.024	0.187
1796.400	1.41	0.0217	0.186
1796.700	1.43	0.0246	0.199
1797.000	1.44	0.0241	0.194
1797.300	1.41	0.024	0.195
1797.600	1.39	0.0228	0.189
1797.900	1.43	0.0269	0.215
1798.200	1.36	0.0222	0.204
1798.500	1.38	0.0234	0.211
1798.800	1.41	0.0256	0.232
1799.100	1.36	0.0237	0.211
1799.400	1.42	0.0236	0.207
1799.700	1.41	0.023	0.194
1800.000	1.4	0.0223	0.172
1800.300	1.4	0.024	0.169
1800.600	1.4	0.0222	0.165
1800.900	1.39	0.0221	0.172
1801.200	1.43	0.0239	0.179
1801.500	1.43	0.0233	0.197
1801.800	1.39	0.0216	0.194
1802.100	1.41	0.0224	0.178
1802.400	1.36	0.0222	0.176
1802.700	1.34	0.0211	0.194
1803.000	1.36	0.0229	0.203
1803.300	1.36	0.0237	0.224
1803.600	1.38	0.0229	0.221
1803.900	1.37	0.0244	0.212
1804.200	1.37	0.0232	0.185
1804.500	1.42	0.0229	0.186
1804.800	1.39	0.0222	0.187
1805.100	1.42	0.0242	0.195
1805.400	1.4	0.0238	0.184
1805.700	1.41	0.0232	0.164
1806.000	1.43	0.0235	0.176
1806.300	1.41	0.0231	0.188
1806.600	1.41	0.0234	0.177
1806.900	1.38	0.0225	0.167
1807.200	1.4	0.0242	0.169
1807.500	1.44	0.0256	0.199
1807.800	1.41	0.0235	0.178
1808.100	1.42	0.024	0.174
1808.400	1.4	0.0223	0.172
1808.700	1.4	0.0217	0.192
1809.000	1.43	0.025	0.202
1809.300	1.42	0.0245	0.196
1809.600	1.42	0.0232	0.182
1809.900	1.4	0.023	0.177
1810.200	1.39	0.022	0.181
1810.500	1.39	0.0212	0.191
1810.800	1.41	0.0224	0.179
1811.100	1.4	0.0239	0.179
1811.400	1.44	0.0244	0.207
1811.700	1.41	0.0234	0.189
1812.000	1.4	0.0235	0.178
1812.300	1.4	0.0243	0.183
1812.600	1.38	0.0228	0.174
1812.900	1.39	0.0222	0.176
1813.200	1.39	0.0244	0.18
1813.500	1.36	0.0225	0.17
1813.800	1.36	0.0229	0.167
1814.100	1.37	0.023	0.166
1814.400	1.4	0.0249	0.192
1814.700	1.39	0.026	0.204
1815.000	1.4	0.0239	0.182
1815.300	1.37	0.0231	0.18
1815.600	1.4	0.0229	0.173
1815.900	1.39	0.0219	0.171
1816.200	1.39	0.024	0.176
1816.500	1.39	0.0238	0.191
1816.800	1.41	0.0232	0.186
1817.100	1.42	0.0225	0.176
1817.400	1.4	0.0232	0.169
1817.700	1.41	0.0244	0.197
1818.000	1.43	0.0247	0.202
1818.300	1.41	0.0232	0.185
1818.600	1.41	0.0237	0.177
1818.900	1.4	0.0235	0.172
1819.200	1.43	0.0239	0.176
1819.500	1.4	0.0229	0.182
1819.800	1.39	0.0239	0.188
1820.100	1.43	0.0256	0.212
1820.400	1.45	0.0254	0.216
1820.700	1.43	0.0239	0.186
1821.000	1.4	0.0235	0.173
1821.300	1.39	0.0239	0.172
1821.600	1.35	0.0223	0.163
1821.900	1.36	0.0209	0.177
1822.200	1.37	0.0227	0.168
1822.500	1.36	0.023	0.179
1822.800	1.37	0.022	0.179
1823.100	1.35	0.0232	0.182
1823.400	1.37	0.023	0.186
1823.700	1.37	0.0234	0.189
1824.000	1.39	0.0247	0.191
1824.300	1.41	0.0245	0.172
1824.600	1.38	0.0239	0.167
1824.900	1.38	0.0234	0.182
1825.200	1.41	0.0244	0.173
1825.500	1.37	0.0236	0.173
1825.800	1.37	0.0227	0.169
1826.100	1.4	0.0235	0.165
1826.400	1.37	0.0227	0.154
1826.700	1.38	0.0232	0.166
1827.000	1.4	0.0252	0.195
1827.300	1.38	0.0243	0.189
1827.600	1.37	0.0233	0.177
1827.900	1.34	0.0233	0.177
1828.200	1.36	0.024	0.184
1828.500	1.36	0.024	0.179
1828.800	1.35	0.0227	0.167
1829.100	1.34	0.0226	0.17
1829.400	1.34	0.0224	0.181
1829.700	1.35	0.0216	0.187
1830.000	1.35	0.0209	0.193
1830.300	1.35	0.0217	0.186
1830.600	1.42	0.0254	0.203
1830.900	1.36	0.0222	0.194
1831.200	1.34	0.0227	0.186
1831.500	1.36	0.0251	0.206
1831.800	1.37	0.0234	0.202
1832.100	1.34	0.0229	0.21
1832.400	1.36	0.0236	0.219
1832.700	1.36	0.0234	0.202
1833.000	1.38	0.0234	0.195
1833.300	1.37	0.0228	0.178
1833.600	1.34	0.0212	0.18
1833.900	1.37	0.0218	0.179
1834.200	1.37	0.0232	0.18
1834.500	1.37	0.0233	0.182
1834.800	1.38	0.0236	0.182
1835.100	1.33	0.0224	0.182
1835.400	1.34	0.0225	0.187
1835.700	1.33	0.0226	0.186
1836.000	1.35	0.0226	0.186
1836.300	1.35	0.0233	0.19
1836.600	1.36	0.023	0.193
1836.900	1.36	0.0228	0.196
1837.200	1.34	0.0231	0.202
1837.500	1.35	0.023	0.198
1837.800	1.37	0.0217	0.198
1838.100	1.37	0.024	0.188
1838.400	1.39	0.0229	0.182
1838.700	1.4	0.022	0.18
1839.000	1.38	0.0241	0.177
1839.300	1.39	0.0244	0.175
1839.600	1.38	0.0239	0.168
1839.900	1.39	0.0245	0.183
1840.200	1.37	0.0238	0.175
1840.500	1.4	0.0234	0.173
1840.800	1.39	0.0229	0.177
1841.100	1.45	0.0248	0.18
1841.400	1.39	0.0242	0.18
1841.700	1.4	0.0248	0.183
1842.000	1.39	0.0222	0.199

1842.300	1.41	0.0246	0.191
1842.600	1.38	0.0237	0.179
1842.900	1.39	0.0235	0.189
1843.200	1.39	0.0234	0.177
1843.500	1.4	0.024	0.177
1843.800	1.42	0.0253	0.194
1844.100	1.43	0.0251	0.194
1844.400	1.44	0.0255	0.196
1844.700	1.45	0.0263	0.21
1845.000	1.4	0.0244	0.199
1845.300	1.38	0.0228	0.183
1845.600	1.37	0.0225	0.19
1845.900	1.36	0.0216	0.195
1846.200	1.38	0.0224	0.189
1846.500	1.37	0.0221	0.183
1846.800	1.41	0.0226	0.179
1847.100	1.42	0.0248	0.181
1847.400	1.39	0.0243	0.187
1847.700	1.38	0.0235	0.2
1848.000	1.39	0.0257	0.202
1848.300	1.41	0.0283	0.209
1848.600	1.38	0.0251	0.194
1848.900	1.4	0.0251	0.196
1849.200	1.4	0.0242	0.219
1849.500	1.45	0.0292	0.237
1849.800	1.45	0.0277	0.232
1850.100	1.42	0.0226	0.236
1850.400	1.39	0.0242	0.213
1850.700	1.4	0.0277	0.236
1851.000	1.4	0.0241	0.228
1851.300	1.42	0.0254	0.22
1851.600	1.45	0.0275	0.228
1851.900	1.42	0.0258	0.213
1852.200	1.39	0.0235	0.217
1852.500	1.41	0.0247	0.212
1852.800	1.41	0.0236	0.226
1853.100	1.43	0.0243	0.232
1853.400	1.45	0.0268	0.221
1853.700	1.47	0.0261	0.211
1854.000	1.45	0.0253	0.212
1854.300	1.45	0.0246	0.204
1854.600	1.43	0.0244	0.2
1854.900	1.44	0.0248	0.209
1855.200	1.44	0.0256	0.216
1855.500	1.45	0.0244	0.218
1855.800	1.43	0.023	0.214
1856.100	1.44	0.0242	0.213
1856.400	1.43	0.0235	0.211
1856.700	1.45	0.0258	0.222
1857.000	1.47	0.0263	0.212
1857.300	1.47	0.0267	0.211
1857.600	1.47	0.0254	0.194
1857.900	1.5	0.0279	0.23
1858.200	1.49	0.0261	0.218
1858.500	1.46	0.0244	0.2
1858.800	1.46	0.0253	0.198
1859.100	1.43	0.0245	0.191
1859.400	1.47	0.0261	0.2
1859.700	1.43	0.0225	0.194
1860.000	1.47	0.0237	0.182
1860.300	1.47	0.0244	0.171
1860.600	1.47	0.0248	0.175
1860.900	1.47	0.0249	0.177
1861.200	1.45	0.0235	0.182
1861.500	1.46	0.0238	0.186
1861.800	1.46	0.025	0.197
1862.100	1.47	0.0261	0.218
1862.400	1.48	0.0252	0.204
1862.700	1.44	0.0237	0.202
1863.000	1.43	0.0226	0.207
1863.300	1.47	0.0253	0.207
1863.600	1.44	0.0257	0.201
1863.900	1.45	0.0243	0.191
1864.200	1.46	0.0243	0.192
1864.500	1.48	0.0251	0.197
1864.800	1.45	0.0237	0.188
1865.100	1.48	0.0249	0.179
1865.400	1.5	0.025	0.19
1865.700	1.51	0.0261	0.194
1866.000	1.44	0.0223	0.196
1866.300	1.45	0.0254	0.199
1866.600	1.48	0.0236	0.186
1866.900	1.47	0.0249	0.192
1867.200	1.39	0.0215	0.214
1867.500	1.41	0.0241	0.212
1867.800	1.47	0.0255	0.206
1868.100	1.44	0.0245	0.197
1868.400	1.45	0.0246	0.195
1868.700	1.49	0.0247	0.184
1869.000	1.45	0.0247	0.192
1869.300	1.45	0.0253	0.188
1869.600	1.47	0.0258	0.197
1869.900	1.44	0.0247	0.183
1870.200	1.43	0.0242	0.181
1870.500	1.46	0.0241	0.193
1870.800	1.44	0.0241	0.194
1871.100	1.48	0.025	0.182
1871.400	1.48	0.0263	0.184
1871.700	1.46	0.0241	0.183
1872.000	1.47	0.0258	0.185
1872.300	1.42	0.0223	0.209
1872.600	1.49	0.0282	0.239
1872.900	1.51	0.0265	0.214
1873.200	1.52	0.0271	0.213
1873.500	1.48	0.0263	0.21
1873.800	1.52	0.0296	0.245
1874.100	1.48	0.0251	0.214
1874.400	1.49	0.027	0.221
1874.700	1.47	0.0248	0.208
1875.000	1.53	0.0276	0.226
1875.300	1.49	0.0252	0.214
1875.600	1.48	0.0251	0.198
1875.900	1.45	0.0235	0.194
1876.200	1.48	0.0242	0.199
1876.500	1.49	0.0259	0.208
1876.800	1.49	0.026	0.205
1877.100	1.49	0.0259	0.192
1877.400	1.53	0.0273	0.212
1877.700	1.48	0.0253	0.237
1878.000	1.49	0.0247	0.225
1878.300	1.56	0.0268	0.208
1878.600	1.5	0.0258	0.219
1878.900	1.52	0.0257	0.209
1879.200	1.5	0.0247	0.212
1879.500	1.52	0.0244	0.21
1879.800	1.51	0.0248	0.209
1880.100	1.51	0.0268	0.237
1880.400	1.51	0.025	0.229
1880.700	1.51	0.0243	0.239
1881.000	1.57	0.0273	0.227
1881.300	1.56	0.0268	0.223
1881.600	1.56	0.0276	0.229
1881.900	1.55	0.0247	0.221
1882.200	1.57	0.028	0.231
1882.500	1.52	0.0244	0.239
1882.800	1.52	0.0247	0.232
1883.100	1.55	0.0256	0.225
1883.400	1.55	0.0259	0.236
1883.700	1.58	0.027	0.233
1884.000	1.61	0.0281	0.242
1884.300	1.55	0.0284	0.24
1884.600	1.56	0.0292	0.244
1884.900	1.56	0.0282	0.232
1885.200	1.59	0.0284	0.228
1885.500	1.56	0.0267	0.237
1885.800	1.57	0.027	0.235
1886.100	1.61	0.0284	0.227
1886.400	1.62	0.0272	0.231
1886.700	1.61	0.026	0.24
1887.000	1.64	0.0267	0.229
1887.300	1.64	0.0277	0.228
1887.600	1.61	0.027	0.23
1887.900	1.61	0.0266	0.235
1888.200	1.61	0.0267	0.234
1888.500	1.63	0.0269	0.225
1888.800	1.65	0.0277	0.232
1889.100	1.64	0.0248	0.242
1889.400	1.71	0.0292	0.24
1889.700	1.67	0.0259	0.222
1890.000	1.71	0.028	0.211
1890.300	1.66	0.0253	0.217
1890.600	1.71	0.0264	0.224
1890.900	1.73	0.0273	0.216
1891.200	1.69	0.0273	0.22
1891.500	1.67	0.0246	0.237
1891.800	1.73	0.0285	0.252
1892.100	1.72	0.0281	0.243
1892.400	1.71	0.0278	0.244
1892.700	1.72	0.0283	0.234
1893.000	1.75	0.0288	0.237
1893.300	1.73	0.0274	0.237
1893.600	1.73	0.0272	0.236
1893.900	1.76	0.0277	0.229
1894.200	1.76	0.0284	0.24
1894.500	1.77	0.0285	0.229
1894.800	1.75	0.0273	0.238
1895.100	1.73	0.0273	0.263
1895.400	1.78	0.0287	0.242
1895.700	1.76	0.0274	0.255
1896.000	1.76	0.0267	0.255
1896.300	1.77	0.0273	0.28
1896.600	1.79	0.0265	0.259
1896.900	1.78	0.0282	0.251
1897.200	1.75	0.0277	0.267
1897.500	1.81	0.0283	0.251
1897.800	1.81	0.0285	0.244
1898.100	1.81	0.0266	0.264
1898.400	1.76	0.0253	0.29
1898.700	1.78	0.0271	0.287
1899.000	1.77	0.0284	0.307
1899.300	1.74	0.0273	0.308
1899.600	1.78	0.0274	0.295
1899.900	1.82	0.0292	0.283
1900.200	1.83	0.0288	0.278
1900.500	1.89	0.0299	0.276
1900.800	1.88	0.0288	0.249
1901.100	1.88	0.0286	0.245
1901.400	1.84	0.0266	0.276
1901.700	1.86	0.0271	0.255
1902.000	1.89	0.0284	0.23
1902.300	1.9	0.0276	0.222
1902.600	1.93	0.0272	0.237
1902.900	1.93	0.028	0.246
1903.200	1.9	0.0281	0.242
1903.500	1.97	0.0301	0.258
1903.800	1.94	0.0298	0.262
1904.100	1.91	0.0301	0.271
1904.400	1.96	0.0299	0.263
1904.700	1.98	0.03	0.272
1905.000	1.99	0.0317	0.286
1905.300	1.91	0.0285	0.261
1905.600	1.96	0.0273	0.27
1905.900	2.03	0.0323	0.296
1906.200	1.98	0.0287	0.262
1906.500	2.01	0.0293	0.259
1906.800	2.01	0.0297	0.255
1907.100	2	0.0287	0.26
1907.400	2.05	0.0317	0.314
1907.700	2.06	0.0307	0.339
1908.000	2.03	0.0319	0.332
1908.300	2	0.0277	0.308
1908.600	2.02	0.0289	0.308
1908.900	2.05	0.0288	0.367
1909.200	2.03	0.0279	0.333
1909.500	1.98	0.0276	0.312
1909.800	2.05	0.0302	0.329
1910.100	2.05	0.0296	0.32
1910.400	2.01	0.0294	0.324
1910.700	1.94	0.0279	0.304
1911.000	1.93	0.0276	0.293
1911.300	1.96	0.0285	0.299
1911.600	1.95	0.0276	0.297
1911.900	1.9	0.0261	0.291
1912.200	1.93	0.0271	0.308
1912.500	1.93	0.0289	0.302
1912.800	1.87	0.028	0.27
1913.100	1.89	0.0291	0.273
1913.400	1.86	0.0263	0.266
1913.700	1.91	0.03	0.314
1914.000	1.88	0.0262	0.302
1914.300	1.87	0.0265	0.282
1914.600	1.86	0.0286	0.291
1914.900	1.86	0.0285	0.285
1915.200	1.85	0.0276	0.275
1915.500	1.87	0.0309	0.296
1915.800	1.85	0.0279	0.292
1916.100	1.77	0.0258	0.259
1916.400	1.74	0.0275	0.257
1916.700	1.74	0.0253	0.249
1917.000	1.77	0.0271	0.233
1917.300	1.74	0.0268	0.218
1917.600	1.72	0.0258	0.218
1917.900	1.71	0.0252	0.222
1918.200	1.72	0.0275	0.247
1918.500	1.74	0.0276	0.249

1918.800	1.72	0.0269	0.257
1919.100	1.68	0.0271	0.248
1919.400	1.68	0.0276	0.239
1919.700	1.67	0.0264	0.218
1920.000	1.66	0.0249	0.234
1920.300	1.67	0.0265	0.242
1920.600	1.7	0.0274	0.255
1920.900	1.64	0.0243	0.236
1921.200	1.62	0.0264	0.242
1921.500	1.67	0.0311	0.245
1921.800	1.68	0.0273	0.247
1922.100	1.63	0.0259	0.243
1922.400	1.6	0.027	0.224
1922.700	1.62	0.0277	0.228
1923.000	1.62	0.0289	0.241
1923.300	1.59	0.0275	0.212
1923.600	1.58	0.0257	0.224
1923.900	1.59	0.0261	0.229
1924.200	1.57	0.0263	0.214
1924.500	1.54	0.0245	0.217
1924.800	1.58	0.0273	0.225
1925.100	1.54	0.0266	0.199
1925.400	1.56	0.0256	0.198
1925.700	1.61	0.0302	0.279
1926.000	1.54	0.0262	0.246
1926.300	1.56	0.0273	0.235
1926.600	1.54	0.0263	0.222
1926.900	1.49	0.0264	0.192
1927.200	1.49	0.0259	0.19
1927.500	1.47	0.0248	0.207
1927.800	1.49	0.0256	0.217
1928.100	1.51	0.0269	0.209
1928.400	1.49	0.0265	0.221
1928.700	1.46	0.0261	0.198
1929.000	1.49	0.0277	0.221
1929.300	1.48	0.0261	0.205
1929.600	1.5	0.0251	0.194
1929.900	1.49	0.0248	0.196
1930.200	1.49	0.0276	0.214
1930.500	1.47	0.0254	0.222
1930.800	1.45	0.0246	0.208
1931.100	1.45	0.0269	0.21
1931.400	1.46	0.0272	0.217
1931.700	1.43	0.0252	0.183
1932.000	1.47	0.0266	0.192
1932.300	1.43	0.0248	0.201
1932.600	1.43	0.0264	0.2
1932.900	1.44	0.028	0.238
1933.200	1.41	0.0239	0.215
1933.500	1.41	0.0243	0.201
1933.800	1.43	0.0242	0.211
1934.100	1.45	0.0262	0.2
1934.400	1.42	0.0256	0.185
1934.700	1.44	0.0264	0.189
1935.000	1.42	0.0247	0.19
1935.300	1.4	0.0251	0.184
1935.600	1.42	0.025	0.187
1935.900	1.44	0.025	0.188
1936.200	1.43	0.0262	0.186
1936.500	1.45	0.0271	0.199
1936.800	1.43	0.0288	0.217
1937.100	1.39	0.026	0.194
1937.400	1.37	0.0248	0.183
1937.700	1.36	0.0241	0.174
1938.000	1.35	0.0242	0.168
1938.300	1.39	0.0265	0.181
1938.600	1.37	0.0251	0.181
1938.900	1.36	0.0246	0.196
1939.200	1.32	0.0232	0.197
1939.500	1.34	0.0257	0.198
1939.800	1.32	0.0236	0.191
1940.100	1.36	0.026	0.195
1940.400	1.4	0.0288	0.246
1940.700	1.39	0.0278	0.217
1941.000	1.36	0.0264	0.211
1941.300	1.35	0.0256	0.188
1941.600	1.34	0.0254	0.189
1941.900	1.36	0.0252	0.195
1942.200	1.34	0.0238	0.195
1942.500	1.36	0.0249	0.201
1942.800	1.37	0.0263	0.195
1943.100	1.39	0.0291	0.254
1943.400	1.36	0.026	0.199
1943.700	1.36	0.0261	0.186
1944.000	1.34	0.0253	0.183
1944.300	1.31	0.024	0.193
1944.600	1.32	0.0246	0.196
1944.900	1.32	0.0254	0.183
1945.200	1.33	0.0251	0.18
1945.500	1.33	0.0245	0.182
1945.800	1.3	0.0248	0.177
1946.100	1.32	0.0252	0.181
1946.400	1.32	0.0244	0.186
1946.700	1.31	0.024	0.19
1947.000	1.33	0.0264	0.208
1947.300	1.31	0.0253	0.202
1947.600	1.3	0.0238	0.188
1947.900	1.29	0.0249	0.184
1948.200	1.3	0.0255	0.187
1948.500	1.28	0.025	0.187
1948.800	1.27	0.0255	0.173
1949.100	1.3	0.0254	0.186
1949.400	1.31	0.0241	0.187
1949.700	1.32	0.0256	0.186
1950.000	1.3	0.025	0.18
1950.300	1.28	0.023	0.21
1950.600	1.3	0.0264	0.203
1950.900	1.29	0.0247	0.185
1951.200	1.3	0.026	0.18
1951.500	1.33	0.0265	0.192
1951.800	1.32	0.026	0.189
1952.100	1.28	0.025	0.182
1952.400	1.31	0.0257	0.186
1952.700	1.3	0.0266	0.196
1953.000	1.33	0.0275	0.215
1953.300	1.33	0.0275	0.213
1953.600	1.3	0.0259	0.2
1953.900	1.29	0.026	0.199
1954.200	1.29	0.0255	0.191
1954.500	1.26	0.025	0.183
1954.800	1.27	0.0249	0.172
1955.100	1.3	0.0256	0.172
1955.400	1.3	0.0262	0.174
1955.700	1.32	0.0271	0.176
1956.000	1.28	0.0244	0.178
1956.300	1.27	0.0234	0.191
1956.600	1.28	0.0242	0.173
1956.900	1.27	0.0242	0.175
1957.200	1.3	0.0286	0.209
1957.500	1.28	0.0252	0.182
1957.800	1.27	0.0249	0.176
1958.100	1.32	0.0278	0.221
1958.400	1.26	0.0252	0.182
1958.700	1.23	0.024	0.173
1959.000	1.24	0.0243	0.164
1959.300	1.27	0.024	0.166
1959.600	1.28	0.0255	0.177
1959.900	1.29	0.0268	0.203
1960.200	1.28	0.0262	0.189
1960.500	1.29	0.0255	0.173
1960.800	1.26	0.0252	0.172
1961.100	1.25	0.0258	0.179
1961.400	1.27	0.0276	0.18
1961.700	1.27	0.0266	0.166
1962.000	1.27	0.0246	0.161
1962.300	1.26	0.0259	0.17
1962.600	1.24	0.0259	0.177
1962.900	1.24	0.0255	0.168
1963.200	1.26	0.0265	0.171
1963.500	1.24	0.0248	0.165
1963.800	1.26	0.0251	0.173
1964.100	1.29	0.0274	0.198
1964.400	1.29	0.0292	0.227
1964.700	1.25	0.0257	0.188
1965.000	1.22	0.0236	0.168
1965.300	1.26	0.0278	0.188
1965.600	1.17	0.0228	0.179
1965.900	1.21	0.0252	0.165
1966.200	1.28	0.0262	0.161
1966.500	1.23	0.0249	0.157
1966.800	1.21	0.0244	0.157
1967.100	1.2	0.024	0.154
1967.400	1.25	0.0284	0.193
1967.700	1.24	0.0247	0.173
1968.000	1.21	0.0259	0.169
1968.300	1.2	0.0237	0.179
1968.600	1.2	0.0239	0.183
1968.900	1.24	0.0264	0.181
1969.200	1.21	0.0243	0.171
1969.500	1.18	0.0238	0.171
1969.800	1.21	0.0253	0.161
1970.100	1.24	0.0264	0.165
1970.400	1.23	0.0267	0.176
1970.700	1.22	0.0245	0.177
1971.000	1.19	0.0225	0.166
1971.300	1.2	0.0241	0.152
1971.600	1.21	0.0235	0.16
1971.900	1.21	0.0246	0.151
1972.200	1.23	0.0278	0.184
1972.500	1.2	0.0253	0.168
1972.800	1.22	0.0253	0.16
1973.100	1.22	0.0249	0.163
1973.400	1.24	0.0268	0.176
1973.700	1.24	0.0281	0.183
1974.000	1.24	0.0265	0.18
1974.300	1.22	0.0236	0.168
1974.600	1.22	0.0268	0.182
1974.900	1.24	0.0281	0.203
1975.200	1.21	0.0242	0.171
1975.500	1.19	0.0218	0.174
1975.800	1.2	0.0239	0.163
1976.100	1.21	0.0262	0.166
1976.400	1.18	0.0236	0.166
1976.700	1.2	0.0248	0.169
1977.000	1.21	0.0259	0.168
1977.300	1.2	0.0244	0.168
1977.600	1.19	0.0256	0.177
1977.900	1.22	0.0267	0.166
1978.200	1.21	0.0265	0.157
1978.500	1.22	0.0286	0.179
1978.800	1.24	0.0277	0.18
1979.100	1.25	0.0278	0.181
1979.400	1.25	0.0293	0.196
1979.700	1.21	0.0275	0.176
1980.000	1.19	0.0243	0.167
1980.300	1.21	0.0283	0.17
1980.600	1.21	0.0263	0.173
1980.900	1.22	0.0246	0.174
1981.200	1.24	0.0288	0.178
1981.500	1.21	0.0272	0.167
1981.800	1.24	0.0289	0.167
1982.100	1.18	0.0257	0.174
1982.400	1.21	0.0311	0.185
1982.700	1.18	0.0258	0.171
1983.000	1.23	0.0329	0.253
1983.300	1.19	0.028	0.198
1983.600	1.18	0.0256	0.173
1983.900	1.21	0.0267	0.168
1984.200	1.2	0.0257	0.164
1984.500	1.2	0.0266	0.156
1984.800	1.22	0.0267	0.156
1985.100	1.24	0.0259	0.168
1985.400	1.21	0.0267	0.179
1985.700	1.18	0.0283	0.171
1986.000	1.19	0.0299	0.189
1986.300	1.24	0.0362	0.21
1986.600	1.22	0.0327	0.2
1986.900	1.2	0.0228	0.186
1987.200	1.21	0.0211	0.182
1987.500	1.17	0.0206	0.179
1987.800	1.19	0.021	0.181
1988.100	1.21	0.0216	0.171
1988.400	1.21	0.0215	0.163
1988.700	1.21	0.0211	0.157
1989.000	1.22	0.0213	0.158
1989.300	1.23	0.0209	0.168
1989.600	1.23	0.0216	0.166
1989.900	1.19	0.0212	0.164
1990.200	1.19	0.0205	0.167
1990.500	1.21	0.0207	0.165
1990.800	1.21	0.0211	0.158
1991.100	1.21	0.0209	0.164
1991.400	1.2	0.0209	0.16
1991.700	1.2	0.0218	0.162
1992.000	1.22	0.0213	0.167
1992.300	1.22	0.021	0.159
1992.600	1.23	0.0217	0.158
1992.900	1.22	0.021	0.158
1993.200	1.2	0.0209	0.16
1993.500	1.19	0.021	0.173
1993.800	1.23	0.0216	0.163
1994.100	1.23	0.021	0.159
1994.400	1.2	0.0209	0.162
1994.700	1.2	0.0207	0.159
1995.000	1.21	0.0205	0.155

1995.300	1.21	0.0208	0.153
1995.600	1.19	0.0206	0.157
1995.900	1.22	0.0206	0.156
1996.200	1.23	0.0211	0.156
1996.500	1.24	0.0213	0.158
1996.800	1.19	0.0203	0.159
1997.100	1.2	0.0206	0.155
1997.400	1.22	0.0212	0.155
1997.700	1.21	0.0209	0.154
1998.000	1.23	0.0207	0.151
1998.300	1.21	0.0209	0.147
1998.600	1.2	0.0206	0.154
1998.900	1.21	0.0203	0.153
1999.200	1.19	0.0208	0.15
1999.500	1.2	0.0208	0.169
1999.800	1.22	0.0205	0.164
2000.100	1.2	0.0206	0.163
2000.400	1.18	0.0204	0.155
2000.700	1.18	0.02	0.151
2001.000	1.21	0.0209	0.152
2001.300	1.22	0.0209	0.153
2001.600	1.24	0.0212	0.16
2001.900	1.22	0.0209	0.159
2002.200	1.23	0.0208	0.151
2002.500	1.2	0.0204	0.154
2002.800	1.19	0.0204	0.151
2003.100	1.19	0.0207	0.16
2003.400	1.19	0.0208	0.153
2003.700	1.19	0.0209	0.154
2004.000	1.2	0.0204	0.155
2004.300	1.19	0.0206	0.151
2004.600	1.23	0.0215	0.156
2004.900	1.22	0.0209	0.148
2005.200	1.2	0.0206	0.152
2005.500	1.23	0.0213	0.157
2005.800	1.2	0.0205	0.162
2006.100	1.2	0.0206	0.165
2006.400	1.18	0.0205	0.16
2006.700	1.18	0.0204	0.16
2007.000	1.19	0.0207	0.159
2007.300	1.19	0.0207	0.153
2007.600	1.21	0.0208	0.152
2007.900	1.2	0.0205	0.146
2008.200	1.22	0.0213	0.153
2008.500	1.22	0.0212	0.154
2008.800	1.19	0.0208	0.148
2009.100	1.2	0.0216	0.147
2009.400	1.21	0.0214	0.149
2009.700	1.19	0.0209	0.146
2010.000	1.2	0.0213	0.149
2010.300	1.2	0.0212	0.153
2010.600	1.2	0.0209	0.15
2010.900	1.19	0.021	0.151
2011.200	1.2	0.0209	0.152
2011.500	1.23	0.0213	0.155
2011.800	1.23	0.0217	0.161
2012.100	1.2	0.0211	0.155
2012.400	1.21	0.0214	0.157
2012.700	1.19	0.0212	0.155
2013.000	1.19	0.021	0.157
2013.300	1.2	0.0216	0.157
2013.600	1.23	0.0226	0.16
2013.900	1.23	0.0222	0.157
2014.200	1.21	0.0217	0.149
2014.500	1.19	0.0216	0.145
2014.800	1.21	0.0221	0.151
2015.100	1.19	0.0216	0.151
2015.400	1.15	0.0211	0.156
2015.700	1.2	0.0218	0.162
2016.000	1.19	0.021	0.158
2016.300	1.18	0.0209	0.154
2016.600	1.2	0.0216	0.152
2016.900	1.2	0.0213	0.153
2017.200	1.21	0.0219	0.151
2017.500	1.18	0.0218	0.153
2017.800	1.18	0.0209	0.153
2018.100	1.19	0.0214	0.158
2018.400	1.16	0.0216	0.152
2018.700	1.17	0.0214	0.156
2019.000	1.17	0.0213	0.156
2019.300	1.16	0.0217	0.153
2019.600	1.18	0.0221	0.155
2019.900	1.2	0.0211	0.154
2020.200	1.22	0.0214	0.146
2020.500	1.19	0.0212	0.147
2020.800	1.19	0.0208	0.152
2021.100	1.15	0.0204	0.155
2021.400	1.16	0.0208	0.154
2021.700	1.19	0.0207	0.152
2022.000	1.19	0.0207	0.156
2022.300	1.18	0.0205	0.165
2022.600	1.19	0.0208	0.158
2022.900	1.22	0.0215	0.156
2023.200	1.21	0.0212	0.155
2023.500	1.19	0.0207	0.16
2023.800	1.21	0.0216	0.164
2024.100	1.18	0.021	0.158
2024.400	1.2	0.0215	0.168
2024.700	1.17	0.0209	0.163
2025.000	1.17	0.021	0.164
2025.300	1.17	0.021	0.153
2025.600	1.17	0.0209	0.158
2025.900	1.17	0.0209	0.164
2026.200	1.18	0.0212	0.157
2026.500	1.2	0.0214	0.159
2026.800	1.15	0.0209	0.166
2027.100	1.17	0.0206	0.165
2027.400	1.16	0.0206	0.159
2027.700	1.18	0.0211	0.149
2028.000	1.17	0.0209	0.15
2028.300	1.17	0.021	0.152
2028.600	1.19	0.0211	0.152
2028.900	1.17	0.0212	0.154
2029.200	1.18	0.0215	0.147
2029.500	1.2	0.0216	0.152
2029.800	1.21	0.0218	0.154
2030.100	1.2	0.0221	0.155
2030.400	1.2	0.0221	0.155
2030.700	1.16	0.0219	0.153
2031.000	1.17	0.0225	0.147
2031.300	1.2	0.0228	0.156
2031.600	1.18	0.0218	0.155
2031.900	1.19	0.0223	0.151
2032.200	1.17	0.0217	0.152
2032.500	1.16	0.0214	0.153
2032.800	1.16	0.0217	0.166
2033.100	1.17	0.0216	0.168
2033.400	1.17	0.0215	0.169
2033.700	1.18	0.0222	0.161
2034.000	1.18	0.0217	0.154
2034.300	1.18	0.0219	0.15
2034.600	1.21	0.0226	0.151
2034.900	1.21	0.0222	0.157
2035.200	1.21	0.0217	0.156
2035.500	1.2	0.0217	0.158
2035.800	1.19	0.0223	0.154
2036.100	1.16	0.0213	0.15
2036.400	1.16	0.0216	0.147
2036.700	1.17	0.0222	0.154
2037.000	1.18	0.0217	0.147
2037.300	1.19	0.0221	0.142
2037.600	1.22	0.0227	0.145
2037.900	1.22	0.0221	0.15
2038.200	1.21	0.022	0.163
2038.500	1.21	0.0225	0.163
2038.800	1.2	0.0217	0.157
2039.100	1.17	0.0212	0.162
2039.400	1.16	0.0213	0.165
2039.700	1.17	0.0214	0.165
2040.000	1.19	0.0213	0.171
2040.300	1.22	0.0221	0.177
2040.600	1.17	0.0212	0.167
2040.900	1.18	0.021	0.162
2041.200	1.19	0.0213	0.158
2041.500	1.19	0.0218	0.148
2041.800	1.22	0.0228	0.148
2042.100	1.2	0.022	0.149
2042.400	1.18	0.0218	0.157
2042.700	1.18	0.0212	0.153
2043.000	1.19	0.0216	0.147
2043.300	1.19	0.022	0.152
2043.600	1.2	0.0216	0.159
2043.900	1.19	0.0216	0.161
2044.200	1.15	0.0211	0.164
2044.500	1.19	0.0215	0.169
2044.800	1.15	0.0212	0.17
2045.100	1.17	0.0218	0.174
2045.400	1.18	0.0222	0.178
2045.700	1.18	0.0217	0.165
2046.000	1.18	0.0218	0.163
2046.300	1.2	0.0223	0.164
2046.600	1.2	0.0218	0.159
2046.900	1.2	0.0218	0.157
2047.200	1.2	0.022	0.16
2047.500	1.21	0.0216	0.161
2047.800	1.19	0.0214	0.166
2048.100	1.19	0.0216	0.154
2048.400	1.2	0.0223	0.152
2048.700	1.18	0.0215	0.161
2049.000	1.19	0.0219	0.153
2049.300	1.16	0.0214	0.164
2049.600	1.16	0.0213	0.161
2049.900	1.21	0.0217	0.161
2050.200	1.21	0.0224	0.16
2050.500	1.18	0.0217	0.163
2050.800	1.21	0.0218	0.156
2051.100	1.21	0.0225	0.159
2051.400	1.19	0.0218	0.149
2051.700	1.19	0.0215	0.151
2052.000	1.18	0.0219	0.152
2052.300	1.19	0.0222	0.145
2052.600	1.2	0.0214	0.149
2052.900	1.2	0.0217	0.153
2053.200	1.17	0.021	0.163
2053.500	1.18	0.0213	0.171
2053.800	1.22	0.0218	0.165
2054.100	1.22	0.0226	0.163
2054.400	1.18	0.0212	0.167
2054.700	1.2	0.0214	0.162
2055.000	1.22	0.0225	0.159
2055.300	1.2	0.0218	0.157
2055.600	1.19	0.0215	0.153
2055.900	1.16	0.0215	0.155
2056.200	1.22	0.0219	0.159
2056.500	1.22	0.0221	0.158
2056.800	1.2	0.0221	0.152
2057.100	1.2	0.0216	0.149
2057.400	1.18	0.0215	0.157
2057.700	1.19	0.0218	0.164
2058.000	1.21	0.0222	0.156
2058.300	1.18	0.0214	0.155
2058.600	1.16	0.0213	0.161
2058.900	1.18	0.0216	0.163
2059.200	1.21	0.022	0.157
2059.500	1.23	0.0224	0.168
2059.800	1.21	0.0219	0.157
2060.100	1.17	0.0218	0.164
2060.400	1.18	0.0232	0.174
2060.700	1.2	0.0231	0.176
2061.000	1.19	0.0226	0.176
2061.300	1.17	0.0224	0.179
2061.600	1.2	0.0224	0.18
2061.900	1.21	0.0227	0.173
2062.200	1.2	0.0227	0.161
2062.500	1.2	0.0225	0.156
2062.800	1.24	0.0225	0.174
2063.100	1.23	0.0224	0.176
2063.400	1.23	0.0227	0.173
2063.700	1.2	0.0221	0.168
2064.000	1.21	0.0226	0.157
2064.300	1.2	0.022	0.157
2064.600	1.21	0.022	0.161
2064.900	1.21	0.0225	0.164
2065.200	1.21	0.0223	0.161
2065.500	1.21	0.0225	0.173
2065.800	1.19	0.0223	0.169
2066.100	1.21	0.0221	0.163
2066.400	1.25	0.0227	0.17
2066.700	1.23	0.0223	0.165
2067.000	1.21	0.0217	0.161
2067.300	1.24	0.0225	0.16
2067.600	1.24	0.0226	0.155
2067.900	1.21	0.0221	0.149
2068.200	1.17	0.0215	0.155
2068.500	1.19	0.0219	0.164
2068.800	1.22	0.0221	0.161
2069.100	1.24	0.0231	0.154
2069.400	1.24	0.023	0.151
2069.700	1.22	0.0225	0.147
2070.000	1.21	0.0221	0.15
2070.300	1.25	0.0231	0.157
2070.600	1.23	0.0226	0.155
2070.900	1.2	0.0216	0.157
2071.200	1.18	0.0212	0.154
2071.500	1.22	0.0228	0.158

2071.800	1.23	0.0222	0.165
2072.100	1.25	0.0223	0.155
2072.400	1.21	0.0225	0.147
2072.700	1.24	0.0222	0.151
2073.000	1.23	0.0226	0.163
2073.300	1.18	0.0219	0.157
2073.600	1.21	0.0219	0.154
2073.900	1.21	0.0221	0.152
2074.200	1.22	0.0223	0.156
2074.500	1.22	0.0218	0.154
2074.800	1.22	0.0221	0.154
2075.100	1.22	0.0223	0.151
2075.400	1.21	0.0215	0.154
2075.700	1.22	0.0222	0.154
2076.000	1.21	0.0224	0.153
2076.300	1.2	0.0217	0.159
2076.600	1.21	0.0217	0.168
2076.900	1.21	0.0223	0.165
2077.200	1.22	0.022	0.163
2077.500	1.18	0.0214	0.16
2077.800	1.2	0.022	0.165
2078.100	1.2	0.0217	0.17
2078.400	1.2	0.0216	0.166
2078.700	1.23	0.0225	0.162
2079.000	1.18	0.0211	0.163
2079.300	1.2	0.0218	0.159
2079.600	1.23	0.0226	0.147
2079.900	1.22	0.0224	0.144
2080.200	1.23	0.0226	0.156
2080.500	1.23	0.0232	0.151
2080.800	1.22	0.0226	0.147
2081.100	1.22	0.0226	0.154
2081.400	1.22	0.0229	0.169
2081.700	1.21	0.0231	0.16
2082.000	1.2	0.023	0.158
2082.300	1.22	0.0234	0.156
2082.600	1.2	0.0229	0.164
2082.900	1.22	0.0229	0.162
2083.200	1.18	0.0239	0.16
2083.500	1.21	0.0269	0.15
2083.800	1.2	0.0244	0.156
2084.100	1.21	0.024	0.156
2084.400	1.21	0.0238	0.157
2084.700	1.23	0.0235	0.152
2085.000	1.21	0.0241	0.148
2085.300	1.19	0.0239	0.155
2085.600	1.19	0.0238	0.159
2085.900	1.2	0.0236	0.159
2086.200	1.18	0.0231	0.158
2086.500	1.19	0.0231	0.167
2086.800	1.19	0.0231	0.171
2087.100	1.23	0.0235	0.17
2087.400	1.21	0.0237	0.156
2087.700	1.2	0.023	0.16
2088.000	1.2	0.0236	0.149
2088.300	1.18	0.0228	0.147
2088.600	1.17	0.0222	0.156
2088.900	1.18	0.0226	0.156
2089.200	1.2	0.0226	0.156
2089.500	1.22	0.0232	0.155
2089.800	1.21	0.0234	0.154
2090.100	1.18	0.0226	0.154
2090.400	1.18	0.0227	0.152
2090.700	1.2	0.0229	0.15
2091.000	1.21	0.0227	0.157
2091.300	1.19	0.0228	0.162
2091.600	1.2	0.023	0.162
2091.900	1.21	0.0228	0.164
2092.200	1.21	0.0229	0.164
2092.500	1.2	0.0232	0.164
2092.800	1.2	0.023	0.162
2093.100	1.22	0.0233	0.162
2093.400	1.23	0.0236	0.157
2093.700	1.25	0.0235	0.161
2094.000	1.23	0.0236	0.161
2094.300	1.21	0.0232	0.158
2094.600	1.19	0.0228	0.161
2094.900	1.18	0.0227	0.166
2095.200	1.13	0.0228	0.17
2095.500	1.15	0.0227	0.164
2095.800	1.16	0.0226	0.161
2096.100	1.19	0.0233	0.159
2096.400	1.2	0.0232	0.159
2096.700	1.18	0.0227	0.157
2097.000	1.19	0.0233	0.153
2097.300	1.19	0.0231	0.162
2097.600	1.21	0.0232	0.168
2097.900	1.2	0.0234	0.157
2098.200	1.19	0.0232	0.149
2098.500	1.22	0.0234	0.158
2098.800	1.2	0.0238	0.166
2099.100	1.16	0.0228	0.166
2099.400	1.17	0.023	0.155
2099.700	1.2	0.024	0.15
2100.000	1.18	0.0238	0.154
2100.300	1.19	0.0235	0.155
2100.600	1.18	0.0232	0.157
2100.900	1.15	0.023	0.163
2101.200	1.13	0.0223	0.171
2101.500	1.15	0.0227	0.163
2101.800	1.15	0.0226	0.163
2102.100	1.17	0.0229	0.155
2102.400	1.19	0.0238	0.149
2102.700	1.19	0.024	0.155
2103.000	1.18	0.0238	0.159
2103.300	1.18	0.0239	0.164
2103.600	1.18	0.0249	0.156
2103.900	1.16	0.0238	0.15
2104.200	1.16	0.0235	0.149
2104.500	1.18	0.0247	0.156
2104.800	1.18	0.0245	0.161
2105.100	1.19	0.025	0.161
2105.400	1.17	0.0249	0.16
2105.700	1.19	0.0245	0.161
2106.000	1.23	0.0247	0.161
2106.300	1.17	0.0248	0.165
2106.600	1.17	0.0244	0.17
2106.900	1.2	0.0248	0.178
2107.200	1.2	0.0252	0.167
2107.500	1.2	0.0253	0.158
2107.800	1.18	0.0244	0.16
2108.100	1.18	0.0252	0.156
2108.400	1.19	0.0259	0.154
2108.700	1.16	0.0245	0.151
2109.000	1.14	0.0244	0.155
2109.300	1.16	0.0254	0.158
2109.600	1.18	0.0257	0.164
2109.900	1.17	0.0257	0.168
2110.200	1.16	0.0251	0.171
2110.500	1.16	0.0246	0.167
2110.800	1.17	0.0261	0.159
2111.100	1.18	0.0245	0.161
2111.400	1.18	0.0246	0.159
2111.700	1.16	0.0245	0.159
2112.000	1.14	0.0238	0.161
2112.300	1.15	0.0243	0.161
2112.600	1.16	0.0247	0.153
2112.900	1.18	0.0247	0.149
2113.200	1.19	0.025	0.153
2113.500	1.2	0.025	0.16
2113.800	1.21	0.0254	0.159
2114.100	1.16	0.0252	0.148
2114.400	1.15	0.0243	0.148
2114.700	1.16	0.0245	0.156
2115.000	1.16	0.0244	0.15
2115.300	1.14	0.0245	0.151
2115.600	1.14	0.0246	0.152
2115.900	1.16	0.0243	0.15
2116.200	1.15	0.0243	0.153
2116.500	1.15	0.0246	0.16
2116.800	1.14	0.0243	0.156
2117.100	1.15	0.0246	0.147
2117.400	1.17	0.0244	0.143
2117.700	1.16	0.0243	0.147
2118.000	1.16	0.0246	0.151
2118.300	1.16	0.0237	0.16
2118.600	1.14	0.0231	0.171
2118.900	1.14	0.024	0.161
2119.200	1.14	0.0237	0.151
2119.500	1.14	0.024	0.15
2119.800	1.15	0.0235	0.146
2120.100	1.13	0.0241	0.147
2120.400	1.13	0.0235	0.15
2120.700	1.17	0.0239	0.148
2121.000	1.17	0.0245	0.152
2121.300	1.17	0.0242	0.147
2121.600	1.19	0.024	0.14
2121.900	1.16	0.0244	0.141
2122.200	1.16	0.0234	0.151
2122.500	1.15	0.0238	0.15
2122.800	1.16	0.0242	0.153
2123.100	1.13	0.0231	0.154
2123.400	1.14	0.0237	0.154
2123.700	1.19	0.0249	0.168
2124.000	1.17	0.0241	0.155
2124.300	1.14	0.0236	0.152
2124.600	1.16	0.0242	0.159
2124.900	1.13	0.0235	0.168
2125.200	1.14	0.0242	0.158
2125.500	1.11	0.0237	0.156
2125.800	1.14	0.024	0.157
2126.100	1.15	0.024	0.153
2126.400	1.12	0.0234	0.161
2126.700	1.14	0.0237	0.154
2127.000	1.15	0.0242	0.154
2127.300	1.15	0.0238	0.152
2127.600	1.15	0.024	0.158
2127.900	1.16	0.0238	0.159
2128.200	1.18	0.0241	0.16
2128.500	1.17	0.0243	0.151
2128.800	1.13	0.0235	0.154
2129.100	1.15	0.0236	0.155
2129.400	1.14	0.0236	0.16
2129.700	1.15	0.0235	0.153
2130.000	1.14	0.0237	0.152
2130.300	1.17	0.0242	0.148
2130.600	1.15	0.0247	0.154
2130.900	1.13	0.0235	0.154
2131.200	1.13	0.0235	0.151
2131.500	1.13	0.0238	0.156
2131.800	1.14	0.0239	0.155
2132.100	1.12	0.0239	0.157
2132.400	1.09	0.0236	0.161
2132.700	1.15	0.0239	0.153
2133.000	1.17	0.0249	0.158
2133.300	1.18	0.0249	0.162
2133.600	1.18	0.0251	0.156
2133.900	1.18	0.0253	0.163
2134.200	1.14	0.0242	0.153
2134.500	1.15	0.0246	0.145
2134.800	1.17	0.0251	0.145
2135.100	1.16	0.0249	0.155
2135.400	1.12	0.0245	0.159
2135.700	1.12	0.0247	0.149
2136.000	1.15	0.0243	0.149
2136.300	1.15	0.0249	0.152
2136.600	1.13	0.0246	0.153
2136.900	1.13	0.0245	0.146
2137.200	1.13	0.0248	0.145
2137.500	1.14	0.0251	0.145
2137.800	1.14	0.0246	0.145
2138.100	1.12	0.0249	0.143
2138.400	1.15	0.0251	0.149
2138.700	1.17	0.0246	0.15
2139.000	1.13	0.0241	0.156
2139.300	1.11	0.0247	0.151
2139.600	1.17	0.0251	0.148
2139.900	1.14	0.0247	0.149
2140.200	1.17	0.0257	0.153
2140.500	1.12	0.0236	0.144
2140.800	1.13	0.0239	0.148
2141.100	1.16	0.0252	0.156
2141.400	1.13	0.024	0.145
2141.700	1.1	0.0237	0.137
2142.000	1.13	0.0247	0.148
2142.300	1.13	0.0239	0.147
2142.600	1.12	0.0241	0.144
2142.900	1.11	0.0242	0.138
2143.200	1.12	0.0236	0.139
2143.500	1.15	0.0242	0.147
2143.800	1.12	0.0241	0.143
2144.100	1.12	0.0244	0.14
2144.400	1.14	0.0243	0.144
2144.700	1.16	0.0246	0.149
2145.000	1.15	0.0242	0.16
2145.300	1.14	0.0239	0.162
2145.600	1.12	0.0242	0.157
2145.900	1.14	0.0242	0.151
2146.200	1.13	0.0242	0.145
2146.500	1.13	0.0244	0.144
2146.800	1.15	0.0246	0.139
2147.100	1.16	0.0244	0.142
2147.400	1.15	0.0246	0.145
2147.700	1.12	0.024	0.144
2148.000	1.12	0.0246	0.141

2148.300	1.11	0.0238	0.144
2148.600	1.11	0.024	0.143
2148.900	1.09	0.0237	0.151
2149.200	1.1	0.0236	0.15
2149.500	1.1	0.0241	0.148
2149.800	1.11	0.0239	0.138
2150.100	1.1	0.0233	0.137
2150.400	1.08	0.0235	0.141
2150.700	1.07	0.0232	0.141
2151.000	1.11	0.0241	0.139
2151.300	1.11	0.0242	0.141
2151.600	1.12	0.0244	0.145
2151.900	1.13	0.0244	0.14
2152.200	1.12	0.0246	0.134
2152.500	1.11	0.0245	0.136
2152.800	1.1	0.0239	0.136
2153.100	1.13	0.0248	0.151
2153.400	1.19	0.0255	0.16
2153.700	1.16	0.025	0.15
2154.000	1.09	0.0252	0.15
2154.300	1.1	0.0248	0.148
2154.600	1.11	0.0247	0.139
2154.900	1.11	0.0254	0.138
2155.200	1.09	0.0248	0.141
2155.500	1.11	0.0247	0.139
2155.800	1.11	0.0259	0.146
2156.100	1.1	0.0244	0.151
2156.400	1.09	0.0246	0.153
2156.700	1.11	0.0256	0.158
2157.000	1.12	0.0252	0.155
2157.300	1.14	0.0255	0.15
2157.600	1.14	0.0266	0.148
2157.900	1.16	0.0259	0.147
2158.200	1.15	0.026	0.143
2158.500	1.12	0.026	0.144
2158.800	1.1	0.0247	0.144
2159.100	1.09	0.0244	0.142
2159.400	1.11	0.0255	0.143
2159.700	1.11	0.0256	0.142
2160.000	1.11	0.0251	0.149
2160.300	1.17	0.0266	0.154
2160.600	1.11	0.0251	0.148
2160.900	1.1	0.0243	0.146
2161.200	1.13	0.0252	0.146
2161.500	1.13	0.0254	0.155
2161.800	1.13	0.0249	0.152
2162.100	1.09	0.0248	0.154
2162.400	1.12	0.0249	0.167
2162.700	1.13	0.0251	0.16
2163.000	1.13	0.0257	0.152
2163.300	1.12	0.0252	0.148
2163.600	1.15	0.0258	0.153
2163.900	1.12	0.0253	0.156
2164.200	1.13	0.0256	0.152
2164.500	1.16	0.0261	0.151
2164.800	1.15	0.0255	0.15
2165.100	1.1	0.025	0.147
2165.400	1.12	0.0261	0.142
2165.700	1.15	0.0256	0.15
2166.000	1.12	0.026	0.151
2166.300	1.09	0.025	0.151
2166.600	1.09	0.0249	0.156
2166.900	1.1	0.0258	0.159
2167.200	1.14	0.026	0.154
2167.500	1.13	0.0256	0.155
2167.800	1.12	0.0261	0.146
2168.100	1.12	0.0255	0.136
2168.400	1.09	0.0253	0.142
2168.700	1.1	0.0259	0.15
2169.000	1.07	0.0249	0.15
2169.300	1.08	0.0253	0.146
2169.600	1.09	0.0258	0.142
2169.900	1.1	0.0252	0.151
2170.200	1.11	0.0254	0.148
2170.500	1.1	0.0257	0.142
2170.800	1.12	0.0256	0.144
2171.100	1.14	0.0259	0.151
2171.400	1.12	0.026	0.15
2171.700	1.13	0.0263	0.155
2172.000	1.1	0.0249	0.155
2172.300	1.07	0.025	0.151
2172.600	1.1	0.0255	0.138
2172.900	1.11	0.0255	0.135
2173.200	1.13	0.0265	0.137
2173.500	1.14	0.0263	0.143
2173.800	1.13	0.0259	0.142
2174.100	1.1	0.0262	0.142
2174.400	1.11	0.0257	0.14
2174.700	1.12	0.0262	0.145
2175.000	1.12	0.0259	0.15
2175.300	1.12	0.0261	0.155
2175.600	1.13	0.0263	0.151
2175.900	1.14	0.0262	0.151
2176.200	1.14	0.0258	0.15
2176.500	1.11	0.0263	0.141
2176.800	1.12	0.0258	0.137
2177.100	1.14	0.0268	0.142
2177.400	1.15	0.0265	0.141
2177.700	1.12	0.0259	0.148
2178.000	1.08	0.0253	0.153
2178.300	1.06	0.0246	0.157
2178.600	1.11	0.0257	0.146
2178.900	1.14	0.0272	0.148
2179.200	1.08	0.0254	0.145
2179.500	1.09	0.0261	0.141
2179.800	1.11	0.0263	0.141
2180.100	1.12	0.026	0.141
2180.400	1.11	0.0263	0.142
2180.700	1.09	0.0262	0.145
2181.000	1.12	0.0264	0.15
2181.300	1.12	0.026	0.151
2181.600	1.11	0.0265	0.155
2181.900	1.07	0.0258	0.159
2182.200	1.08	0.0262	0.168
2182.500	1.16	0.0286	0.164
2182.800	1.11	0.027	0.151
2183.100	1.12	0.0277	0.148
2183.400	1.16	0.0287	0.155
2183.700	1.14	0.0274	0.152
2184.000	1.13	0.0278	0.148
2184.300	1.13	0.0282	0.147
2184.600	1.14	0.0278	0.14
2184.900	1.12	0.0274	0.137
2185.200	1.09	0.0269	0.141
2185.500	1.09	0.0265	0.14
2185.800	1.11	0.0271	0.135
2186.100	1.07	0.027	0.133
2186.400	1.08	0.0266	0.141
2186.700	1.09	0.0261	0.143
2187.000	1.11	0.0274	0.141
2187.300	1.09	0.0262	0.149
2187.600	1.12	0.0271	0.147
2187.900	1.11	0.0272	0.147
2188.200	1.08	0.027	0.152
2188.500	1.1	0.0261	0.144
2188.800	1.09	0.0272	0.14
2189.100	1.1	0.0269	0.138
2189.400	1.1	0.0264	0.15
2189.700	1.08	0.0271	0.148
2190.000	1.11	0.027	0.144
2190.300	1.1	0.0264	0.141
2190.600	1.12	0.0273	0.142
2190.900	1.11	0.0267	0.142
2191.200	1.09	0.0267	0.151
2191.500	1.08	0.0264	0.159
2191.800	1.1	0.0272	0.144
2192.100	1.1	0.0266	0.141
2192.400	1.09	0.0261	0.142
2192.700	1.09	0.0272	0.139
2193.000	1.11	0.0269	0.145
2193.300	1.1	0.0259	0.148
2193.600	1.11	0.0273	0.142
2193.900	1.1	0.0267	0.138
2194.200	1.1	0.0262	0.144
2194.500	1.08	0.0264	0.154
2194.800	1.1	0.0267	0.152
2195.100	1.11	0.0269	0.152
2195.400	1.05	0.0262	0.152
2195.700	1.05	0.0256	0.153
2196.000	1.08	0.0266	0.149
2196.300	1.1	0.0268	0.138
2196.600	1.08	0.0268	0.139
2196.900	1.07	0.0259	0.139
2197.200	1.1	0.0265	0.131
2197.500	1.13	0.0271	0.135
2197.800	1.11	0.0271	0.151
2198.100	1.07	0.0264	0.152
2198.400	1.1	0.0272	0.145
2198.700	1.08	0.0269	0.143
2199.000	1.09	0.027	0.14
2199.300	1.12	0.0273	0.149
2199.600	1.09	0.0265	0.147
2199.900	1.12	0.0278	0.146
2200.200	1.12	0.0274	0.143
2200.500	1.08	0.0265	0.14
2200.800	1.08	0.0273	0.137
2201.100	1.07	0.026	0.145
2201.400	1.07	0.026	0.147
2201.700	1.07	0.0269	0.147
2202.000	1.08	0.0266	0.147
2202.300	1.1	0.0266	0.151
2202.600	1.12	0.0277	0.147
2202.900	1.07	0.0263	0.147
2203.200	1.06	0.0262	0.141
2203.500	1.08	0.0268	0.143
2203.800	1.09	0.0263	0.146
2204.100	1.1	0.0268	0.147
2204.400	1.12	0.0275	0.145
2204.700	1.12	0.0278	0.137
2205.000	1.14	0.0272	0.144
2205.300	1.14	0.0273	0.14
2205.600	1.09	0.0275	0.139
2205.900	1.08	0.0264	0.136
2206.200	1.08	0.0261	0.137
2206.500	1.08	0.0277	0.143
2206.800	1.1	0.0265	0.139
2207.100	1.08	0.0267	0.142
2207.400	1.08	0.0268	0.139
2207.700	1.1	0.0269	0.144
2208.000	1.11	0.0269	0.143
2208.300	1.09	0.0266	0.141
2208.600	1.09	0.0269	0.134
2208.900	1.09	0.0264	0.141
2209.200	1.08	0.0264	0.148
2209.500	1.08	0.0265	0.142
2209.800	1.1	0.0264	0.137
2210.100	1.11	0.0267	0.136
2210.400	1.13	0.0278	0.139
2210.700	1.1	0.0269	0.144
2211.000	1.07	0.0267	0.141
2211.300	1.07	0.0261	0.141
2211.600	1.1	0.0262	0.143
2211.900	1.09	0.0271	0.142
2212.200	1.06	0.027	0.146
2212.500	1.08	0.0262	0.141
2212.800	1.12	0.0277	0.14
2213.100	1.09	0.0267	0.14
2213.400	1.09	0.0264	0.143
2213.700	1.09	0.0269	0.139
2214.000	1.09	0.0277	0.141
2214.300	1.04	0.0261	0.143
2214.600	1.07	0.0263	0.154
2214.900	1.09	0.0264	0.151
2215.200	1.09	0.0263	0.142
2215.500	1.1	0.0268	0.141
2215.800	1.11	0.0273	0.143
2216.100	1.06	0.0262	0.143
2216.400	1.03	0.0254	0.147
2216.700	1.09	0.0267	0.15
2217.000	1.12	0.027	0.146
2217.300	1.09	0.0267	0.143
2217.600	1.05	0.0269	0.151
2217.900	1.07	0.0262	0.149
2218.200	1.08	0.0266	0.161
2218.500	1.12	0.0273	0.15
2218.800	1.12	0.0272	0.139
2219.100	1.11	0.0275	0.138
2219.400	1.13	0.0279	0.135
2219.700	1.12	0.0274	0.136
2220.000	1.12	0.0278	0.139
2220.300	1.11	0.0273	0.14
2220.600	1.12	0.0275	0.143
2220.900	1.11	0.0277	0.137
2221.200	1.1	0.0273	0.134
2221.500	1.12	0.0272	0.139
2221.800	1.13	0.0278	0.142
2222.100	1.11	0.0279	0.143
2222.400	1.11	0.0272	0.162
2222.700	1.11	0.0277	0.171
2223.000	1.11	0.0279	0.163
2223.300	1.16	0.0286	0.161
2223.600	1.13	0.0278	0.153
2223.900	1.11	0.0285	0.148
2224.200	1.09	0.0268	0.147
2224.500	1.07	0.0273	0.138

2224.800	1.09	0.0282	0.139
2225.100	1.1	0.0279	0.145
2225.400	1.12	0.028	0.154
2225.700	1.09	0.028	0.146
2226.000	1.11	0.0286	0.149
2226.300	1.12	0.0287	0.156
2226.600	1.08	0.0279	0.157
2226.900	1.08	0.0281	0.149
2227.200	1.13	0.0286	0.153
2227.500	1.09	0.0281	0.149
2227.800	1.07	0.0278	0.144
2228.100	1.09	0.0278	0.145
2228.400	1.08	0.0275	0.15
2228.700	1.1	0.0281	0.152
2229.000	1.13	0.0285	0.153
2229.300	1.12	0.0284	0.149
2229.600	1.07	0.0277	0.151
2229.900	1.09	0.0279	0.142
2230.200	1.1	0.028	0.137
2230.500	1.11	0.0285	0.134
2230.800	1.08	0.0276	0.139
2231.100	1.07	0.0273	0.15
2231.400	1.09	0.0285	0.146
2231.700	1.11	0.0285	0.143
2232.000	1.12	0.0278	0.149
2232.300	1.12	0.0286	0.145
2232.600	1.1	0.0281	0.135
2232.900	1.1	0.0279	0.141
2233.200	1.05	0.0277	0.143
2233.500	1.04	0.0264	0.15
2233.800	1.03	0.0268	0.158
2234.100	1.05	0.0275	0.152
2234.400	1.06	0.0278	0.146
2234.700	1.03	0.0266	0.143
2235.000	1.08	0.028	0.141
2235.300	1.1	0.0283	0.142
2235.600	1.09	0.0284	0.141
2235.900	1.05	0.0278	0.141
2236.200	1.04	0.0273	0.141
2236.500	1.05	0.0274	0.141
2236.800	1.06	0.0277	0.156
2237.100	1.06	0.0276	0.158
2237.400	1.07	0.0275	0.149
2237.700	1.08	0.0287	0.139
2238.000	1.11	0.0283	0.152
2238.300	1.12	0.0287	0.148
2238.600	1.1	0.029	0.144
2238.900	1.08	0.0281	0.139
2239.200	1.07	0.0279	0.143
2239.500	1.03	0.028	0.153
2239.800	1.06	0.0281	0.151
2240.100	1.05	0.0288	0.147
2240.400	1.03	0.0289	0.154
2240.700	1.02	0.0276	0.159
2241.000	1.06	0.0286	0.145
2241.300	1.07	0.0295	0.145
2241.600	1.05	0.0285	0.158
2241.900	1.09	0.03	0.154
2242.200	1.06	0.029	0.143
2242.500	1.05	0.0282	0.145
2242.800	1.06	0.0285	0.146
2243.100	1.07	0.0292	0.14
2243.400	1.05	0.029	0.139
2243.700	1.07	0.0291	0.144
2244.000	1.07	0.0295	0.149
2244.300	1.11	0.0298	0.145
2244.600	1.11	0.0293	0.139
2244.900	1.1	0.0297	0.135
2245.200	1.11	0.0295	0.145
2245.500	1.1	0.0297	0.143
2245.800	1.05	0.0295	0.143
2246.100	1.06	0.0289	0.158
2246.400	1.06	0.0288	0.157
2246.700	1.05	0.0292	0.144
2247.000	1.09	0.0297	0.151
2247.300	1.1	0.0297	0.149
2247.600	1.1	0.0295	0.154
2247.900	1.1	0.0307	0.146
2248.200	1.09	0.0302	0.169
2248.500	1.08	0.0299	0.168
2248.800	1.07	0.0308	0.152
2249.100	1.12	0.0322	0.15
2249.400	1.09	0.0308	0.155
2249.700	1.07	0.0314	0.146
2250.000	1.12	0.0311	0.137
2250.300	1.09	0.0305	0.134
2250.600	1.05	0.0311	0.141
2250.900	1.08	0.0311	0.146
2251.200	1.1	0.0316	0.137
2251.500	1.09	0.0322	0.137
2251.800	1.04	0.0308	0.146
2252.100	1.06	0.0308	0.151
2252.400	1.1	0.0327	0.147
2252.700	1.12	0.0322	0.148
2253.000	1.07	0.031	0.148
2253.300	1.08	0.0315	0.143
2253.600	1.05	0.0307	0.136
2253.900	1.03	0.0307	0.149
2254.200	1.07	0.0313	0.146
2254.500	1.07	0.0315	0.15
2254.800	1.11	0.0319	0.154
2255.100	1.08	0.032	0.157
2255.400	1.09	0.0322	0.156
2255.700	1.09	0.0314	0.16
2256.000	1.06	0.0315	0.151
2256.300	1.06	0.0312	0.143
2256.600	1.1	0.0321	0.151
2256.900	1.22	0.0353	0.184
2257.200	1.14	0.0336	0.162
2257.500	1.1	0.0321	0.15
2257.800	1.11	0.0329	0.144
2258.100	1.09	0.0329	0.145
2258.400	1.07	0.033	0.143
2258.700	1.1	0.0332	0.147
2259.000	1.09	0.0338	0.139
2259.300	1.09	0.0329	0.14
2259.600	1.08	0.0326	0.14
2259.900	1.12	0.034	0.137
2260.200	1.11	0.0339	0.138
2260.500	1.09	0.0332	0.136
2260.800	1.07	0.0336	0.137
2261.100	1.1	0.0352	0.142
2261.400	1.06	0.0328	0.154
2261.700	1.06	0.0335	0.165
2262.000	1.05	0.0337	0.158
2262.300	1.04	0.033	0.151
2262.600	1.1	0.0369	0.146
2262.900	1.06	0.0336	0.166
2263.200	1.1	0.0347	0.157
2263.500	1.13	0.0345	0.168
2263.800	1.08	0.0326	0.163
2264.100	1.05	0.0316	0.149
2264.400	1.08	0.0328	0.14
2264.700	1.09	0.0324	0.145
2265.000	1.07	0.0328	0.155
2265.300	1.11	0.0333	0.16
2265.600	1.12	0.0332	0.157
2265.900	1.11	0.0328	0.15
2266.200	1.09	0.0331	0.143
2266.500	1.1	0.0332	0.144
2266.800	1.13	0.0331	0.146
2267.100	1.09	0.0333	0.14
2267.400	1.06	0.0322	0.149
2267.700	1.09	0.0317	0.151
2268.000	1.07	0.0331	0.149
2268.300	1.1	0.0329	0.142
2268.600	1.09	0.0321	0.14
2268.900	1.09	0.0332	0.138
2269.200	1.13	0.033	0.133
2269.500	1.13	0.0338	0.131
2269.800	1.11	0.0333	0.127
2270.100	1.11	0.034	0.14
2270.400	1.09	0.0325	0.143
2270.700	1.07	0.0322	0.138
2271.000	1.06	0.0324	0.133
2271.300	1.08	0.033	0.137
2271.600	1.07	0.0321	0.15
2271.900	1.09	0.0333	0.155
2272.200	1.1	0.0322	0.147
2272.500	1.11	0.0327	0.142
2272.800	1.12	0.0337	0.14
2273.100	1.13	0.0338	0.142
2273.400	1.07	0.0312	0.142
2273.700	1.09	0.0331	0.156
2274.000	1.08	0.0321	0.16
2274.300	1.11	0.0325	0.147
2274.600	1.11	0.0328	0.141
2274.900	1.07	0.0333	0.138
2275.200	1.07	0.0321	0.135
2275.500	1.07	0.0321	0.137
2275.800	1.12	0.0327	0.138
2276.100	1.13	0.0328	0.138
2276.400	1.15	0.0337	0.14
2276.700	1.15	0.0341	0.144
2277.000	1.15	0.0334	0.146
2277.300	1.12	0.0331	0.15
2277.600	1.12	0.033	0.144
2277.900	1.11	0.0329	0.14
2278.200	1.09	0.0332	0.139
2278.500	1.09	0.0325	0.143
2278.800	1.09	0.0328	0.153
2279.100	1.11	0.0336	0.15
2279.400	1.08	0.0325	0.153
2279.700	1.1	0.0337	0.16
2280.000	1.16	0.0349	0.15
2280.300	1.15	0.0341	0.149
2280.600	1.13	0.0345	0.151
2280.900	1.07	0.0322	0.17
2281.200	1.1	0.0331	0.165
2281.500	1.11	0.0335	0.149
2281.800	1.13	0.0332	0.146
2282.100	1.1	0.0338	0.149
2282.400	1.12	0.0344	0.143
2282.700	1.1	0.0333	0.143
2283.000	1.11	0.0345	0.141
2283.300	1.14	0.0342	0.14
2283.600	1.09	0.0349	0.143
2283.900	1.05	0.0334	0.142
2284.200	1.09	0.0329	0.151
2284.500	1.13	0.0339	0.147
2284.800	1.13	0.0348	0.141
2285.100	1.11	0.0337	0.141
2285.400	1.12	0.0346	0.141
2285.700	1.11	0.0342	0.146
2286.000	1.12	0.0347	0.147
2286.300	1.16	0.0351	0.146
2286.600	1.12	0.0348	0.158
2286.900	1.1	0.0335	0.158
2287.200	1.17	0.0355	0.156
2287.500	1.19	0.0365	0.172
2287.800	1.11	0.0357	0.159
2288.100	1.18	0.0366	0.162
2288.400	1.19	0.0375	0.162
2288.700	1.14	0.0357	0.155
2289.000	1.12	0.0349	0.15
2289.300	1.13	0.0356	0.163
2289.600	1.13	0.0343	0.148
2289.900	1.09	0.0322	0.137
2290.200	1.12	0.0347	0.137
2290.500	1.12	0.0337	0.14
2290.800	1.1	0.0331	0.143
2291.100	1.11	0.0344	0.141
2291.400	1.14	0.0337	0.14
2291.700	1.15	0.0338	0.139
2292.000	1.15	0.0354	0.181
2292.300	1.13	0.0347	0.186
2292.600	1.13	0.0346	0.176
2292.900	1.16	0.0354	0.177
2293.200	1.12	0.0354	0.172
2293.500	1.08	0.0335	0.155
2293.800	1.11	0.0352	0.154
2294.100	1.16	0.0369	0.156
2294.400	1.14	0.0353	0.15
2294.700	1.11	0.0339	0.148
2295.000	1.08	0.0355	0.143
2295.300	1.13	0.0393	0.142
2295.600	1.09	0.0394	0.158
2295.900	1.09	0.0379	0.16
2296.200	1.13	0.0383	0.157
2296.500	1.14	0.0368	0.149
2296.800	1.11	0.0351	0.143
2297.100	1.11	0.0345	0.143
2297.400	1.1	0.0352	0.147
2297.700	1.16	0.0368	0.15
2298.000	1.18	0.036	0.156
2298.300	1.12	0.0361	0.15
2298.600	1.12	0.0353	0.14
2298.900	1.11	0.0351	0.133
2299.200	1.09	0.0332	0.145
2299.500	1.08	0.0336	0.154
2299.800	1.11	0.0342	0.138
2300.100	1.13	0.0334	0.135
2300.400	1.15	0.0349	0.153
2300.700	1.15	0.0337	0.157
2301.000	1.12	0.0331	0.156

2301.300	1.08	0.0332	0.164
2301.600	1.14	0.0342	0.15
2301.900	1.17	0.0343	0.14
2302.200	1.14	0.0354	0.135
2302.500	1.08	0.0321	0.148
2302.800	1.11	0.0329	0.156
2303.100	1.1	0.0334	0.144
2303.400	1.13	0.033	0.146
2303.700	1.14	0.0339	0.146
2304.000	1.14	0.0334	0.147
2304.300	1.18	0.0345	0.146
2304.600	1.15	0.034	0.139
2304.900	1.15	0.0338	0.135
2305.200	1.14	0.0337	0.138
2305.500	1.15	0.0336	0.132
2305.800	1.16	0.0341	0.132
2306.100	1.15	0.0342	0.141
2306.400	1.14	0.0331	0.141
2306.700	1.15	0.0338	0.146
2307.000	1.14	0.0347	0.151
2307.300	1.13	0.0329	0.146
2307.600	1.13	0.0338	0.147
2307.900	1.14	0.0354	0.149
2308.200	1.15	0.0341	0.153
2308.500	1.1	0.0349	0.167
2308.800	1.12	0.0336	0.152
2309.100	1.16	0.0343	0.14
2309.400	1.18	0.035	0.133
2309.700	1.17	0.0344	0.143
2310.000	1.19	0.0347	0.175
2310.300	1.14	0.0338	0.157
2310.600	1.12	0.034	0.143
2310.900	1.11	0.0326	0.143
2311.200	1.13	0.034	0.139
2311.500	1.14	0.034	0.14
2311.800	1.12	0.0339	0.142
2312.100	1.12	0.0335	0.138
2312.400	1.17	0.036	0.141
2312.700	1.14	0.0344	0.141
2313.000	1.11	0.0334	0.149
2313.300	1.11	0.0349	0.153
2313.600	1.13	0.035	0.15
2313.900	1.18	0.0358	0.162
2314.200	1.14	0.0362	0.16
2314.500	1.13	0.0362	0.154
2314.800	1.1	0.0352	0.146
2315.100	1.11	0.0339	0.138
2315.400	1.12	0.0345	0.137
2315.700	1.12	0.0334	0.142
2316.000	1.16	0.0346	0.143
2316.300	1.14	0.0338	0.146
2316.600	1.15	0.0339	0.147
2316.900	1.17	0.035	0.14
2317.200	1.1	0.0336	0.141
2317.500	1.14	0.0339	0.142
2317.800	1.19	0.0351	0.139
2318.100	1.17	0.0351	0.143
2318.400	1.11	0.033	0.144
2318.700	1.11	0.0337	0.146
2319.000	1.11	0.0346	0.147
2319.300	1.14	0.0341	0.148
2319.600	1.14	0.035	0.153
2319.900	1.15	0.0357	0.147
2320.200	1.13	0.0358	0.144
2320.500	1.16	0.0367	0.152
2320.800	1.15	0.0358	0.14
2321.100	1.17	0.0353	0.153
2321.400	1.13	0.035	0.151
2321.700	1.13	0.0343	0.143
2322.000	1.13	0.0345	0.142
2322.300	1.12	0.0347	0.142
2322.600	1.13	0.0345	0.141
2322.900	1.12	0.0343	0.144
2323.200	1.12	0.0346	0.143
2323.500	1.15	0.0366	0.147
2323.800	1.16	0.0356	0.144
2324.100	1.15	0.0355	0.147
2324.400	1.17	0.0363	0.164
2324.700	1.18	0.0358	0.158
2325.000	1.17	0.0365	0.161
2325.300	1.22	0.0376	0.156
2325.600	1.18	0.0361	0.141
2325.900	1.17	0.0357	0.135
2326.200	1.21	0.038	0.154
2326.500	1.21	0.0364	0.166
2326.800	1.16	0.036	0.153
2327.100	1.16	0.0372	0.138
2327.400	1.14	0.0348	0.139
2327.700	1.13	0.035	0.138
2328.000	1.16	0.0362	0.144
2328.300	1.11	0.0342	0.157
2328.600	1.13	0.0341	0.155
2328.900	1.19	0.0376	0.145
2329.200	1.17	0.0358	0.139
2329.500	1.12	0.0351	0.14
2329.800	1.1	0.0357	0.138
2330.100	1.14	0.0345	0.134
2330.400	1.16	0.0359	0.133
2330.700	1.12	0.035	0.133
2331.000	1.14	0.0364	0.14
2331.300	1.14	0.0351	0.137
2331.600	1.11	0.0347	0.133
2331.900	1.12	0.0347	0.134
2332.200	1.13	0.0341	0.133
2332.500	1.11	0.0341	0.131
2332.800	1.11	0.0346	0.129
2333.100	1.1	0.0337	0.131
2333.400	1.11	0.0338	0.134
2333.700	1.13	0.0353	0.135
2334.000	1.14	0.0333	0.134
2334.300	1.16	0.0345	0.137
2334.600	1.16	0.0366	0.144
2334.900	1.16	0.0342	0.137
2335.200	1.14	0.0351	0.127
2335.500	1.14	0.0352	0.125
2335.800	1.15	0.0342	0.131
2336.100	1.15	0.0348	0.154
2336.400	1.17	0.0357	0.158
2336.700	1.14	0.034	0.144
2337.000	1.15	0.035	0.134
2337.300	1.15	0.0358	0.132
2337.600	1.14	0.0347	0.14
2337.900	1.14	0.0352	0.147
2338.200	1.13	0.0349	0.146
2338.500	1.17	0.0374	0.144
2338.800	1.19	0.036	0.156
2339.100	1.19	0.0368	0.168
2339.400	1.11	0.0355	0.148
2339.700	1.12	0.0341	0.144
2340.000	1.13	0.036	0.144
2340.300	1.15	0.0357	0.137
2340.600	1.15	0.035	0.142
2340.900	1.16	0.0359	0.14
2341.200	1.16	0.0347	0.135
2341.500	1.16	0.0354	0.135
2341.800	1.17	0.0372	0.143
2342.100	1.15	0.035	0.146
2342.400	1.15	0.0356	0.137
2342.700	1.13	0.0356	0.139
2343.000	1.12	0.0343	0.143
2343.300	1.15	0.0363	0.146
2343.600	1.15	0.0357	0.152
2343.900	1.15	0.0358	0.155
2344.200	1.14	0.0368	0.15
2344.500	1.16	0.0364	0.148
2344.800	1.14	0.0369	0.138
2345.100	1.15	0.0369	0.141
2345.400	1.12	0.0358	0.143
2345.700	1.15	0.0363	0.147
2346.000	1.17	0.0357	0.145
2346.300	1.15	0.0372	0.147
2346.600	1.15	0.0373	0.135
2346.900	1.14	0.0355	0.134
2347.200	1.15	0.0361	0.139
2347.500	1.11	0.0371	0.137
2347.800	1.1	0.0348	0.141
2348.100	1.14	0.0373	0.158
2348.400	1.17	0.0381	0.152
2348.700	1.14	0.0362	0.146
2349.000	1.11	0.0369	0.147
2349.300	1.13	0.0358	0.145
2349.600	1.17	0.0371	0.141
2349.900	1.15	0.0368	0.136
2350.200	1.17	0.0377	0.148
2350.500	1.16	0.0369	0.149
2350.800	1.11	0.0349	0.143
2351.100	1.11	0.0374	0.158
2351.400	1.12	0.0361	0.158
2351.700	1.11	0.0356	0.154
2352.000	1.1	0.0366	0.15
2352.300	1.1	0.0361	0.149
2352.600	1.09	0.0348	0.152
2352.900	1.1	0.0373	0.148
2353.200	1.14	0.0357	0.143
2353.500	1.12	0.0359	0.138
2353.800	1.07	0.0361	0.141
2354.100	1.09	0.0352	0.147
2354.400	1.11	0.0365	0.145
2354.700	1.09	0.0362	0.141
2355.000	1.11	0.0364	0.143
2355.300	1.11	0.0352	0.141
2355.600	1.11	0.0357	0.15
2355.900	1.09	0.0364	0.141
2356.200	1.09	0.0346	0.143
2356.500	1.08	0.0352	0.145
2356.800	1.12	0.0372	0.141
2357.100	1.14	0.037	0.143
2357.400	1.19	0.0368	0.149
2357.700	1.17	0.0388	0.147
2358.000	1.15	0.0361	0.138
2358.300	1.19	0.0369	0.145
2358.600	1.17	0.039	0.16
2358.900	1.09	0.0348	0.153
2359.200	1.12	0.036	0.147
2359.500	1.17	0.0373	0.146
2359.800	1.13	0.0359	0.139
2360.100	1.15	0.0359	0.129
2360.400	1.17	0.038	0.127
2360.700	1.14	0.0361	0.133
2361.000	1.11	0.0352	0.132
2361.300	1.09	0.0362	0.137
2361.600	1.11	0.0362	0.14
2361.900	1.13	0.0356	0.138
2362.200	1.14	0.036	0.135
2362.500	1.16	0.0377	0.137
2362.800	1.2	0.037	0.142
2363.100	1.19	0.038	0.147
2363.400	1.15	0.0373	0.143
2363.700	1.15	0.0362	0.137
2364.000	1.14	0.0372	0.136
2364.300	1.16	0.0362	0.137
2364.600	1.11	0.0365	0.137
2364.900	1.13	0.0368	0.137
2365.200	1.14	0.0362	0.136
2365.500	1.15	0.0367	0.14
2365.800	1.12	0.0349	0.144
2366.100	1.16	0.037	0.145
2366.400	1.13	0.0363	0.142
2366.700	1.11	0.0363	0.139
2367.000	1.11	0.0354	0.134
2367.300	1.12	0.036	0.146
2367.600	1.13	0.0364	0.156
2367.900	1.09	0.0352	0.146
2368.200	1.12	0.0356	0.136
2368.500	1.13	0.0367	0.13
2368.800	1.16	0.0379	0.143
2369.100	1.12	0.0361	0.139
2369.400	1.1	0.0363	0.135
2369.700	1.1	0.0352	0.139
2370.000	1.05	0.035	0.171
2370.300	1.07	0.0351	0.167
2370.600	1.16	0.0369	0.156
2370.900	1.17	0.0374	0.144
2371.200	1.12	0.0362	0.148
2371.500	1.12	0.0362	0.142
2371.800	1.14	0.0356	0.138
2372.100	1.12	0.0358	0.133
2372.400	1.12	0.0358	0.143
2372.700	1.1	0.0346	0.148
2373.000	1.11	0.0345	0.146
2373.300	1.15	0.0371	0.139
2373.600	1.16	0.0369	0.142
2373.900	1.17	0.0358	0.142
2374.200	1.16	0.0379	0.143
2374.500	1.13	0.0348	0.137
2374.800	1.11	0.035	0.136
2375.100	1.08	0.0352	0.148
2375.400	1.1	0.034	0.143
2375.700	1.09	0.0352	0.136
2376.000	1.1	0.0358	0.14
2376.300	1.12	0.0356	0.14
2376.600	1.13	0.0356	0.141
2376.900	1.14	0.0372	0.139
2377.200	1.09	0.0349	0.14
2377.500	1.08	0.0345	0.141

2377.800	1.1	0.0355	0.139
2378.100	1.09	0.0366	0.144
2378.400	1.15	0.0367	0.141
2378.700	1.18	0.0369	0.139
2379.000	1.14	0.0377	0.143
2379.300	1.15	0.0359	0.136
2379.600	1.15	0.0367	0.125
2379.900	1.15	0.0367	0.122
2380.200	1.14	0.0355	0.122
2380.500	1.16	0.037	0.126
2380.800	1.16	0.0377	0.137
2381.100	1.14	0.0359	0.139
2381.400	1.12	0.0361	0.138
2381.700	1.11	0.0363	0.137
2382.000	1.1	0.0354	0.136
2382.300	1.07	0.0347	0.136
2382.600	1.12	0.0363	0.146
2382.900	1.16	0.0371	0.142
2383.200	1.1	0.0354	0.138
2383.500	1.13	0.0361	0.133
2383.800	1.14	0.0373	0.138
2384.100	1.13	0.0354	0.141
2384.400	1.1	0.0358	0.137
2384.700	1.11	0.0361	0.133
2385.000	1.15	0.0358	0.137
2385.300	1.18	0.0386	0.147
2385.600	1.16	0.0367	0.148
2385.900	1.17	0.0371	0.146
2386.200	1.15	0.038	0.151
2386.500	1.15	0.0368	0.158
2386.800	1.14	0.0373	0.144
2387.100	1.14	0.0375	0.147
2387.400	1.11	0.0366	0.151
2387.700	1.09	0.0373	0.153
2388.000	1.13	0.0379	0.147
2388.300	1.14	0.0364	0.145
2388.600	1.16	0.0385	0.15
2388.900	1.13	0.0373	0.151
2389.200	1.1	0.0363	0.142
2389.500	1.12	0.0379	0.136
2389.800	1.13	0.038	0.145
2390.100	1.11	0.0393	0.144
2390.400	1.13	0.0378	0.142
2390.700	1.12	0.0392	0.135
2391.000	1.14	0.0397	0.146
2391.300	1.18	0.0394	0.147
2391.600	1.18	0.0405	0.148
2391.900	1.15	0.0399	0.143
2392.200	1.13	0.0388	0.135
2392.500	1.14	0.0401	0.134
2392.800	1.06	0.0384	0.137
2393.100	1.08	0.037	0.139
2393.400	1.1	0.0392	0.136
2393.700	1.12	0.0388	0.135
2394.000	1.09	0.0383	0.143
2394.300	1.11	0.0393	0.144
2394.600	1.11	0.0382	0.147
2394.900	1.13	0.0394	0.141
2395.200	1.13	0.0379	0.136
2395.500	1.14	0.0396	0.136
2395.800	1.14	0.039	0.133
2396.100	1.12	0.0378	0.136
2396.400	1.13	0.0396	0.152
2396.700	1.11	0.0375	0.141
2397.000	1.1	0.0376	0.135
2397.300	1.09	0.0385	0.134
2397.600	1.11	0.0379	0.138
2397.900	1.1	0.037	0.14
2398.200	1.1	0.0392	0.137
2398.500	1.12	0.0373	0.134
2398.800	1.16	0.0392	0.137
2399.100	1.17	0.0407	0.141
2399.400	1.08	0.0368	0.14
2399.700	1.07	0.0374	0.143
2400.000	1.13	0.0393	0.137
2400.300	1.1	0.0382	0.133
2400.600	1.12	0.0386	0.134
2400.900	1.13	0.0393	0.146
2401.200	1.09	0.0387	0.151
2401.500	1.11	0.0382	0.139
2401.800	1.12	0.0391	0.138
2402.100	1.1	0.0395	0.141
2402.400	1.12	0.0388	0.14
2402.700	1.16	0.0388	0.14
2403.000	1.21	0.0433	0.14
2403.300	1.16	0.0387	0.137
2403.600	1.13	0.0391	0.132
2403.900	1.08	0.0383	0.131
2404.200	1.11	0.0385	0.136
2404.500	1.14	0.0398	0.134
2404.800	1.17	0.0407	0.145
2405.100	1.11	0.0386	0.146
2405.400	1.1	0.0389	0.14
2405.700	1.13	0.0403	0.138
2406.000	1.13	0.0404	0.143
2406.300	1.15	0.0402	0.141
2406.600	1.15	0.0409	0.134
2406.900	1.12	0.04	0.129
2407.200	1.12	0.039	0.133
2407.500	1.16	0.0411	0.144
2407.800	1.14	0.0405	0.139
2408.100	1.14	0.0392	0.144
2408.400	1.15	0.0407	0.144
2408.700	1.13	0.0388	0.141
2409.000	1.07	0.0377	0.154
2409.300	1.13	0.0401	0.146
2409.600	1.2	0.0403	0.144
2409.900	1.15	0.0405	0.149
2410.200	1.12	0.0389	0.159
2410.500	1.11	0.039	0.147
2410.800	1.1	0.0393	0.139
2411.100	1.06	0.0384	0.144
2411.400	1.14	0.0399	0.142
2411.700	1.17	0.0413	0.146
2412.000	1.16	0.0415	0.142
2412.300	1.1	0.0398	0.142
2412.600	1.11	0.0395	0.144
2412.900	1.18	0.0443	0.176
2413.200	1.12	0.0423	0.173
2413.500	1.08	0.0406	0.163
2413.800	1.11	0.0423	0.154
2414.100	1.08	0.0418	0.154
2414.400	1.1	0.0402	0.155
2414.700	1.13	0.0429	0.146
2415.000	1.17	0.0426	0.137
2415.300	1.14	0.0403	0.136
2415.600	1.16	0.0424	0.143
2415.900	1.1	0.0412	0.141
2416.200	1.08	0.0398	0.132
2416.500	1.1	0.0413	0.133
2416.800	1.1	0.0415	0.133
2417.100	1.13	0.0414	0.137
2417.400	1.18	0.0422	0.135
2417.700	1.16	0.0429	0.133
2418.000	1.17	0.0427	0.148
2418.300	1.16	0.0419	0.152
2418.600	1.18	0.0441	0.159
2418.900	1.16	0.0415	0.149
2419.200	1.12	0.0399	0.143
2419.500	1.13	0.0427	0.152
2419.800	1.16	0.0413	0.15
2420.100	1.17	0.0423	0.152
2420.400	1.18	0.0432	0.143
2420.700	1.19	0.042	0.142
2421.000	1.17	0.043	0.147
2421.300	1.18	0.0427	0.149
2421.600	1.2	0.0438	0.156
2421.900	1.15	0.0415	0.154
2422.200	1.14	0.0419	0.15
2422.500	1.14	0.0413	0.154
2422.800	1.14	0.0417	0.163
2423.100	1.13	0.0413	0.16
2423.400	1.12	0.0419	0.142
2423.700	1.13	0.0404	0.133
2424.000	1.11	0.0405	0.133
2424.300	1.14	0.0429	0.159
2424.600	1.12	0.04	0.155
2424.900	1.08	0.0401	0.147
2425.200	1.1	0.041	0.149
2425.500	1.14	0.0405	0.152
2425.800	1.17	0.0431	0.151
2426.100	1.15	0.0409	0.159
2426.400	1.14	0.042	0.15
2426.700	1.11	0.0403	0.142
2427.000	1.13	0.042	0.133
2427.300	1.11	0.0413	0.131
2427.600	1.09	0.0413	0.135
2427.900	1.11	0.0411	0.13
2428.200	1.13	0.0426	0.136
2428.500	1.17	0.0427	0.145
2428.800	1.17	0.0426	0.143
2429.100	1.15	0.0432	0.137
2429.400	1.14	0.0406	0.136
2429.700	1.12	0.0416	0.143
2430.000	1.13	0.0414	0.146
2430.300	1.11	0.0411	0.138
2430.600	1.1	0.042	0.136
2430.900	1.14	0.0407	0.138
2431.200	1.11	0.0417	0.131
2431.500	1.1	0.0425	0.13
2431.800	1.14	0.0425	0.136
2432.100	1.17	0.044	0.15
2432.400	1.12	0.0424	0.141
2432.700	1.14	0.042	0.139
2433.000	1.17	0.0445	0.142
2433.300	1.12	0.0429	0.135
2433.600	1.11	0.0406	0.132
2433.900	1.09	0.0422	0.133
2434.200	1.1	0.0412	0.142
2434.500	1.14	0.0433	0.138
2434.800	1.11	0.041	0.132
2435.100	1.12	0.0422	0.13
2435.400	1.13	0.0432	0.133
2435.700	1.12	0.0414	0.138
2436.000	1.11	0.0427	0.141
2436.300	1.11	0.0423	0.154
2436.600	1.09	0.0406	0.166
2436.900	1.09	0.0427	0.151
2437.200	1.09	0.0415	0.136
2437.500	1.13	0.0418	0.14
2437.800	1.19	0.0446	0.158
2438.100	1.14	0.0422	0.146
2438.400	1.16	0.0418	0.136
2438.700	1.15	0.0442	0.139
2439.000	1.12	0.0417	0.137
2439.300	1.11	0.042	0.134
2439.600	1.07	0.0411	0.136
2439.900	1.11	0.0425	0.149
2440.200	1.11	0.0421	0.153
2440.500	1.12	0.041	0.144
2440.800	1.12	0.0423	0.131
2441.100	1.11	0.0408	0.132
2441.400	1.1	0.0407	0.14
2441.700	1.11	0.0427	0.15
2442.000	1.11	0.0412	0.156
2442.300	1.11	0.0413	0.15
2442.600	1.16	0.0432	0.142
2442.900	1.17	0.042	0.133
2443.200	1.12	0.0401	0.132
2443.500	1.11	0.0424	0.14
2443.800	1.12	0.0406	0.143
2444.100	1.17	0.0426	0.152
2444.400	1.15	0.0426	0.147
2444.700	1.14	0.0411	0.143
2445.000	1.22	0.0436	0.157
2445.300	1.14	0.0418	0.155
2445.600	1.06	0.0415	0.146
2445.900	1.08	0.0409	0.15
2446.200	1.07	0.041	0.155
2446.500	1.12	0.0433	0.144
2446.800	1.14	0.0415	0.151
2447.100	1.17	0.0433	0.167
2447.400	1.15	0.0438	0.156
2447.700	1.15	0.0427	0.149
2448.000	1.12	0.0412	0.143
2448.300	1.1	0.0423	0.14
2448.600	1.08	0.0409	0.139
2448.900	1.09	0.0416	0.136
2449.200	1.1	0.0415	0.137
2449.500	1.14	0.0417	0.137
2449.800	1.14	0.0426	0.141
2450.100	1.09	0.0417	0.134
2450.400	1.17	0.0449	0.153
2450.700	1.14	0.0427	0.149
2451.000	1.12	0.0426	0.137
2451.300	1.14	0.043	0.135
2451.600	1.13	0.0418	0.137
2451.900	1.13	0.0432	0.144
2452.200	1.15	0.0431	0.155
2452.500	1.1	0.0431	0.149
2452.800	1.08	0.0428	0.161
2453.100	1.11	0.0429	0.158
2453.400	1.14	0.045	0.152
2453.700	1.12	0.045	0.136
2454.000	1.12	0.0431	0.143

2454.300	1.11	0.0432	0.162
2454.600	1.17	0.0465	0.17
2454.900	1.1	0.0444	0.155
2455.200	1.13	0.0486	0.169
2455.500	1.08	0.0467	0.157
2455.800	1.1	0.0467	0.154
2456.100	1.12	0.0469	0.147
2456.400	1.08	0.0461	0.145
2456.700	1.05	0.0447	0.157
2457.000	1.1	0.045	0.169
2457.300	1.08	0.0466	0.166
2457.600	1.1	0.0471	0.15
2457.900	1.11	0.0461	0.155
2458.200	1.09	0.0473	0.154
2458.500	1.07	0.0469	0.14
2458.800	1.09	0.0453	0.14
2459.100	1.13	0.0472	0.137
2459.400	1.13	0.0485	0.134
2459.700	1.09	0.0455	0.126
2460.000	1.09	0.0472	0.135
2460.300	1.11	0.0473	0.132
2460.600	1.1	0.0467	0.135
2460.900	1.06	0.0456	0.13
2461.200	1.06	0.0462	0.136
2461.500	1.12	0.0457	0.149
2461.800	1.19	0.0469	0.158
2462.100	1.15	0.0472	0.149
2462.400	1.12	0.045	0.14
2462.700	1.12	0.0451	0.141
2463.000	1.1	0.0459	0.135
2463.300	1.12	0.0457	0.151
2463.600	1.18	0.0466	0.156
2463.900	1.13	0.0463	0.142
2464.200	1.2	0.0476	0.157
2464.500	1.15	0.0463	0.154
2464.800	1.1	0.046	0.141
2465.100	1.13	0.0448	0.148
2465.400	1.2	0.048	0.163
2465.700	1.23	0.0484	0.189
2466.000	1.16	0.0452	0.164
2466.300	1.19	0.0474	0.157
2466.600	1.21	0.0478	0.159
2466.900	1.12	0.046	0.152
2467.200	1.14	0.045	0.158
2467.500	1.16	0.0467	0.167
2467.800	1.16	0.048	0.161
2468.100	1.13	0.0451	0.153
2468.400	1.11	0.0456	0.152
2468.700	1.15	0.0477	0.15
2469.000	1.08	0.044	0.144
2469.300	1.06	0.044	0.145
2469.600	1.06	0.0444	0.157
2469.900	1.11	0.0441	0.144
2470.200	1.11	0.0455	0.136
2470.500	1.16	0.0467	0.141
2470.800	1.17	0.0465	0.153
2471.100	1.2	0.0485	0.181
2471.400	1.18	0.047	0.184
2471.700	1.12	0.0463	0.177
2472.000	1.07	0.0439	0.148
2472.300	1.12	0.0465	0.142
2472.600	1.17	0.0483	0.168
2472.900	1.15	0.0466	0.17
2473.200	1.08	0.0443	0.152
2473.500	1.07	0.0453	0.138
2473.800	1.11	0.0451	0.13
2474.100	1.13	0.0462	0.154
2474.400	1.09	0.0453	0.152
2474.700	1.14	0.0452	0.139
2475.000	1.15	0.0469	0.131
2475.300	1.14	0.0446	0.129
2475.600	1.13	0.0458	0.137
2475.900	1.06	0.0452	0.16
2476.200	1.1	0.0442	0.153
2476.500	1.14	0.0464	0.154
2476.800	1.15	0.0463	0.151
2477.100	1.16	0.046	0.148
2477.400	1.16	0.0473	0.152
2477.700	1.14	0.046	0.149
2478.000	1.19	0.0465	0.165
2478.300	1.19	0.0477	0.172
2478.600	1.14	0.0473	0.165
2478.900	1.15	0.0461	0.152
2479.200	1.15	0.0473	0.145
2479.500	1.18	0.0492	0.149
2479.800	1.18	0.0505	0.16
2480.100	1.15	0.0476	0.148
2480.400	1.11	0.0473	0.132
2480.700	1.07	0.0477	0.14
2481.000	1.14	0.0462	0.145
2481.300	1.22	0.0497	0.15
2481.600	1.14	0.0476	0.147
2481.900	1.12	0.0464	0.14
2482.200	1.1	0.0464	0.141
2482.500	1.09	0.047	0.137
2482.800	1.09	0.0459	0.137
2483.100	1.13	0.0476	0.139
2483.400	1.15	0.0498	0.149
2483.700	1.14	0.0471	0.158
2484.000	1.16	0.0495	0.161
2484.300	1.15	0.049	0.152
2484.600	1.21	0.0501	0.172
2484.900	1.1	0.0477	0.184
2485.200	1	0.0435	0.178
2485.500	1.11	0.0478	0.156
2485.800	1.12	0.0462	0.155
2486.100	1.11	0.0474	0.157
2486.400	1.08	0.0458	0.144
2486.700	1.06	0.0464	0.155
2487.000	1.11	0.0472	0.141
2487.300	1.1	0.0461	0.132
2487.600	1.09	0.0465	0.136
2487.900	1.07	0.0467	0.146
2488.200	1.12	0.0455	0.147
2488.500	1.16	0.0456	0.149
2488.800	1.17	0.0472	0.153
2489.100	1.15	0.0452	0.143
2489.400	1.18	0.0462	0.149
2489.700	1.14	0.0459	0.16
2490.000	1.17	0.0471	0.166
2490.300	1.13	0.0458	0.158
2490.600	1.1	0.0452	0.156
2490.900	1.09	0.0461	0.141
2491.200	1.06	0.0446	0.133
2491.500	1.07	0.0453	0.136
2491.800	1.1	0.046	0.142
2492.100	1.1	0.0463	0.156
2492.400	1.12	0.0472	0.159
2492.700	1.16	0.0492	0.17
2493.000	1.1	0.0468	0.144
2493.300	1.12	0.0463	0.14
2493.600	1.14	0.0502	0.143
2493.900	1.13	0.0473	0.14
2494.200	1.12	0.0472	0.133
2494.500	1.16	0.0493	0.131
2494.800	1.12	0.0468	0.135
2495.100	1.13	0.0476	0.145
2495.400	1.14	0.048	0.144
2495.700	1.11	0.0473	0.155
2496.000	1.16	0.0491	0.155
2496.300	1.2	0.0505	0.172
2496.600	1.14	0.0466	0.165
2496.900	1.1	0.0467	0.145
2497.200	1.09	0.047	0.139
2497.500	1.1	0.0452	0.134
2497.800	1.12	0.0478	0.133
2498.100	1.07	0.046	0.132
2498.400	1.05	0.0449	0.138
2498.700	1.09	0.0459	0.143
2499.000	1.16	0.0477	0.139
2499.300	1.16	0.0473	0.134
2499.600	1.1	0.0464	0.143
2499.900	1.11	0.0466	0.143
2500.200	1.06	0.0441	0.144
2500.500	1.08	0.0454	0.144
2500.800	1.13	0.0474	0.152
2501.100	1.08	0.0463	0.148
2501.400	1.08	0.0447	0.138
2501.700	1.15	0.0481	0.157
2502.000	1.18	0.0489	0.169
2502.300	1.12	0.0458	0.162
2502.600	1.09	0.0463	0.145
2502.900	1.17	0.0469	0.156
2503.200	1.13	0.0453	0.156
2503.500	1.09	0.0452	0.146
2503.800	1.11	0.046	0.139
2504.100	1.12	0.0455	0.15
2504.400	1.12	0.0462	0.153
2504.700	1.09	0.0461	0.141
2505.000	1.13	0.0451	0.137
2505.300	1.15	0.0466	0.153
2505.600	1.11	0.0478	0.161
2505.900	1.1	0.0458	0.151
2506.200	1.12	0.0459	0.151
2506.500	1.15	0.0478	0.164
2506.800	1.08	0.0447	0.143
2507.100	1.07	0.0439	0.134
2507.400	1.14	0.0479	0.15
2507.700	1.15	0.0458	0.156
2508.000	1.15	0.0461	0.157
2508.300	1.1	0.0459	0.14
2508.600	1.1	0.0441	0.138
2508.900	1.12	0.0455	0.137
2509.200	1.07	0.0445	0.133
2509.500	1.07	0.0451	0.135
2509.800	1.1	0.0449	0.132
2510.100	1.08	0.0458	0.134
2510.400	1.07	0.0433	0.149
2510.700	1.1	0.0447	0.151
2511.000	1.1	0.0449	0.15
2511.300	1.12	0.0472	0.16
2511.600	1.06	0.0449	0.153
2511.900	1.08	0.0448	0.15
2512.200	1.16	0.0495	0.16
2512.500	1.11	0.0454	0.144
2512.800	1.06	0.0451	0.137
2513.100	1.09	0.0467	0.135
2513.400	1.1	0.0454	0.136
2513.700	1.1	0.0465	0.14
2514.000	1.03	0.0447	0.134
2514.300	1.07	0.0462	0.134
2514.600	1.1	0.046	0.135
2514.900	1.07	0.0468	0.138
2515.200	1.08	0.0449	0.137
2515.500	1.04	0.0439	0.133
2515.800	1.06	0.0467	0.155
2516.100	1.01	0.0436	0.161
2516.400	1.04	0.0451	0.158
2516.700	1.06	0.045	0.145
2517.000	1.1	0.0456	0.136
2517.300	1.09	0.0457	0.132
2517.600	1.08	0.0455	0.135
2517.900	1.11	0.046	0.15
2518.200	1.12	0.0467	0.146
2518.500	1.09	0.0467	0.142
2518.800	1.12	0.0477	0.173
2519.100	1.13	0.0476	0.165
2519.400	1.07	0.0451	0.144
2519.700	1.04	0.0455	0.139
2520.000	1.08	0.0455	0.134
2520.300	1.12	0.0475	0.138
2520.600	1.09	0.0475	0.14
2520.900	1.1	0.0476	0.133
2521.200	1.08	0.0482	0.131
2521.500	1.1	0.0462	0.147
2521.800	1.09	0.0484	0.152
2522.100	1.07	0.0466	0.142
2522.400	1.05	0.0458	0.141
2522.700	1.04	0.0443	0.137
2523.000	1.07	0.0458	0.147
2523.300	1.08	0.0461	0.154
2523.600	1.08	0.0458	0.154
2523.900	1.04	0.0453	0.149
2524.200	1.04	0.045	0.145
2524.500	1.05	0.0461	0.144
2524.800	1.08	0.0459	0.146
2525.100	1.06	0.0449	0.136
2525.400	1.06	0.0464	0.147
2525.700	1.1	0.0466	0.156
2526.000	1.1	0.0479	0.142
2526.300	1.09	0.0446	0.135
2526.600	1.06	0.0453	0.137
2526.900	1.07	0.0472	0.14
2527.200	1.04	0.0439	0.136
2527.500	1.03	0.0441	0.138
2527.800	1.1	0.0484	0.146
2528.100	1.04	0.0442	0.15
2528.400	1.04	0.0447	0.156
2528.700	1.07	0.0467	0.159
2529.000	1.12	0.0469	0.157
2529.300	1.17	0.0489	0.167
2529.600	1.1	0.0474	0.156
2529.900	1.06	0.0447	0.143
2530.200	1.05	0.046	0.135
2530.500	1.08	0.0466	0.134

2530.800	1.07	0.0457	0.134
2531.100	1.08	0.0444	0.136
2531.400	1.08	0.0452	0.138
2531.700	1.03	0.0436	0.151
2532.000	1.06	0.044	0.15
2532.300	1.05	0.0433	0.142
2532.600	1.06	0.0448	0.145
2532.900	1.04	0.0434	0.14
2533.200	1.08	0.0435	0.142
2533.500	1.07	0.0453	0.138
2533.800	1.08	0.0439	0.14
2534.100	1.08	0.045	0.146
2534.400	1.07	0.0445	0.139
2534.700	1.13	0.0453	0.139
2535.000	1.1	0.046	0.136
2535.300	1.05	0.0434	0.132
2535.600	1.03	0.0445	0.138
2535.900	1.09	0.0455	0.14
2536.200	1.08	0.0456	0.151
2536.500	1.11	0.0472	0.166
2536.800	1.13	0.0456	0.159
2537.100	1.14	0.048	0.166
2537.400	1.13	0.047	0.177
2537.700	1.07	0.0445	0.162
2538.000	1.09	0.0461	0.148
2538.300	1.08	0.0458	0.147
2538.600	1.04	0.0437	0.136
2538.900	1.09	0.0471	0.138
2539.200	1.1	0.0452	0.158
2539.500	1.14	0.0464	0.168
2539.800	1.12	0.0483	0.192
2540.100	1.09	0.045	0.171
2540.400	1.08	0.0461	0.152
2540.700	1.01	0.0435	0.143
2541.000	1.08	0.0453	0.145
2541.300	1.05	0.0445	0.142
2541.600	0.992	0.0431	0.15
2541.900	1	0.044	0.151
2542.200	1.04	0.0444	0.139
2542.500	1.06	0.0458	0.139
2542.800	1.07	0.0443	0.132
2543.100	1.06	0.0464	0.133
2543.400	1.09	0.0442	0.133
2543.700	1.11	0.0462	0.138
2544.000	1.11	0.0466	0.15
2544.300	1.13	0.046	0.157
2544.600	1.06	0.0441	0.159
2544.900	1	0.0422	0.154
2545.200	1.05	0.0446	0.146
2545.500	1.02	0.0432	0.144
2545.800	1.05	0.0428	0.137
2546.100	1.1	0.0455	0.136
2546.400	1.15	0.047	0.162
2546.700	1.08	0.0449	0.154
2547.000	1.01	0.0437	0.15
2547.300	1.01	0.043	0.151
2547.600	1.01	0.0416	0.15
2547.900	0.992	0.0431	0.151
2548.200	1.06	0.0446	0.147
2548.500	1.04	0.0429	0.142
2548.800	1.06	0.0442	0.145
2549.100	1.07	0.0454	0.151
2549.400	1.04	0.0431	0.138
2549.700	1.06	0.0443	0.138
2550.000	1.09	0.0469	0.14
2550.300	1.12	0.0452	0.152
2550.600	1.1	0.0451	0.157
2550.900	1.04	0.0441	0.144
2551.200	1.05	0.0429	0.147
2551.500	1.02	0.0432	0.155
2551.800	1.02	0.0438	0.151
2552.100	1.09	0.0449	0.138
2552.400	1.08	0.0444	0.133
2552.700	1.02	0.0452	0.139
2553.000	1.05	0.0444	0.135
2553.300	1.09	0.0441	0.145
2553.600	1.05	0.0448	0.155
2553.900	1.08	0.0452	0.149
2554.200	1.09	0.0451	0.146
2554.500	1.08	0.0441	0.142
2554.800	1.07	0.0456	0.145
2555.100	1.05	0.0448	0.137
2555.400	1.06	0.0443	0.15
2555.700	1.13	0.0478	0.162
2556.000	1.08	0.0452	0.156
2556.300	0.999	0.0429	0.154
2556.600	1.01	0.0439	0.142
2556.900	1.04	0.0446	0.132
2557.200	1.04	0.0447	0.128
2557.500	0.998	0.0434	0.126
2557.800	1.02	0.0443	0.134
2558.100	1.07	0.0445	0.137
2558.400	1.09	0.0464	0.136
2558.700	1.1	0.0455	0.149
2559.000	1.06	0.0449	0.151
2559.300	1.02	0.0451	0.146
2559.600	1.1	0.0469	0.154
2559.900	1.13	0.046	0.158
2560.200	1.09	0.047	0.148
2560.500	1.06	0.0442	0.152
2560.800	1.09	0.0451	0.171
2561.100	1.08	0.0458	0.149
2561.400	1.08	0.0439	0.142
2561.700	1.1	0.0475	0.158
2562.000	1.06	0.0466	0.151
2562.300	1.04	0.0448	0.14
2562.600	1.06	0.0464	0.147
2562.900	1.02	0.0437	0.145
2563.200	1.01	0.0441	0.143
2563.500	1.02	0.0443	0.141
2563.800	1.06	0.0459	0.151
2564.100	1.06	0.0441	0.145
2564.400	1.04	0.0452	0.147
2564.700	1.01	0.0422	0.142
2565.000	1.04	0.0452	0.139
2565.300	1.06	0.0456	0.138
2565.600	1.07	0.0446	0.141
2565.900	1.04	0.046	0.149
2566.200	0.989	0.0437	0.151
2566.500	0.985	0.0449	0.161
2566.800	1.05	0.047	0.146
2567.100	1.05	0.0459	0.14
2567.400	0.975	0.0447	0.164
2567.700	1	0.0449	0.149
2568.000	1.01	0.0457	0.139
2568.300	1.08	0.0481	0.143
2568.600	1.13	0.0491	0.172
2568.900	1.06	0.0458	0.161
2569.200	1.01	0.0467	0.159
2569.500	1.04	0.0458	0.149
2569.800	1.06	0.0467	0.142
2570.100	1.05	0.048	0.136
2570.400	1.03	0.0489	0.141
2570.700	0.991	0.0475	0.156
2571.000	1.02	0.0469	0.156
2571.300	1.02	0.0491	0.139
2571.600	1.02	0.0473	0.143
2571.900	0.997	0.0461	0.145
2572.200	1.02	0.0495	0.131
2572.500	1.04	0.0467	0.127
2572.800	1.01	0.0468	0.124
2573.100	1.01	0.0484	0.128
2573.400	1	0.047	0.134
2573.700	1.03	0.0474	0.147
2574.000	1.03	0.0497	0.143
2574.300	0.991	0.0459	0.14
2574.600	1.02	0.048	0.143
2574.900	1.06	0.0493	0.141
2575.200	1.07	0.0493	0.14
2575.500	1.02	0.0486	0.142
2575.800	1.05	0.0472	0.137
2576.100	1.11	0.0521	0.146
2576.400	1.03	0.0484	0.144
2576.700	1.02	0.0471	0.143
2577.000	0.981	0.0487	0.141
2577.300	0.972	0.0459	0.136
2577.600	1.07	0.0486	0.146
2577.900	1.12	0.0531	0.165
2578.200	1.09	0.0497	0.152
2578.500	1.05	0.0482	0.152
2578.800	1.07	0.0514	0.174
2579.100	1.09	0.0502	0.16
2579.400	1.09	0.0495	0.152
2579.700	1.08	0.0509	0.176
2580.000	1.02	0.0479	0.154
2580.300	1.05	0.0501	0.143
2580.600	1.08	0.0498	0.15
2580.900	0.994	0.0474	0.146
2581.200	1	0.0479	0.152
2581.500	1.05	0.0485	0.151
2581.800	1.05	0.049	0.145
2582.100	1.07	0.0488	0.151
2582.400	1.06	0.0499	0.149
2582.700	0.985	0.0471	0.142
2583.000	0.981	0.0465	0.141
2583.300	1	0.0476	0.14
2583.600	1.05	0.0487	0.151
2583.900	1.06	0.05	0.138
2584.200	1.04	0.0495	0.132
2584.500	1.03	0.0492	0.148
2584.800	1.02	0.049	0.151
2585.100	0.989	0.0487	0.156
2585.400	1.05	0.0487	0.169
2585.700	1.02	0.0499	0.165
2586.000	0.962	0.0467	0.161
2586.300	1.01	0.0475	0.153
2586.600	1.03	0.0503	0.146
2586.900	1.03	0.048	0.135
2587.200	1.03	0.0495	0.137
2587.500	1.01	0.0498	0.14
2587.800	1.01	0.0487	0.139
2588.100	0.993	0.0486	0.137
2588.400	0.998	0.0491	0.137
2588.700	1.03	0.0495	0.134
2589.000	1.01	0.0482	0.152
2589.300	1.01	0.0496	0.163
2589.600	0.994	0.0476	0.158
2589.900	1.01	0.0499	0.143
2590.200	1.04	0.0502	0.141
2590.500	1.03	0.051	0.142
2590.800	0.977	0.0484	0.13
2591.100	1.01	0.0483	0.126
2591.400	1.07	0.052	0.134
2591.700	1.02	0.0492	0.142
2592.000	0.958	0.0455	0.136
2592.300	1.02	0.0473	0.141
2592.600	1.02	0.0489	0.144
2592.900	1.01	0.0468	0.138
2593.200	1.04	0.0481	0.138
2593.500	1.01	0.0485	0.147
2593.800	1.06	0.048	0.146
2594.100	1.02	0.0484	0.151
2594.400	1.07	0.0512	0.161
2594.700	1.05	0.0476	0.152
2595.000	1.05	0.0481	0.152
2595.300	1.05	0.0496	0.167
2595.600	1.01	0.047	0.143
2595.900	1	0.0466	0.136
2596.200	1.04	0.0492	0.142
2596.500	1.07	0.0501	0.15
2596.800	0.998	0.0477	0.149
2597.100	0.978	0.0451	0.135
2597.400	0.996	0.0475	0.136
2597.700	1.04	0.0479	0.14
2598.000	1.07	0.0479	0.139
2598.300	1.02	0.0492	0.137
2598.600	0.981	0.0465	0.133
2598.900	1	0.0469	0.13
2599.200	1.02	0.0491	0.129
2599.500	0.992	0.0474	0.133
2599.800	1.03	0.0478	0.133
2600.100	0.997	0.0493	0.144
2600.400	0.972	0.0472	0.147
2600.700	1	0.0469	0.142
2601.000	1.07	0.0509	0.156
2601.300	1.02	0.0483	0.154
2601.600	1.06	0.0491	0.156
2601.900	1.03	0.0479	0.147
2602.200	1.03	0.0486	0.145
2602.500	0.999	0.048	0.144
2602.800	1.01	0.0477	0.141
2603.100	0.998	0.0478	0.149
2603.400	0.991	0.0473	0.154
2603.700	1.03	0.0487	0.147
2604.000	1.02	0.048	0.159
2604.300	1.01	0.0479	0.158
2604.600	1.01	0.048	0.146
2604.900	1.03	0.0476	0.145
2605.200	1.08	0.0512	0.194
2605.500	1.04	0.0502	0.18
2605.800	1.02	0.0483	0.154
2606.100	0.989	0.0476	0.144
2606.400	1.04	0.0509	0.15
2606.700	1.06	0.0482	0.156
2607.000	1.02	0.049	0.143

2607.300	0.997	0.0484	0.149
2607.600	0.987	0.0459	0.16
2607.900	0.996	0.048	0.142
2608.200	1.01	0.0468	0.129
2608.500	1.07	0.0499	0.139
2608.800	1.06	0.05	0.152
2609.100	1.02	0.047	0.146
2609.400	1.04	0.0491	0.155
2609.700	1.05	0.0488	0.157
2610.000	1.03	0.0494	0.163
2610.300	0.974	0.0469	0.156
2610.600	0.986	0.0475	0.145
2610.900	1.04	0.0483	0.14
2611.200	1.07	0.05	0.148
2611.500	1.09	0.0495	0.146
2611.800	1.08	0.0494	0.159
2612.100	1.06	0.0511	0.157
2612.400	1.07	0.0495	0.161
2612.700	1.06	0.0509	0.158
2613.000	1.02	0.0486	0.141
2613.300	1.04	0.0477	0.139
2613.600	1.06	0.0497	0.169
2613.900	1.09	0.0512	0.184
2614.200	1.06	0.0487	0.167
2614.500	0.992	0.0485	0.158
2614.800	1.03	0.0509	0.159
2615.100	1.03	0.0486	0.152
2615.400	1.01	0.049	0.145
2615.700	1.05	0.0507	0.148
2616.000	1.12	0.0517	0.16
2616.300	1.08	0.0493	0.15
2616.600	1.02	0.0499	0.14
2616.900	0.968	0.0474	0.143
2617.200	1.02	0.0476	0.139
2617.500	1.08	0.052	0.147
2617.800	0.968	0.0456	0.146
2618.100	0.997	0.0473	0.144
2618.400	1.05	0.0497	0.135
2618.700	1.06	0.0492	0.131
2619.000	1.01	0.0481	0.137
2619.300	1.04	0.0494	0.151
2619.600	1	0.0506	0.164
2619.900	1.02	0.0483	0.149
2620.200	1.06	0.0487	0.135
2620.500	1.03	0.0493	0.138
2620.800	1.02	0.0486	0.15
2621.100	0.98	0.0458	0.153
2621.400	1.01	0.0495	0.15
2621.700	1.03	0.0495	0.139
2622.000	0.946	0.0449	0.151
2622.300	0.894	0.0453	0.17
2622.600	1.03	0.049	0.155
2622.900	1.05	0.0479	0.138
2623.200	0.989	0.048	0.15
2623.500	0.979	0.047	0.145
2623.800	1.07	0.0486	0.142
2624.100	0.989	0.0474	0.143
2624.400	0.987	0.0479	0.14
2624.700	1.03	0.0476	0.14
2625.000	1.06	0.0498	0.137
2625.300	1.04	0.0484	0.133
2625.600	1.02	0.049	0.127
2625.900	0.995	0.0481	0.143
2626.200	0.924	0.0451	0.152
2626.500	0.916	0.0462	0.135
2626.800	0.976	0.0469	0.134
2627.100	1.05	0.0489	0.139
2627.400	1	0.0483	0.143
2627.700	1	0.0478	0.149
2628.000	1.06	0.0486	0.146
2628.300	1.03	0.0485	0.135
2628.600	1.02	0.0484	0.13
2628.900	1.04	0.0479	0.142
2629.200	1.02	0.0491	0.151
2629.500	1	0.0489	0.147
2629.800	1.01	0.0486	0.137
2630.100	1.07	0.0498	0.15
2630.400	1.09	0.0497	0.143
2630.700	1.06	0.0515	0.141
2631.000	1	0.0477	0.15
2631.300	0.964	0.0478	0.154
2631.600	1.07	0.0505	0.156
2631.900	1.05	0.05	0.172
2632.200	1	0.0481	0.151
2632.500	0.994	0.0477	0.139
2632.800	0.958	0.0478	0.135
2633.100	1.02	0.0492	0.149
2633.400	1.04	0.0499	0.148
2633.700	1.03	0.0517	0.146
2634.000	0.99	0.0503	0.147
2634.300	1.05	0.0526	0.147
2634.600	1.1	0.0531	0.158
2634.900	0.984	0.0493	0.165
2635.200	0.948	0.0498	0.158
2635.500	0.994	0.0501	0.156
2635.800	0.981	0.0481	0.152
2636.100	0.999	0.0518	0.136
2636.400	1	0.0488	0.139
2636.700	1.01	0.0505	0.134
2637.000	0.981	0.0511	0.136
2637.300	1.02	0.0501	0.151
2637.600	1.05	0.0513	0.149
2637.900	1.01	0.051	0.141
2638.200	0.995	0.0493	0.133
2638.500	0.945	0.049	0.137
2638.800	0.971	0.0514	0.135
2639.100	1.08	0.0517	0.153
2639.400	1.03	0.0509	0.158
2639.700	0.933	0.0477	0.152
2640.000	1.01	0.0503	0.156
2640.300	0.965	0.0497	0.152
2640.600	0.973	0.0473	0.15
2640.900	1.03	0.0537	0.168
2641.200	1	0.0507	0.164
2641.500	0.985	0.0502	0.157
2641.800	0.917	0.0475	0.154
2642.100	0.997	0.0493	0.149
2642.400	1.01	0.0502	0.146
2642.700	1.01	0.0503	0.154
2643.000	1.01	0.0482	0.164
2643.300	0.951	0.046	0.162
2643.600	0.944	0.0474	0.147
2643.900	0.965	0.0471	0.135
2644.200	0.946	0.0456	0.133
2644.500	0.973	0.048	0.144
2644.800	1.02	0.0492	0.154
2645.100	0.992	0.0472	0.151
2645.400	0.982	0.0471	0.15
2645.700	1.01	0.0488	0.162
2646.000	0.988	0.0464	0.155
2646.300	0.944	0.0464	0.151
2646.600	1	0.0481	0.156
2646.900	0.988	0.0475	0.146
2647.200	0.976	0.0482	0.135
2647.500	0.959	0.0463	0.135
2647.800	0.951	0.0466	0.138
2648.100	0.967	0.0463	0.148
2648.400	0.99	0.048	0.163
2648.700	1	0.0486	0.156
2649.000	0.968	0.0479	0.151
2649.300	0.903	0.045	0.148
2649.600	0.939	0.0472	0.147
2649.900	0.969	0.0485	0.14
2650.200	0.937	0.0458	0.136
2650.500	1.04	0.0498	0.157
2650.800	0.996	0.0485	0.145
2651.100	0.949	0.0459	0.143
2651.400	1.04	0.0489	0.166
2651.700	1.03	0.0482	0.17
2652.000	1.02	0.0495	0.152
2652.300	0.991	0.0473	0.143
2652.600	0.987	0.0471	0.151
2652.900	0.969	0.0473	0.142
2653.200	0.939	0.0471	0.152
2653.500	0.991	0.0484	0.151
2653.800	0.941	0.0459	0.143
2654.100	0.918	0.0456	0.147
2654.400	0.921	0.0456	0.135
2654.700	0.943	0.0464	0.13
2655.000	0.912	0.046	0.141
2655.300	0.921	0.0464	0.153
2655.600	0.939	0.0466	0.144
2655.900	0.956	0.0468	0.133
2656.200	0.916	0.0457	0.13
2656.500	0.914	0.0461	0.134
2656.800	0.854	0.0443	0.151
2657.100	0.895	0.0444	0.159
2657.400	0.951	0.047	0.151
2657.700	0.973	0.0456	0.143
2658.000	1.02	0.0475	0.15
2658.300	1.01	0.0494	0.144
2658.600	0.942	0.0458	0.138
2658.900	0.883	0.0459	0.144
2659.200	0.942	0.0481	0.148
2659.500	0.968	0.0475	0.147
2659.800	0.941	0.0486	0.141
2660.100	0.916	0.0483	0.135
2660.400	0.904	0.0449	0.131
2660.700	0.942	0.0478	0.131
2661.000	0.955	0.0491	0.131
2661.300	1	0.0488	0.132
2661.600	0.989	0.0494	0.135
2661.900	1.01	0.0502	0.141
2662.200	0.948	0.049	0.142
2662.500	0.992	0.0478	0.156
2662.800	0.978	0.047	0.148
2663.100	0.939	0.0504	0.146
2663.400	0.956	0.0471	0.148
2663.700	0.974	0.0482	0.155
2664.000	0.934	0.0483	0.146
2664.300	0.902	0.0459	0.149
2664.600	0.934	0.0472	0.141
2664.900	0.947	0.0484	0.144
2665.200	0.935	0.0459	0.144
2665.500	1	0.0485	0.149
2665.800	1.02	0.0504	0.147
2666.100	0.982	0.0476	0.154
2666.400	0.919	0.0467	0.149
2666.700	0.938	0.0471	0.141
2667.000	0.933	0.049	0.143
2667.300	0.962	0.0462	0.152
2667.600	0.968	0.0473	0.149
2667.900	0.92	0.0485	0.141
2668.200	0.963	0.0465	0.142
2668.500	0.948	0.0474	0.138
2668.800	0.931	0.046	0.147
2669.100	0.945	0.0457	0.145
2669.400	0.927	0.047	0.139
2669.700	0.933	0.045	0.134
2670.000	0.95	0.0463	0.132
2670.300	0.937	0.0476	0.136
2670.600	0.938	0.0454	0.138
2670.900	0.936	0.0466	0.139
2671.200	0.912	0.0462	0.159
2671.500	0.95	0.0445	0.159
2671.800	0.993	0.0482	0.15
2672.100	0.966	0.0473	0.151
2672.400	0.947	0.0447	0.151
2672.700	0.958	0.048	0.145
2673.000	1	0.0472	0.137
2673.300	0.967	0.0486	0.134
2673.600	0.908	0.0461	0.149
2673.900	0.904	0.0456	0.148
2674.200	1.02	0.0502	0.157
2674.500	0.983	0.0488	0.146
2674.800	0.9	0.0451	0.135
2675.100	0.937	0.0485	0.142
2675.400	0.969	0.0476	0.138
2675.700	0.932	0.0468	0.136
2676.000	0.955	0.0477	0.148
2676.300	0.973	0.0458	0.16
2676.600	0.939	0.0466	0.161
2676.900	0.866	0.046	0.165
2677.200	0.894	0.0456	0.169
2677.500	0.92	0.0477	0.173
2677.800	0.966	0.0483	0.157
2678.100	0.965	0.0485	0.146
2678.400	0.931	0.0466	0.135
2678.700	0.918	0.0464	0.131
2679.000	0.974	0.0484	0.136
2679.300	0.982	0.0474	0.136
2679.600	1	0.0497	0.156
2679.900	1.03	0.049	0.181
2680.200	0.989	0.0491	0.167
2680.500	0.97	0.0493	0.172
2680.800	0.969	0.0469	0.158
2681.100	0.953	0.0465	0.141
2681.400	1.01	0.0498	0.141
2681.700	0.964	0.0474	0.133
2682.000	0.974	0.0472	0.134
2682.300	0.971	0.0488	0.151
2682.600	0.902	0.0441	0.152
2682.900	0.916	0.0456	0.154
2683.200	0.951	0.0473	0.139
2683.500	0.917	0.0469	0.145

2683.800	0.921	0.0455	0.156
2684.100	0.967	0.0464	0.146
2684.400	1.01	0.049	0.134
2684.700	1.01	0.0473	0.136
2685.000	0.972	0.0469	0.136
2685.300	1	0.0498	0.133
2685.600	0.975	0.0478	0.128
2685.900	0.967	0.0455	0.126
2686.200	0.974	0.0488	0.127
2686.500	1.02	0.0487	0.14
2686.800	0.971	0.0458	0.143
2687.100	0.882	0.0464	0.158
2687.400	0.919	0.0451	0.166
2687.700	0.945	0.0455	0.151
2688.000	0.947	0.0474	0.141
2688.300	0.869	0.0444	0.156
2688.600	0.876	0.0444	0.16
2688.900	0.956	0.0476	0.144
2689.200	0.94	0.0474	0.14
2689.500	0.922	0.0457	0.158
2689.800	0.926	0.0473	0.147
2690.100	0.898	0.0465	0.151
2690.400	0.913	0.0452	0.149
2690.700	0.911	0.046	0.143
2691.000	0.903	0.0468	0.138
2691.300	0.99	0.048	0.138
2691.600	0.991	0.0485	0.143
2691.900	0.977	0.05	0.138
2692.200	1.03	0.0496	0.142
2692.500	1.04	0.051	0.145
2692.800	1.01	0.0472	0.144
2693.100	1.06	0.0516	0.162
2693.400	0.988	0.0494	0.153
2693.700	0.951	0.0458	0.139
2694.000	0.989	0.0497	0.132
2694.300	1.01	0.0476	0.128
2694.600	0.999	0.0488	0.128
2694.900	0.986	0.0487	0.133
2695.200	1.01	0.048	0.142
2695.500	0.994	0.0485	0.139
2695.800	1.03	0.0496	0.143
2696.100	1.01	0.0484	0.142
2696.400	0.973	0.0489	0.141
2696.700	0.957	0.0481	0.148
2697.000	0.948	0.0463	0.15
2697.300	0.954	0.0484	0.144
2697.600	0.93	0.0452	0.145
2697.900	0.978	0.0476	0.141
2698.200	0.997	0.0492	0.146
2698.500	0.974	0.0457	0.147
2698.800	1.01	0.0491	0.156
2699.100	1	0.0492	0.153
2699.400	0.972	0.0476	0.155
2699.700	0.967	0.0475	0.147
2700.000	0.947	0.0467	0.136
2700.300	0.935	0.0476	0.143
2700.600	0.979	0.0485	0.139
2700.900	0.99	0.0483	0.13
2701.200	0.952	0.0468	0.144
2701.500	0.922	0.0451	0.156
2701.800	0.977	0.0486	0.149
2702.100	0.961	0.0477	0.141
2702.400	0.926	0.046	0.146
2702.700	0.992	0.0496	0.15
2703.000	1.01	0.0493	0.159
2703.300	0.992	0.0474	0.149
2703.600	0.949	0.0489	0.159
2703.900	0.93	0.0451	0.152
2704.200	0.959	0.0467	0.14
2704.500	0.962	0.0487	0.131
2704.800	0.982	0.0467	0.136
2705.100	0.942	0.0473	0.142
2705.400	0.937	0.0458	0.157
2705.700	0.971	0.0471	0.156
2706.000	0.965	0.0471	0.16
2706.300	0.985	0.0469	0.154
2706.600	0.972	0.0482	0.154
2706.900	0.917	0.0463	0.151
2707.200	0.969	0.0468	0.156
2707.500	1.01	0.0491	0.15
2707.800	1.03	0.0503	0.157
2708.100	1.09	0.0506	0.165
2708.400	1.04	0.0519	0.17
2708.700	0.934	0.046	0.164
2709.000	0.885	0.0442	0.151
2709.300	0.977	0.0503	0.138
2709.600	1.04	0.0483	0.133
2709.900	1.05	0.0489	0.136
2710.200	1.04	0.0505	0.144
2710.500	1.02	0.0488	0.145
2710.800	0.907	0.0459	0.152
2711.100	0.915	0.0461	0.161
2711.400	0.96	0.0468	0.145
2711.700	0.984	0.0472	0.139
2712.000	1.01	0.0488	0.13
2712.300	0.96	0.0471	0.135
2712.600	0.967	0.0481	0.142
2712.900	1	0.0485	0.136
2713.200	0.964	0.0497	0.143
2713.500	0.965	0.0464	0.14
2713.800	0.997	0.0484	0.139
2714.100	1.02	0.0509	0.144
2714.400	1.02	0.0485	0.142
2714.700	1.06	0.0514	0.142
2715.000	0.986	0.0485	0.14
2715.300	0.936	0.0474	0.133
2715.600	0.997	0.0486	0.134
2715.900	1.05	0.0496	0.137
2716.200	1.05	0.0507	0.136
2716.500	1.02	0.049	0.135
2716.800	1.06	0.0498	0.137
2717.100	1.07	0.0496	0.144
2717.400	1.01	0.0493	0.149
2717.700	0.95	0.0458	0.176
2718.000	0.948	0.0475	0.177
2718.300	1.03	0.049	0.152
2718.600	1.01	0.0477	0.146
2718.900	0.965	0.049	0.15
2719.200	0.959	0.0471	0.145
2719.500	0.981	0.0487	0.134
2719.800	0.988	0.0494	0.128
2720.100	0.979	0.049	0.137
2720.400	0.975	0.0502	0.137
2720.700	0.996	0.0493	0.13
2721.000	1.04	0.0504	0.134
2721.300	1.06	0.0528	0.153
2721.600	1.02	0.0496	0.16
2721.900	1.03	0.0497	0.157
2722.200	1.02	0.0509	0.165
2722.500	0.992	0.0471	0.165
2722.800	0.969	0.048	0.168
2723.100	1.06	0.0512	0.159
2723.400	1.04	0.0498	0.151
2723.700	0.942	0.0473	0.153
2724.000	0.935	0.0497	0.172
2724.300	0.964	0.0484	0.178
2724.600	1.02	0.0499	0.157
2724.900	1.06	0.0539	0.147
2725.200	1	0.0501	0.145
2725.500	0.985	0.0485	0.16
2725.800	1.02	0.0521	0.147
2726.100	1.09	0.0527	0.15
2726.400	1.08	0.0544	0.159
2726.700	1.03	0.0543	0.161
2727.000	1.02	0.0528	0.145
2727.300	1.05	0.0539	0.141
2727.600	1.07	0.0541	0.147
2727.900	1.03	0.0538	0.139
2728.200	0.999	0.0516	0.146
2728.500	1.02	0.0536	0.157
2728.800	1.01	0.0544	0.16
2729.100	0.975	0.0535	0.18
2729.400	1.02	0.0537	0.173
2729.700	1.1	0.0576	0.157
2730.000	1.1	0.0558	0.151
2730.300	1.11	0.0556	0.153
2730.600	1.06	0.0568	0.154
2730.900	1.05	0.0545	0.141
2731.200	1.08	0.055	0.138
2731.500	1.11	0.0571	0.147
2731.800	1.1	0.0557	0.153
2732.100	1.06	0.0544	0.148
2732.400	1.03	0.054	0.143
2732.700	1.12	0.056	0.139
2733.000	1.06	0.0517	0.136
2733.300	1.06	0.0549	0.133
2733.600	1.04	0.0534	0.139
2733.900	1.04	0.0525	0.143
2734.200	1.07	0.0536	0.144
2734.500	1.05	0.0546	0.141
2734.800	1.12	0.0552	0.147
2735.100	1.12	0.0558	0.149
2735.400	1.04	0.0543	0.14
2735.700	1.04	0.0521	0.142
2736.000	1.08	0.0555	0.147
2736.300	0.999	0.0529	0.158
2736.600	1.03	0.0519	0.155
2736.900	1.06	0.0541	0.164
2737.200	1.09	0.0544	0.158
2737.500	1.11	0.0557	0.152
2737.800	1.12	0.0562	0.147
2738.100	1.1	0.0543	0.152
2738.400	1.13	0.0556	0.148
2738.700	1.1	0.0542	0.141
2739.000	1.13	0.0556	0.152
2739.300	1.11	0.0559	0.147
2739.600	1.1	0.0544	0.137
2739.900	1.09	0.0536	0.139
2740.200	1.09	0.0553	0.146
2740.500	1.08	0.053	0.142
2740.800	1.1	0.0563	0.137
2741.100	1.1	0.0564	0.138
2741.400	1.1	0.0538	0.142
2741.700	1.09	0.0553	0.152
2742.000	1.12	0.056	0.14
2742.300	1.11	0.0555	0.135
2742.600	1.09	0.0549	0.146
2742.900	1.12	0.0564	0.148
2743.200	1.12	0.0561	0.149
2743.500	1.16	0.0585	0.147
2743.800	1.13	0.0548	0.167
2744.100	0.996	0.0526	0.162
2744.400	1.04	0.0551	0.153
2744.700	1.13	0.0556	0.148
2745.000	1.12	0.057	0.147
2745.300	1.18	0.0579	0.15
2745.600	1.21	0.0573	0.159
2745.900	1.17	0.0564	0.156
2746.200	1.16	0.0573	0.152
2746.500	1.17	0.0571	0.155
2746.800	1.16	0.0556	0.14
2747.100	1.11	0.0572	0.134
2747.400	1.1	0.0549	0.141
2747.700	1.12	0.0564	0.157
2748.000	1.14	0.0582	0.167
2748.300	1.09	0.0551	0.167
2748.600	1.1	0.0546	0.172
2748.900	1.14	0.0582	0.168
2749.200	1.11	0.056	0.155
2749.500	1.13	0.0549	0.144
2749.800	1.18	0.0575	0.152
2750.100	1.18	0.057	0.161
2750.400	1.17	0.0563	0.147
2750.700	1.16	0.056	0.145
2751.000	1.17	0.0573	0.167
2751.300	1.18	0.0566	0.165
2751.600	1.13	0.0549	0.156
2751.900	1.14	0.0582	0.165
2752.200	1.15	0.0576	0.162
2752.500	1.1	0.0561	0.181
2752.800	1.1	0.0573	0.158
2753.100	1.09	0.0563	0.153
2753.400	1.15	0.0561	0.155
2753.700	1.15	0.0575	0.146
2754.000	1.13	0.0577	0.153
2754.300	1.16	0.0557	0.148
2754.600	1.11	0.0577	0.158
2754.900	1.09	0.0543	0.158
2755.200	1.11	0.0546	0.145
2755.500	1.13	0.0586	0.134
2755.800	1.09	0.0564	0.144
2756.100	1.1	0.0554	0.169
2756.400	1.13	0.0577	0.16
2756.700	1.19	0.0593	0.159
2757.000	1.17	0.0578	0.157
2757.300	1.18	0.0578	0.149
2757.600	1.13	0.0562	0.153
2757.900	1.13	0.0565	0.157
2758.200	1.16	0.0574	0.154
2758.500	1.17	0.0579	0.165
2758.800	1.16	0.0584	0.179
2759.100	1.17	0.0573	0.161
2759.400	1.14	0.0557	0.162
2759.700	1.15	0.0563	0.168
2760.000	1.18	0.0575	0.161

2760.300	1.12	0.0567	0.157
2760.600	1.12	0.0551	0.152
2760.900	1.16	0.0556	0.157
2761.200	1.16	0.0584	0.147
2761.500	1.14	0.0574	0.131
2761.800	1.19	0.0573	0.127
2762.100	1.21	0.0591	0.131
2762.400	1.17	0.0578	0.172
2762.700	1.24	0.0599	0.164
2763.000	1.16	0.0572	0.168
2763.300	1.17	0.0569	0.201
2763.600	1.15	0.0574	0.213
2763.900	1.11	0.056	0.198
2764.200	1.14	0.0578	0.171
2764.500	1.12	0.0572	0.176
2764.800	1.16	0.0572	0.174
2765.100	1.17	0.0588	0.154
2765.400	1.06	0.0545	0.207
2765.700	1.09	0.0565	0.2
2766.000	1.18	0.0587	0.176
2766.300	1.17	0.0586	0.153
2766.600	1.24	0.0615	0.152
2766.900	1.22	0.0593	0.148
2767.200	1.25	0.0605	0.157
2767.500	1.3	0.0626	0.167
2767.800	1.17	0.0586	0.169
2768.100	1.17	0.0572	0.167
2768.400	1.19	0.0619	0.162
2768.700	1.11	0.0549	0.176
2769.000	1.15	0.0566	0.197
2769.300	1.21	0.0614	0.185
2769.600	1.24	0.0586	0.159
2769.900	1.17	0.058	0.161
2770.200	1.14	0.0592	0.153
2770.500	1.18	0.0578	0.149
2770.800	1.23	0.0593	0.153
2771.100	1.29	0.0681	0.16
2771.400	1.2	0.0609	0.212
2771.700	1.27	0.0639	0.223
2772.000	1.4	0.0716	0.233
2772.300	1.31	0.0662	0.204
2772.600	1.26	0.062	0.189
2772.900	1.24	0.0591	0.19
2773.200	1.2	0.0631	0.199
2773.500	1.23	0.0596	0.188
2773.800	1.23	0.0583	0.199
2774.100	1.29	0.0643	0.197
2774.400	1.28	0.0599	0.194
2774.700	1.22	0.0593	0.207
2775.000	1.19	0.0598	0.235
2775.300	1.21	0.0575	0.216
2775.600	1.21	0.0593	0.199
2775.900	1.24	0.0625	0.192
2776.200	1.22	0.0626	0.219
2776.500	1.24	0.062	0.228
2776.800	1.26	0.0667	0.201
2777.100	1.21	0.0611	0.227
2777.400	1.21	0.0622	0.224
2777.700	1.28	0.0677	0.201
2778.000	1.26	0.0695	0.262
2778.300	1.27	0.0692	0.316
2778.600	1.27	0.0733	0.269
2778.900	1.15	0.0656	0.301
2779.200	1.26	0.0663	0.247
2779.500	1.3	0.0727	0.219
2779.800	1.36	0.0706	0.218
2780.100	1.43	0.0694	0.183
2780.400	1.4	0.072	0.165
2780.700	1.24	0.0642	0.221
2781.000	1.22	0.0652	0.257
2781.300	1.31	0.0692	0.232
2781.600	1.33	0.07	0.201
2781.900	1.34	0.0684	0.188
2782.200	1.39	0.0732	0.188
2782.500	1.39	0.0704	0.209
2782.800	1.43	0.0708	0.214
2783.100	1.46	0.0727	0.208
2783.400	1.43	0.0775	0.258
2783.700	1.41	0.0719	0.25
2784.000	1.41	0.0705	0.238
2784.300	1.36	0.0713	0.239
2784.600	1.42	0.0711	0.221
2784.900	1.48	0.0728	0.212
2785.200	1.48	0.075	0.21
2785.500	1.42	0.0714	0.209
2785.800	1.39	0.0703	0.212
2786.100	1.38	0.0708	0.223
2786.400	1.45	0.0697	0.231
2786.700	1.56	0.0685	0.211
2787.000	1.65	0.0736	0.171
2787.300	1.5	0.0666	0.176
2787.600	1.49	0.0654	0.187
2787.900	1.5	0.07	0.185
2788.200	1.53	0.0695	0.201
2788.500	1.55	0.0688	0.201
2788.800	1.52	0.0692	0.212
2789.100	1.46	0.0682	0.22
2789.400	1.48	0.0652	0.223
2789.700	1.54	0.0711	0.179
2790.000	1.5	0.0683	0.161
2790.300	1.49	0.0659	0.153
2790.600	1.5	0.0687	0.164
2790.900	1.55	0.0675	0.155
2791.200	1.61	0.0697	0.139
2791.500	1.63	0.0718	0.14
2791.800	1.65	0.0712	0.14
2792.100	1.64	0.0703	0.13
2792.400	1.65	0.0706	0.132
2792.700	1.69	0.0726	0.151
2793.000	1.63	0.069	0.158
2793.300	1.62	0.0714	0.158
2793.600	1.63	0.0718	0.183
2793.900	1.62	0.0708	0.17
2794.200	1.61	0.0683	0.148
2794.500	1.58	0.0725	0.138
2794.800	1.65	0.0703	0.137
2795.100	1.7	0.0705	0.137
2795.400	1.75	0.0785	0.145
2795.700	1.64	0.0691	0.153
2796.000	1.57	0.069	0.159
2796.300	1.65	0.0723	0.157
2796.600	1.67	0.0709	0.177
2796.900	1.64	0.0719	0.175
2797.200	1.62	0.0713	0.164
2797.500	1.7	0.073	0.163
2797.800	1.68	0.0717	0.158
2798.100	1.7	0.0751	0.176
2798.400	1.62	0.0717	0.169
2798.700	1.6	0.0706	0.184
2799.000	1.54	0.0679	0.195
2799.300	1.62	0.0719	0.188
2799.600	1.62	0.0692	0.19
2799.900	1.56	0.0681	0.206
2800.200	1.65	0.0746	0.207
2800.500	1.68	0.0705	0.205
2800.800	1.62	0.0708	0.202
2801.100	1.63	0.0727	0.198
2801.400	1.65	0.0694	0.213
2801.700	1.63	0.0739	0.206
2802.000	1.58	0.0702	0.176
2802.300	1.62	0.0705	0.195
2802.600	1.6	0.0731	0.223
2802.900	1.62	0.0719	0.209
2803.200	1.59	0.0703	0.212
2803.500	1.63	0.0734	0.279
2803.800	1.65	0.0719	0.302
2804.100	1.68	0.0735	0.297
2804.400	1.65	0.0725	0.265
2804.700	1.62	0.0697	0.236
2805.000	1.54	0.0706	0.189
2805.300	1.52	0.066	0.204
2805.600	1.54	0.0704	0.231
2805.900	1.6	0.0712	0.251
2806.200	1.62	0.0694	0.23
2806.500	1.63	0.0753	0.237
2806.800	1.59	0.069	0.23
2807.100	1.54	0.0685	0.227
2807.400	1.55	0.0736	0.251
2807.700	1.58	0.0713	0.276
2808.000	1.56	0.0692	0.276
2808.300	1.54	0.0737	0.252
2808.600	1.5	0.0707	0.199
2808.900	1.51	0.0695	0.2
2809.200	1.5	0.0723	0.204
2809.500	1.5	0.07	0.216
2809.800	1.51	0.0742	0.229
2810.100	1.49	0.0711	0.204
2810.400	1.53	0.0715	0.18
2810.700	1.47	0.0739	0.221
2811.000	1.41	0.0699	0.202
2811.300	1.43	0.0716	0.189
2811.600	1.51	0.0735	0.224
2811.900	1.38	0.0739	0.18
2812.200	1.29	0.0727	0.172
2812.500	1.31	0.0714	0.185
2812.800	1.33	0.0731	0.18
2813.100	1.38	0.0772	0.173
2813.400	1.38	0.0755	0.169
2813.700	1.4	0.0785	0.169
2814.000	1.33	0.076	0.16
2814.300	1.32	0.0724	0.178
2814.600	1.35	0.0792	0.176
2814.900	1.44	0.0775	0.211
2815.200	1.38	0.0754	0.225
2815.500	1.38	0.0788	0.213
2815.800	1.34	0.0739	0.186
2816.100	1.3	0.0739	0.169
2816.400	1.26	0.0731	0.17
2816.700	1.29	0.0733	0.17
2817.000	1.35	0.0741	0.17
2817.300	1.41	0.0766	0.192
2817.600	1.38	0.0787	0.208
2817.900	1.38	0.075	0.249
2818.200	1.3	0.0735	0.217
2818.500	1.3	0.0808	0.191
2818.800	1.39	0.0825	0.193
2819.100	1.36	0.0802	0.219
2819.400	1.22	0.0789	0.171
2819.700	1.3	0.0758	0.163
2820.000	1.32	0.0761	0.165
2820.300	1.35	0.084	0.188
2820.600	1.31	0.0776	0.188
2820.900	1.3	0.0778	0.18
2821.200	1.27	0.0771	0.196
2821.500	1.26	0.0761	0.203
2821.800	1.25	0.0744	0.195
2822.100	1.28	0.0788	0.18
2822.400	1.29	0.0772	0.233
2822.700	1.19	0.0721	0.218
2823.000	1.16	0.0739	0.194
2823.300	1.2	0.0741	0.179
2823.600	1.2	0.0745	0.179
2823.900	1.13	0.071	0.208
2824.200	1.21	0.0765	0.213
2824.500	1.2	0.0774	0.186
2824.800	1.17	0.0767	0.159
2825.100	1.16	0.0738	0.169
2825.400	1.22	0.0782	0.196
2825.700	1.24	0.0868	0.191
2826.000	1.23	0.0816	0.212
2826.300	1.16	0.0757	0.236
2826.600	1.08	0.077	0.24
2826.900	1.15	0.0807	0.221
2827.200	1.29	0.0836	0.195
2827.500	1.27	0.0825	0.178
2827.800	1.13	0.0755	0.177
2828.100	1.21	0.0757	0.187
2828.400	1.25	0.0817	0.176
2828.700	1.2	0.0747	0.189
2829.000	1.21	0.0759	0.182
2829.300	1.24	0.0795	0.16
2829.600	1.17	0.0776	0.175
2829.900	1.13	0.0738	0.171
2830.200	1.09	0.073	0.156
2830.500	1.08	0.0749	0.189
2830.800	1.1	0.0722	0.204
2831.100	1.06	0.0749	0.191
2831.400	1.14	0.0862	0.185
2831.700	1.14	0.0805	0.157
2832.000	1.15	0.0815	0.155
2832.300	1.24	0.0908	0.186
2832.600	1.15	0.0853	0.189
2832.900	1.03	0.0793	0.203
2833.200	1.1	0.0959	0.17
2833.500	1.12	0.0899	0.182
2833.800	1.09	0.0851	0.19
2834.100	1.07	0.0914	0.174
2834.400	1.1	0.0893	0.152
2834.700	1.08	0.0862	0.142
2835.000	1.1	0.0886	0.151
2835.300	1.2	0.0945	0.154
2835.600	1.17	0.0904	0.15
2835.900	1.13	0.0858	0.147
2836.200	1.16	0.0853	0.142
2836.500	1.12	0.0816	0.154

2836.800	1.09	0.0827	0.172
2837.100	1.2	0.0822	0.169
2837.400	1.2	0.0871	0.172
2837.700	1.19	0.0837	0.19
2838.000	1.24	0.083	0.206
2838.300	1.28	0.0899	0.209
2838.600	1.14	0.082	0.171
2838.900	1.02	0.0782	0.16
2839.200	0.975	0.0778	0.174
2839.500	1.13	0.0824	0.188
2839.800	1.04	0.0781	0.172
2840.100	1.01	0.0764	0.162
2840.400	1.15	0.0824	0.154
2840.700	1.17	0.0828	0.16
2841.000	1.19	0.0859	0.196
2841.300	1.18	0.0803	0.183
2841.600	1.17	0.088	0.16
2841.900	1.14	0.0793	0.148
2842.200	1.1	0.0832	0.145
2842.500	1.1	0.0802	0.148
2842.800	1.11	0.0784	0.147
2843.100	1.09	0.0827	0.14
2843.400	1.07	0.0794	0.135
2843.700	1.12	0.0817	0.137
2844.000	1.11	0.0835	0.132
2844.300	1.17	0.0836	0.15
2844.600	1.19	0.0814	0.161
2844.900	1.13	0.0846	0.142
2845.200	1.09	0.0804	0.136
2845.500	1.09	0.08	0.146
2845.800	1.06	0.0816	0.135
2846.100	1.05	0.0761	0.129
2846.400	1.04	0.083	0.137
2846.700	1.05	0.0761	0.139
2847.000	1.06	0.0765	0.144
2847.300	1.15	0.0877	0.179
2847.600	1.14	0.0797	0.181
2847.900	1.07	0.0845	0.159
2848.200	0.968	0.0733	0.139
2848.500	0.988	0.0768	0.128
2848.800	1.09	0.0831	0.127
2849.100	1.1	0.081	0.133
2849.400	1.01	0.0754	0.135
2849.700	0.943	0.0771	0.147
2850.000	1.05	0.0796	0.148
2850.300	1.09	0.0806	0.148
2850.600	1.1	0.0836	0.138
2850.900	1.05	0.0765	0.135
2851.200	1.03	0.0829	0.139
2851.500	1	0.0748	0.14
2851.800	1.01	0.0748	0.144
2852.100	1.04	0.0834	0.151
2852.400	1.09	0.0778	0.157
2852.700	1.13	0.0846	0.165
2853.000	1.04	0.0784	0.155
2853.300	1.06	0.0799	0.159
2853.600	1.08	0.0824	0.174
2853.900	0.992	0.0744	0.153
2854.200	0.953	0.0756	0.133
2854.500	1.01	0.0799	0.129
2854.800	0.955	0.0758	0.155
2855.100	0.94	0.075	0.152
2855.400	0.999	0.0822	0.135
2855.700	0.988	0.0775	0.15
2856.000	0.961	0.0836	0.174
2856.300	0.989	0.0772	0.143
2856.600	0.977	0.0767	0.137
2856.900	0.977	0.0838	0.152
2857.200	1.02	0.0783	0.138
2857.500	1.05	0.0844	0.127
2857.800	1.04	0.081	0.163
2858.100	1.03	0.0806	0.157
2858.400	1.1	0.0863	0.146
2858.700	1.01	0.0767	0.162
2859.000	1.02	0.0804	0.166
2859.300	1.04	0.0835	0.144
2859.600	0.94	0.077	0.137
2859.900	0.94	0.0772	0.131
2860.200	0.978	0.0806	0.135
2860.500	1.02	0.0772	0.153
2860.800	1.04	0.081	0.149
2861.100	0.968	0.0802	0.143
2861.400	0.987	0.0761	0.152
2861.700	1.08	0.0876	0.134
2862.000	0.944	0.0749	0.15
2862.300	0.896	0.0781	0.154
2862.600	0.958	0.0781	0.15
2862.900	0.988	0.0795	0.141
2863.200	1.05	0.0831	0.14
2863.500	1.09	0.0839	0.15
2863.800	0.996	0.08	0.159
2864.100	0.977	0.0819	0.152
2864.400	1.09	0.0835	0.188
2864.700	1.05	0.0824	0.175
2865.000	0.977	0.0791	0.153
2865.300	1.06	0.0773	0.187
2865.600	1.04	0.0789	0.195
2865.900	0.99	0.0799	0.183
2866.200	1.01	0.0756	0.163
2866.500	0.981	0.079	0.152
2866.800	1	0.0773	0.153
2867.100	1.02	0.0804	0.163
2867.400	1.03	0.0784	0.149
2867.700	1.07	0.0774	0.135
2868.000	1.05	0.0819	0.138
2868.300	0.992	0.075	0.148
2868.600	0.905	0.0736	0.138
2868.900	0.966	0.0759	0.143
2869.200	1.08	0.0836	0.174
2869.500	1.04	0.079	0.172
2869.800	1.04	0.0793	0.166
2870.100	1.09	0.0822	0.194
2870.400	1.04	0.0795	0.197
2870.700	1.06	0.0829	0.2
2871.000	0.908	0.0718	0.165
2871.300	0.88	0.0756	0.151
2871.600	1.06	0.0803	0.135
2871.900	1.08	0.0835	0.166
2872.200	0.939	0.0751	0.157
2872.500	0.9	0.0714	0.139
2872.800	0.895	0.0759	0.127
2873.100	0.894	0.0734	0.128
2873.400	0.909	0.0742	0.127
2873.700	0.926	0.0748	0.121
2874.000	0.909	0.0759	0.122
2874.300	0.964	0.076	0.12
2874.600	0.957	0.0728	0.125
2874.900	0.992	0.0791	0.14
2875.200	0.98	0.0767	0.145
2875.500	0.886	0.0748	0.146
2875.800	0.892	0.0706	0.15
2876.100	0.992	0.0797	0.152
2876.400	1.06	0.0796	0.209
2876.700	0.955	0.0752	0.197
2877.000	0.906	0.0737	0.152
2877.300	0.927	0.0743	0.136
2877.600	0.917	0.0759	0.135
2877.900	0.927	0.0743	0.136
2878.200	0.91	0.0755	0.135
2878.500	0.925	0.0718	0.14
2878.800	0.959	0.0779	0.135
2879.100	0.892	0.0726	0.137
2879.400	0.83	0.0678	0.158
2879.700	0.879	0.0749	0.157
2880.000	0.984	0.0767	0.163
2880.300	1	0.0801	0.183
2880.600	0.848	0.0706	0.155
2880.900	0.828	0.0702	0.156
2881.200	0.885	0.0729	0.165
2881.500	0.939	0.0747	0.152
2881.800	0.962	0.0761	0.136
2882.100	0.925	0.0745	0.14
2882.400	0.918	0.0766	0.144
2882.700	0.953	0.0732	0.139
2883.000	0.978	0.0813	0.146
2883.300	0.998	0.075	0.138
2883.600	0.941	0.0752	0.134
2883.900	0.924	0.0766	0.147
2884.200	1	0.0754	0.14
2884.500	1.01	0.0806	0.144
2884.800	0.879	0.0728	0.139
2885.100	0.828	0.0708	0.136
2885.400	0.932	0.0774	0.129
2885.700	0.979	0.0771	0.155
2886.000	0.99	0.0774	0.173
2886.300	0.99	0.0774	0.151
2886.600	0.965	0.076	0.132
2886.900	0.915	0.0745	0.125
2887.200	0.866	0.074	0.158
2887.500	0.948	0.0732	0.157
2887.800	0.983	0.0815	0.134
2888.100	1	0.0753	0.131
2888.400	0.962	0.074	0.139
2888.700	0.841	0.0755	0.145
2889.000	0.899	0.0713	0.135
2889.300	0.918	0.0763	0.135
2889.600	0.982	0.0762	0.138
2889.900	1.04	0.0788	0.154
2890.200	0.942	0.0767	0.137
2890.500	0.969	0.0731	0.129
2890.800	1.04	0.0787	0.129
2891.100	0.991	0.079	0.132
2891.400	0.874	0.0721	0.134
2891.700	0.876	0.0721	0.134
2892.000	0.928	0.0767	0.127
2892.300	0.9	0.0707	0.124
2892.600	0.909	0.0758	0.125
2892.900	0.926	0.0746	0.128
2893.200	0.913	0.0718	0.133
2893.500	0.876	0.0768	0.157
2893.800	0.939	0.073	0.155
2894.100	0.935	0.0776	0.15
2894.400	0.808	0.0695	0.149
2894.700	0.833	0.0707	0.145
2895.000	0.938	0.0776	0.134
2895.300	0.923	0.0718	0.133
2895.600	0.914	0.0742	0.135
2895.900	0.894	0.0754	0.128
2896.200	0.946	0.0756	0.126
2896.500	1	0.0755	0.123
2896.800	0.977	0.0816	0.131
2897.100	0.946	0.0733	0.13
2897.400	0.931	0.0773	0.126
2897.700	0.976	0.0771	0.142
2898.000	0.996	0.0753	0.143
2898.300	0.982	0.0819	0.131
2898.600	0.914	0.0722	0.147
2898.900	0.903	0.0745	0.15
2899.200	0.999	0.0804	0.18
2899.500	1.02	0.0767	0.189
2899.800	0.997	0.0827	0.164
2900.100	0.93	0.0727	0.14
2900.400	0.94	0.0762	0.14
2900.700	0.89	0.0759	0.138
2901.000	0.957	0.0762	0.14
2901.300	0.944	0.0735	0.146
2901.600	0.848	0.0762	0.136
2901.900	0.853	0.07	0.13
2902.200	0.829	0.0731	0.145
2902.500	0.84	0.0719	0.18
2902.800	0.863	0.0701	0.169
2903.100	0.882	0.0775	0.164
2903.400	0.884	0.0707	0.168
2903.700	0.882	0.073	0.165
2904.000	0.869	0.0744	0.14
2904.300	0.846	0.0687	0.137
2904.600	0.871	0.0741	0.139
2904.900	0.96	0.0753	0.138
2905.200	1.01	0.0775	0.148
2905.500	0.949	0.0771	0.152
2905.800	0.892	0.0726	0.138
2906.100	0.885	0.0704	0.127
2906.400	0.837	0.0725	0.143
2906.700	0.92	0.074	0.146
2907.000	0.952	0.0748	0.151
2907.300	0.993	0.0791	0.151
2907.600	0.901	0.0707	0.143
2907.900	0.807	0.0734	0.129
2908.200	0.87	0.0697	0.136
2908.500	0.935	0.0746	0.135
2908.800	0.992	0.0789	0.145
2909.100	1.04	0.0763	0.207
2909.400	0.966	0.0778	0.211
2909.700	0.955	0.0756	0.168
2910.000	0.932	0.0749	0.148
2910.300	0.833	0.0701	0.135
2910.600	0.866	0.0744	0.137
2910.900	0.982	0.0765	0.158
2911.200	1.01	0.0781	0.161
2911.500	0.878	0.0725	0.165
2911.800	0.906	0.074	0.148
2912.100	0.896	0.0758	0.137
2912.400	0.888	0.0709	0.131
2912.700	0.885	0.0753	0.128
2913.000	0.926	0.0748	0.129

2913.300	0.943	0.0752	0.138
2913.600	0.95	0.0783	0.153
2913.900	0.881	0.071	0.154
2914.200	0.807	0.0722	0.142
2914.500	0.866	0.0725	0.133
2914.800	0.934	0.0753	0.128
2915.100	0.976	0.077	0.126
2915.400	1.02	0.0807	0.141
2915.700	1.03	0.0794	0.154
2916.000	0.935	0.0752	0.136
2916.300	0.784	0.0687	0.145
2916.600	0.834	0.071	0.143
2916.900	0.94	0.0779	0.148
2917.200	0.913	0.0719	0.137
2917.500	0.895	0.076	0.131
2917.800	0.777	0.0683	0.161
2918.100	0.802	0.0698	0.145
2918.400	0.952	0.076	0.159
2918.700	0.935	0.075	0.145
2919.000	0.827	0.0727	0.157
2919.300	0.885	0.073	0.143
2919.600	0.901	0.0739	0.139
2919.900	0.984	0.0768	0.169
2920.200	1.04	0.079	0.183
2920.500	0.975	0.0787	0.164
2920.800	0.978	0.0742	0.161
2921.100	0.959	0.0781	0.147
2921.400	0.93	0.0744	0.135
2921.700	0.857	0.0736	0.138
2922.000	0.852	0.0684	0.133
2922.300	0.952	0.0752	0.129
2922.600	0.941	0.0774	0.134
2922.900	0.878	0.0724	0.156
2923.200	0.836	0.0712	0.169
2923.500	0.89	0.0734	0.17
2923.800	0.922	0.0772	0.144
2924.100	0.907	0.074	0.131
2924.400	0.928	0.0751	0.125
2924.700	0.926	0.0748	0.118
2925.000	0.883	0.073	0.118
2925.300	0.837	0.0731	0.119
2925.600	0.874	0.0702	0.115
2925.900	0.889	0.0752	0.115
2926.200	0.935	0.0749	0.117
2926.500	0.918	0.0746	0.132
2926.800	0.812	0.0696	0.145
2927.100	0.868	0.0723	0.139
2927.400	0.913	0.0762	0.127
2927.700	0.913	0.0741	0.121
2928.000	0.865	0.0719	0.117
2928.300	0.847	0.0712	0.12
2928.600	0.862	0.0736	0.155
2928.900	0.883	0.0703	0.16
2929.200	0.851	0.0712	0.141
2929.500	0.875	0.0745	0.138
2929.800	0.949	0.0754	0.141
2930.100	0.956	0.0788	0.142
2930.400	0.902	0.0731	0.16
2930.700	0.892	0.0792	0.162
2931.000	0.945	0.0787	0.145
2931.300	0.962	0.0801	0.138
2931.600	0.995	0.0802	0.141
2931.900	0.983	0.0796	0.135
2932.200	0.995	0.0834	0.136
2932.500	0.933	0.0777	0.126
2932.800	0.915	0.0774	0.12
2933.100	0.946	0.0783	0.122
2933.400	0.902	0.0792	0.133
2933.700	0.886	0.0734	0.133
2934.000	0.868	0.0747	0.129
2934.300	0.889	0.0776	0.139
2934.600	0.935	0.075	0.136
2934.900	0.939	0.0827	0.128
2935.200	0.922	0.0751	0.15
2935.500	0.948	0.0819	0.178
2935.800	0.955	0.0786	0.156
2936.100	0.943	0.0761	0.143
2936.400	0.881	0.0775	0.139
2936.700	0.859	0.0739	0.144
2937.000	0.85	0.074	0.151
2937.300	0.881	0.0774	0.164
2937.600	0.965	0.081	0.193
2937.900	0.852	0.0738	0.17
2938.200	0.898	0.076	0.157
2938.500	0.958	0.0797	0.144
2938.800	0.931	0.0781	0.139
2939.100	0.759	0.0723	0.148
2939.400	0.814	0.0703	0.141
2939.700	0.912	0.0811	0.133
2940.000	1.05	0.0791	0.162
2940.300	1.08	0.0829	0.175
2940.600	0.927	0.0783	0.147
2940.900	0.905	0.0727	0.139
2941.200	0.902	0.0779	0.137
2941.500	0.915	0.0717	0.129
2941.800	0.947	0.0755	0.13
2942.100	0.918	0.0771	0.135
2942.400	0.827	0.0703	0.163
2942.700	0.866	0.0703	0.17
2943.000	0.869	0.0748	0.163
2943.300	0.899	0.0739	0.15
2943.600	0.887	0.0755	0.136
2943.900	0.832	0.0708	0.145
2944.200	0.896	0.0713	0.159
2944.500	0.948	0.08	0.176
2944.800	0.939	0.0728	0.148
2945.100	0.942	0.0729	0.135
2945.400	0.957	0.0806	0.144
2945.700	0.965	0.0741	0.143
2946.000	0.935	0.0797	0.137
2946.300	0.939	0.0727	0.128
2946.600	0.985	0.0769	0.13
2946.900	1.02	0.0809	0.134
2947.200	0.927	0.074	0.178
2947.500	0.874	0.0697	0.189
2947.800	0.857	0.0733	0.157
2948.100	0.927	0.0742	0.14
2948.400	0.949	0.075	0.14
2948.700	0.859	0.0737	0.151
2949.000	0.925	0.0721	0.145
2949.300	0.974	0.0812	0.131
2949.600	0.954	0.0734	0.151
2949.900	0.936	0.073	0.158
2950.200	0.872	0.0771	0.141
2950.500	0.88	0.0708	0.145
2950.800	0.878	0.0752	0.134
2951.100	0.911	0.0744	0.125
2951.400	0.945	0.0761	0.123
2951.700	0.926	0.0772	0.121
2952.000	0.944	0.0734	0.134
2952.300	0.912	0.0746	0.142
2952.600	0.859	0.0743	0.161
2952.900	0.913	0.0747	0.14
2953.200	0.937	0.0755	0.13
2953.500	0.904	0.0764	0.125
2953.800	0.889	0.0711	0.121
2954.100	0.872	0.0747	0.124
2954.400	0.944	0.0734	0.135
2954.700	0.95	0.0733	0.139
2955.000	0.959	0.0807	0.143
2955.300	0.938	0.0728	0.136
2955.600	0.958	0.0785	0.148
2955.900	0.903	0.0736	0.147
2956.200	0.893	0.0734	0.141
2956.500	0.915	0.074	0.13
2956.800	0.938	0.0754	0.134
2957.100	0.922	0.0742	0.155
2957.400	0.94	0.0776	0.178
2957.700	0.934	0.075	0.164
2958.000	0.937	0.0756	0.144
2958.300	0.808	0.0718	0.15
2958.600	0.854	0.0694	0.134
2958.900	0.953	0.0756	0.142
2959.200	0.979	0.0792	0.143
2959.500	0.927	0.0722	0.141
2959.800	0.907	0.0783	0.136
2960.100	0.901	0.0714	0.148
2960.400	0.873	0.0746	0.158
2960.700	0.908	0.0743	0.169
2961.000	0.994	0.0751	0.202
2961.300	1.02	0.0812	0.19
2961.600	0.931	0.0755	0.16
2961.900	0.896	0.0749	0.139
2962.200	0.869	0.0761	0.138
2962.500	0.871	0.0763	0.143
2962.800	0.916	0.0772	0.141
2963.100	0.95	0.0816	0.147
2963.400	0.875	0.0728	0.134
2963.700	0.875	0.075	0.139
2964.000	0.934	0.081	0.144
2964.300	0.878	0.0732	0.145
2964.600	0.89	0.0788	0.128
2964.900	0.911	0.0769	0.142
2965.200	0.989	0.0835	0.148
2965.500	0.882	0.0753	0.14
2965.800	0.829	0.0711	0.137
2966.100	0.784	0.0733	0.145
2966.400	0.856	0.0747	0.142
2966.700	0.921	0.0805	0.145
2967.000	0.86	0.0729	0.169
2967.300	0.843	0.0775	0.161
2967.600	0.86	0.0745	0.162
2967.900	0.912	0.0776	0.166
2968.200	0.888	0.0767	0.153
2968.500	0.912	0.077	0.141
2968.800	0.993	0.0842	0.158
2969.100	0.92	0.0777	0.145
2969.400	0.828	0.0738	0.133
2969.700	0.901	0.077	0.137
2970.000	0.908	0.0795	0.132
2970.300	0.874	0.0731	0.141
2970.600	0.906	0.0773	0.148
2970.900	0.835	0.0762	0.159
2971.200	0.84	0.0741	0.148
2971.500	0.904	0.0791	0.16
2971.800	0.849	0.0718	0.15
2972.100	0.951	0.0811	0.153
2972.400	0.956	0.0777	0.213
2972.700	0.898	0.0726	0.194
2973.000	0.918	0.0771	0.163
2973.300	0.852	0.072	0.145
2973.600	0.839	0.0738	0.132
2973.900	0.919	0.0755	0.127
2974.200	0.896	0.0742	0.125
2974.500	0.866	0.0734	0.121
2974.800	0.871	0.0734	0.12
2975.100	0.946	0.0764	0.132
2975.400	1.04	0.0803	0.188
2975.700	0.998	0.0805	0.182
2976.000	0.945	0.0763	0.159
2976.300	0.995	0.0802	0.177
2976.600	0.871	0.0704	0.196
2976.900	0.833	0.0717	0.19
2977.200	0.881	0.0756	0.176
2977.500	0.845	0.0694	0.154
2977.800	0.88	0.0757	0.136
2978.100	0.847	0.0722	0.128
2978.400	0.852	0.0725	0.126
2978.700	0.989	0.081	0.122
2979.000	0.939	0.077	0.124
2979.300	0.938	0.0789	0.145
2979.600	0.939	0.0792	0.156
2979.900	0.857	0.0753	0.148
2980.200	0.831	0.0741	0.148
2980.500	0.962	0.082	0.18
2980.800	0.878	0.0742	0.208
2981.100	0.662	0.0704	0.198
2981.400	0.803	0.0713	0.163
2981.700	0.864	0.0756	0.142
2982.000	0.837	0.0771	0.152
2982.300	0.892	0.0727	0.137
2982.600	0.897	0.0799	0.131
2982.900	0.887	0.0765	0.14
2983.200	0.88	0.0769	0.14
2983.500	0.857	0.0775	0.129
2983.800	0.853	0.0731	0.125
2984.100	0.837	0.0774	0.125
2984.400	0.841	0.0748	0.139
2984.700	0.833	0.0746	0.138
2985.000	0.889	0.0768	0.144
2985.300	1.01	0.0848	0.152
2985.600	0.88	0.0735	0.148
2985.900	0.792	0.0767	0.141
2986.200	0.837	0.0723	0.147
2986.500	0.848	0.0728	0.151
2986.800	0.836	0.0796	0.15
2987.100	0.903	0.0752	0.144
2987.400	0.957	0.0826	0.143
2987.700	0.842	0.0747	0.14
2988.000	0.834	0.0752	0.135
2988.300	0.841	0.0769	0.146
2988.600	0.867	0.0733	0.16
2988.900	0.948	0.0808	0.18
2989.200	0.762	0.0728	0.17
2989.500	0.783	0.0712	0.158

2989.800	0.875	0.0746	0.147
2990.100	0.794	0.0717	0.137
2990.400	0.876	0.0711	0.153
2990.700	0.893	0.076	0.159
2991.000	0.867	0.0726	0.143
2991.300	0.857	0.0703	0.135
2991.600	0.772	0.0729	0.131
2991.900	0.811	0.0682	0.127
2992.200	0.852	0.0766	0.121
2992.500	0.871	0.0708	0.122
2992.800	0.918	0.0747	0.139
2993.100	0.941	0.0786	0.165
2993.400	0.792	0.0669	0.145
2993.700	0.805	0.0699	0.137
2994.000	0.88	0.0758	0.159
2994.300	0.825	0.0708	0.146
2994.600	0.846	0.0718	0.143
2994.900	0.851	0.0745	0.138
2995.200	0.873	0.0708	0.145
2995.500	0.908	0.0769	0.169
2995.800	0.857	0.0722	0.144
2996.100	0.839	0.0696	0.128
2996.400	0.778	0.0733	0.124
2996.700	0.806	0.068	0.128
2997.000	0.835	0.0736	0.137
2997.300	0.833	0.0715	0.126
2997.600	0.834	0.0693	0.124
2997.900	0.857	0.0771	0.126
2998.200	0.872	0.0712	0.123
2998.500	0.876	0.0736	0.136
2998.800	0.845	0.0747	0.158
2999.100	0.753	0.0682	0.137
2999.400	0.794	0.0698	0.139
2999.700	0.896	0.075	0.158
3000.000	0.825	0.0715	0.145
3000.300	0.822	0.0739	0.129
3000.600	0.834	0.0722	0.127
3000.900	0.87	0.0714	0.143
3001.200	0.899	0.0795	0.16
3001.500	0.861	0.0709	0.152
3001.800	0.848	0.0749	0.141
3002.100	0.874	0.0736	0.162
3002.400	0.829	0.0695	0.159
3002.700	0.737	0.0696	0.202
3003.000	0.852	0.0727	0.18
3003.300	0.892	0.0745	0.157
3003.600	0.854	0.0743	0.152
3003.900	0.868	0.0737	0.148
3004.200	0.836	0.0716	0.134
3004.500	0.854	0.0732	0.124
3004.800	0.841	0.0724	0.12
3005.100	0.809	0.0708	0.147
3005.400	0.871	0.076	0.14
3005.700	0.873	0.0714	0.154
3006.000	0.846	0.0768	0.157
3006.300	0.872	0.0711	0.141
3006.600	0.869	0.0732	0.131
3006.900	0.83	0.0738	0.126
3007.200	0.811	0.0683	0.122
3007.500	0.815	0.0732	0.124
3007.800	0.722	0.0666	0.141
3008.100	0.73	0.0672	0.146
3008.400	0.834	0.0741	0.128
3008.700	0.821	0.0714	0.122
3009.000	0.843	0.0725	0.137
3009.300	0.865	0.0739	0.163
3009.600	0.785	0.0694	0.141
3009.900	0.864	0.0732	0.134
3010.200	0.911	0.0779	0.138
3010.500	0.8	0.0686	0.139
3010.800	0.706	0.0682	0.16
3011.100	0.878	0.0745	0.171
3011.400	1.01	0.0796	0.181
3011.700	0.918	0.0782	0.179
3012.000	0.869	0.0713	0.155
3012.300	0.852	0.075	0.147
3012.600	0.808	0.0709	0.157
3012.900	0.87	0.0735	0.174
3013.200	0.869	0.0731	0.164
3013.500	0.874	0.0736	0.164
3013.800	0.934	0.0784	0.185
3014.100	0.828	0.0715	0.169
3014.400	0.72	0.067	0.14
3014.700	0.753	0.0686	0.138
3015.000	0.825	0.0741	0.15
3015.300	0.804	0.0688	0.135
3015.600	0.777	0.0696	0.127
3015.900	0.811	0.0739	0.144
3016.200	0.791	0.0702	0.147
3016.500	0.77	0.0695	0.14
3016.800	0.808	0.0714	0.139
3017.100	0.828	0.074	0.143
3017.400	0.886	0.0746	0.154
3017.700	0.865	0.0762	0.161
3018.000	0.764	0.0671	0.157
3018.300	0.753	0.0687	0.161
3018.600	0.837	0.0752	0.18
3018.900	0.902	0.0739	0.155
3019.200	0.838	0.0755	0.149
3019.500	0.85	0.0735	0.147
3019.800	0.895	0.0782	0.165
3020.100	0.798	0.0709	0.149
3020.400	0.799	0.0686	0.154
3020.700	0.892	0.0781	0.183
3021.000	0.739	0.0679	0.192
3021.300	0.678	0.0658	0.195
3021.600	0.75	0.0692	0.166
3021.900	0.762	0.0721	0.148
3022.200	0.733	0.0691	0.136
3022.500	0.777	0.0725	0.13
3022.800	0.746	0.0716	0.146
3023.100	0.745	0.072	0.143
3023.400	0.688	0.0702	0.149
3023.700	0.731	0.0684	0.164
3024.000	0.745	0.0725	0.165
3024.300	0.829	0.0747	0.148
3024.600	0.874	0.0798	0.138
3024.900	0.804	0.0728	0.15
3025.200	0.855	0.0738	0.166
3025.500	0.852	0.0789	0.157
3025.800	0.851	0.0757	0.146
3026.100	0.803	0.0735	0.147
3026.400	0.779	0.0732	0.131
3026.700	0.783	0.0747	0.123
3027.000	0.855	0.0734	0.123
3027.300	0.932	0.0823	0.126
3027.600	0.794	0.0731	0.132
3027.900	0.748	0.0714	0.147
3028.200	0.766	0.074	0.138
3028.500	0.777	0.07	0.132
3028.800	0.846	0.0787	0.14
3029.100	0.898	0.0775	0.154
3029.400	0.87	0.0747	0.162
3029.700	0.867	0.0854	0.177
3030.000	0.885	0.0794	0.158
3030.300	0.805	0.0818	0.135
3030.600	0.705	0.0722	0.156
3030.900	0.779	0.0772	0.157
3031.200	0.807	0.0811	0.141
3031.500	0.805	0.0769	0.127
3031.800	0.787	0.0757	0.122
3032.100	0.8	0.0771	0.129
3032.400	0.877	0.0781	0.195
3032.700	0.813	0.0751	0.187
3033.000	0.858	0.0791	0.18
3033.300	0.793	0.0694	0.15
3033.600	0.775	0.0765	0.156
3033.900	0.72	0.0698	0.175
3034.200	0.8	0.0718	0.161
3034.500	0.966	0.0868	0.147
3034.800	0.857	0.0745	0.142
3035.100	0.8	0.0745	0.134
3035.400	0.809	0.0806	0.127
3035.700	0.831	0.0796	0.126
3036.000	0.861	0.0838	0.129
3036.300	0.862	0.0823	0.14
3036.600	0.885	0.0836	0.144
3036.900	0.83	0.0825	0.135
3037.200	0.774	0.079	0.149
3037.500	0.756	0.0771	0.156
3037.800	0.774	0.0936	0.16
3038.100	0.795	0.0853	0.149
3038.400	0.811	0.0898	0.136
3038.700	0.818	0.0918	0.148
3039.000	0.822	0.0875	0.144
3039.300	0.826	0.0945	0.128
3039.600	0.751	0.0819	0.155
3039.900	0.774	0.0852	0.171
3040.200	0.83	0.0986	0.175
3040.500	0.781	0.0894	0.17
3040.800	0.823	0.0898	0.158
3041.100	0.825	0.0892	0.159
3041.400	0.727	0.0846	0.186
3041.700	0.7	0.0819	0.255
3042.000	0.839	0.0913	0.195
3042.300	0.868	0.0884	0.155
3042.600	0.783	0.0915	0.155
3042.900	0.841	0.0865	0.15
3043.200	0.877	0.0928	0.141
3043.500	0.805	0.0887	0.125
3043.800	0.815	0.085	0.123
3044.100	0.83	0.0937	0.128
3044.400	0.921	0.0903	0.131
3044.700	0.904	0.0934	0.129
3045.000	0.791	0.0866	0.134
3045.300	0.83	0.0853	0.129
3045.600	0.839	0.0939	0.122
3045.900	0.803	0.0835	0.132
3046.200	0.823	0.0854	0.148
3046.500	0.762	0.0858	0.135
3046.800	0.779	0.0876	0.124
3047.100	0.856	0.0881	0.133
3047.400	0.867	0.0922	0.14
3047.700	0.867	0.0937	0.154
3048.000	0.831	0.0903	0.167
3048.300	0.876	0.0946	0.162
3048.600	0.819	0.0865	0.151
3048.900	0.755	0.0909	0.142
3049.200	0.877	0.0892	0.169
3049.500	0.915	0.0956	0.188
3049.800	0.915	0.0941	0.176
3050.100	0.964	0.0925	0.18
3050.400	1.04	0.105	0.211
3050.700	0.866	0.0876	0.172
3051.000	0.813	0.0896	0.144
3051.300	0.883	0.0937	0.129
3051.600	0.793	0.0887	0.14
3051.900	0.808	0.0856	0.148
3052.200	0.812	0.0895	0.142
3052.500	0.796	0.0895	0.139
3052.800	0.804	0.089	0.15
3053.100	0.859	0.0927	0.167
3053.400	0.828	0.0862	0.15
3053.700	0.817	0.0936	0.14
3054.000	0.854	0.0873	0.146
3054.300	0.822	0.0862	0.14
3054.600	0.682	0.0846	0.162
3054.900	0.731	0.0803	0.174
3055.200	0.764	0.0899	0.161
3055.500	0.765	0.087	0.141
3055.800	0.752	0.0906	0.133
3056.100	0.801	0.0935	0.147
3056.400	0.834	0.0949	0.151
3056.700	0.795	0.0889	0.137
3057.000	0.777	0.0924	0.132
3057.300	0.792	0.0927	0.132
3057.600	0.817	0.0951	0.133
3057.900	0.8	0.0932	0.13
3058.200	0.787	0.0885	0.128
3058.500	0.754	0.0942	0.178
3058.800	0.783	0.0873	0.194
3059.100	0.775	0.0866	0.187
3059.400	0.866	0.103	0.168
3059.700	0.849	0.0921	0.212
3060.000	0.856	0.0995	0.252
3060.300	0.915	0.0953	0.246
3060.600	0.896	0.0989	0.235
3060.900	0.753	0.0904	0.177
3061.200	0.74	0.0863	0.177
3061.500	0.702	0.0883	0.221
3061.800	0.705	0.0893	0.203
3062.100	0.808	0.0956	0.168
3062.400	0.936	0.104	0.177
3062.700	0.88	0.0994	0.196
3063.000	0.74	0.0884	0.162
3063.300	0.826	0.11	0.168
3063.600	0.911	0.111	0.162
3063.900	0.89	0.112	0.168
3064.200	0.695	0.0956	0.18
3064.500	0.773	0.0959	0.187
3064.800	0.878	0.111	0.194
3065.100	0.771	0.0901	0.152
3065.400	0.76	0.093	0.148
3065.700	0.845	0.0992	0.149
3066.000	0.894	0.0972	0.146

3066.300	0.904	0.108	0.157
3066.600	0.775	0.0892	0.196
3066.900	0.88	0.101	0.193
3067.200	0.963	0.106	0.153
3067.500	0.922	0.103	0.149
3067.800	0.835	0.0934	0.139
3068.100	0.724	0.0916	0.17
3068.400	0.596	0.0827	0.245
3068.700	0.619	0.0851	0.235
3069.000	0.627	0.0899	0.226
3069.300	0.655	0.0887	0.218
3069.600	0.751	0.105	0.182
3069.900	0.949	0.107	0.162
3070.200	0.98	0.108	0.174
3070.500	0.912	0.116	0.168
3070.800	0.831	0.106	0.158
3071.100	0.755	0.116	0.175
3071.400	0.696	0.103	0.181
3071.700	0.685	0.106	0.177
3072.000	1.05	0.144	0.177
3072.300	0.763	0.107	0.199
3072.600	0.73	0.101	0.209
3072.900	0.875	0.121	0.191
3073.200	0.827	0.133	0.197
3073.500	0.779	0.118	0.189
3073.800	0.734	0.125	0.192
3074.100	0.923	0.129	0.195
3074.400	0.967	0.143	0.205
3074.700	0.798	0.118	0.192
3075.000	0.802	0.119	0.188
3075.300	0.99	0.145	0.205
3075.600	0.99	0.132	0.201
3075.900	0.99	0.145	0.208
3076.200	0.882	0.125	0.197
3076.500	0.781	0.129	0.197
3076.800	0.915	0.128	0.196
3077.100	0.937	0.129	0.196
3077.400	0.898	0.139	0.202
3077.700	0.9	0.127	0.196
3078.000	0.911	0.14	0.203
3078.300	0.917	0.128	0.197
3078.600	0.923	0.14	0.204
3078.900	0.775	0.117	0.191
3079.200	0.767	0.117	0.187
3079.500	0.866	0.136	0.198
3079.800	0.861	0.124	0.194
3080.100	0.837	0.135	0.199
3080.400	0.87	0.125	0.195
3080.700	0.904	0.14	0.203
3081.000	0.85	0.125	0.195
3081.300	0.84	0.136	0.201
3081.600	0.828	0.123	0.193
3081.900	0.798	0.122	0.19
3082.200	0.676	0.122	0.19
3082.500	0.805	0.121	0.189
3082.800	0.948	0.142	0.203
3083.100	0.847	0.123	0.194
3083.400	0.754	0.127	0.194
3083.700	0.77	0.117	0.188
3084.000	0.807	0.119	0.187
3084.300	1	0.145	0.204
3084.600	0.901	0.126	0.196
3084.900	0.807	0.131	0.197
3085.200	0.853	0.123	0.192
3085.500	0.9	0.138	0.201
3085.800	0.94	0.129	0.197
3086.100	0.912	0.128	0.195
3086.400	0.754	0.127	0.195
3086.700	0.782	0.117	0.188
3087.000	0.944	0.142	0.203
3087.300	0.912	0.127	0.197
3087.600	0.88	0.137	0.202
3087.900	0.967	0.132	0.2
3088.200	0.985	0.146	0.209
3088.500	0.885	0.127	0.198
3088.800	0.858	0.126	0.194
3089.100	0.815	0.135	0.2
3089.400	0.893	0.129	0.197
3089.700	0.976	0.147	0.209
3090.000	0.942	0.132	0.201
3090.300	0.936	0.144	0.208
3090.600	0.943	0.132	0.201
3090.900	0.938	0.132	0.199
3091.200	0.909	0.142	0.206
3091.500	0.973	0.134	0.202
3091.800	1.04	0.152	0.213
3092.100	0.898	0.129	0.201
3092.400	0.769	0.132	0.199
3092.700	0.799	0.122	0.193
3093.000	0.783	0.122	0.19
3093.300	0.682	0.124	0.191
3093.600	0.714	0.114	0.185
3093.900	0.901	0.141	0.201
3094.200	0.887	0.128	0.197
3094.500	0.873	0.139	0.203
3094.800	0.986	0.134	0.202
3095.100	0.966	0.134	0.201
3095.400	0.774	0.131	0.198
3095.700	0.798	0.12	0.191
3096.000	0.927	0.142	0.203
3096.300	0.893	0.127	0.197
3096.600	0.861	0.137	0.202
3096.900	0.811	0.122	0.193
3097.200	0.801	0.133	0.198
3097.500	0.835	0.123	0.193
3097.800	0.85	0.124	0.192
3098.100	0.887	0.137	0.2
3098.400	0.779	0.118	0.19
3098.700	0.68	0.12	0.189
3099.000	0.751	0.115	0.185
3099.300	0.827	0.132	0.195
3099.600	0.906	0.127	0.194
3099.900	0.908	0.127	0.194
3100.200	0.837	0.133	0.198
3100.500	0.81	0.12	0.191
3100.800	0.784	0.13	0.195
3101.100	0.92	0.128	0.195
3101.400	1.07	0.151	0.211
3101.700	1.02	0.135	0.204
3102.000	0.968	0.133	0.201
3102.300	0.779	0.13	0.198
3102.600	0.804	0.12	0.191
3102.900	0.945	0.143	0.204
3103.200	0.917	0.129	0.198
3103.500	0.89	0.139	0.203
3103.800	0.722	0.114	0.189
3104.100	0.693	0.124	0.19
3104.400	0.923	0.131	0.196
3104.700	0.959	0.132	0.198
3105.000	0.869	0.138	0.203
3105.300	0.958	0.132	0.2
3105.600	1.05	0.151	0.212
3105.900	0.8	0.119	0.195
3106.200	0.758	0.129	0.195
3106.500	0.756	0.117	0.188
3106.800	0.743	0.116	0.186
3107.100	0.681	0.121	0.188
3107.400	0.775	0.118	0.187
3107.700	0.877	0.137	0.199
3108.000	0.905	0.127	0.195
3108.300	0.933	0.141	0.204
3108.600	0.652	0.107	0.185
3108.900	0.648	0.107	0.179
3109.200	0.891	0.138	0.197
3109.500	0.91	0.127	0.195
3109.800	1.01	0.148	0.208
3110.100	0.899	0.128	0.199
3110.400	0.794	0.132	0.198
3110.700	0.872	0.126	0.195
3111.000	0.874	0.126	0.194
3111.300	0.803	0.132	0.198
3111.600	0.832	0.122	0.192
3111.900	1	0.147	0.207
3112.200	0.928	0.129	0.199
3112.500	0.859	0.136	0.202
3112.800	0.84	0.123	0.194
3113.100	0.836	0.135	0.199
3113.400	0.864	0.125	0.194
3113.700	0.85	0.124	0.192
3114.000	0.762	0.128	0.194
3114.300	0.749	0.116	0.187
3114.600	0.735	0.125	0.191
3114.900	0.81	0.12	0.189
3115.200	0.89	0.138	0.2
3115.500	0.775	0.118	0.19
3115.800	0.766	0.118	0.187
3116.100	0.829	0.135	0.198
3116.400	0.876	0.127	0.195
3116.700	0.926	0.144	0.206
3117.000	0.992	0.136	0.203
3117.300	1.06	0.154	0.215
3117.600	1.13	0.146	0.212
3117.900	1.12	0.145	0.211
3118.200	1	0.15	0.214
3118.500	1.02	0.138	0.207
3118.800	1.15	0.16	0.22
3119.100	1.06	0.14	0.21
3119.400	0.969	0.147	0.212
3119.700	0.934	0.132	0.203
3120.000	0.927	0.145	0.209
3120.300	0.863	0.128	0.199
3120.600	0.86	0.128	0.196
3120.900	0.91	0.145	0.207
3121.200	0.96	0.136	0.204
3121.500	1.01	0.153	0.214
3121.800	0.855	0.127	0.2
3122.100	0.827	0.138	0.203
3122.400	1.06	0.142	0.207
3122.700	1.09	0.143	0.209
3123.000	0.978	0.147	0.211
3123.300	0.953	0.132	0.202
3123.600	0.929	0.142	0.206
3123.900	0.917	0.129	0.199
3124.200	0.905	0.14	0.204
3124.500	0.806	0.121	0.193
3124.800	0.821	0.122	0.19
3125.100	1.02	0.149	0.208
3125.400	1.01	0.135	0.204
3125.700	0.95	0.144	0.208
3126.000	0.994	0.135	0.203
3126.300	1.04	0.151	0.213
3126.600	0.939	0.131	0.202
3126.900	0.937	0.131	0.199
3127.200	1.02	0.151	0.212
3127.500	1	0.137	0.206
3127.800	0.928	0.144	0.209
3128.100	0.97	0.134	0.203
3128.400	1.01	0.151	0.213
3128.700	0.983	0.135	0.205
3129.000	0.978	0.148	0.211
3129.300	0.901	0.129	0.2
3129.600	0.915	0.129	0.197
3129.900	1.08	0.154	0.214
3130.200	0.971	0.134	0.204
3130.500	0.869	0.139	0.205
3130.800	0.905	0.129	0.199
3131.100	0.943	0.144	0.207
3131.400	0.921	0.13	0.2
3131.700	0.911	0.13	0.198
3132.000	0.881	0.14	0.204
3132.300	0.901	0.129	0.198
3132.600	0.921	0.143	0.206
3132.900	1.02	0.137	0.204
3133.200	1.12	0.157	0.218
3133.500	1.05	0.139	0.209
3133.800	1.03	0.139	0.206
3134.100	1	0.15	0.213
3134.400	0.971	0.136	0.205
3134.700	0.832	0.137	0.204
3135.000	0.96	0.134	0.201
3135.300	1.1	0.156	0.216
3135.600	1.05	0.139	0.209
3135.900	1.04	0.152	0.215
3136.200	1.01	0.137	0.207
3136.500	1.01	0.137	0.204
3136.800	1.05	0.153	0.215
3137.100	1.04	0.14	0.208
3137.400	1.03	0.152	0.215
3137.700	0.891	0.129	0.201
3138.000	0.865	0.14	0.205
3138.300	0.885	0.129	0.199
3138.600	0.893	0.13	0.197
3138.900	0.913	0.144	0.206
3139.200	0.862	0.127	0.198
3139.500	0.812	0.136	0.201
3139.800	0.816	0.124	0.194
3140.100	0.819	0.136	0.2
3140.400	0.856	0.126	0.195
3140.700	0.861	0.126	0.194
3141.000	0.846	0.137	0.201
3141.300	0.874	0.126	0.195
3141.600	1.03	0.151	0.211
3141.900	0.994	0.135	0.204
3142.200	0.958	0.145	0.209
3142.500	0.983	0.134	0.203

3142.800	0.965	0.133	0.2
3143.100	0.858	0.137	0.202
3143.400	0.858	0.125	0.195
3143.700	0.86	0.137	0.201
3144.000	0.826	0.123	0.193
3144.300	0.792	0.132	0.197
3144.600	0.978	0.135	0.201
3144.900	1.02	0.15	0.212
3145.200	0.857	0.125	0.198
3145.500	0.832	0.124	0.193
3145.800	0.859	0.14	0.203
3146.100	0.913	0.134	0.201
3146.400	0.971	0.154	0.215
3146.700	1.02	0.149	0.214
3147.000	1.07	0.172	0.231
3147.300	0.927	0.145	0.216
3147.600	0.879	0.143	0.211
3147.900	0.779	0.147	0.212
3148.200	0.833	0.139	0.207
3148.500	0.889	0.157	0.219
3148.800	0.859	0.141	0.21
3149.100	0.829	0.152	0.216
3149.400	0.752	0.132	0.203
3149.700	0.737	0.131	0.199
3150.000	0.734	0.143	0.207
3150.300	0.75	0.131	0.201
3150.600	0.835	0.152	0.213
3150.900	0.907	0.144	0.211
3151.200	0.984	0.164	0.225
3151.500	0.766	0.132	0.206
3151.800	0.73	0.142	0.207
3152.100	0.793	0.136	0.204
3152.400	0.86	0.139	0.205
3152.700	1.2	0.181	0.236
3153.000	1.05	0.156	0.225
3153.300	0.922	0.16	0.225
3153.600	0.866	0.142	0.213
3153.900	0.855	0.155	0.218
3154.200	0.983	0.153	0.219
3154.500	0.963	0.152	0.218
3154.800	0.754	0.147	0.214
3155.100	0.809	0.139	0.208
3155.400	0.866	0.157	0.219
3155.700	0.898	0.146	0.214
3156.000	0.932	0.163	0.224
3156.300	0.961	0.15	0.218
3156.600	0.974	0.15	0.216
3156.900	1.01	0.167	0.228
3157.200	0.994	0.151	0.219
3157.500	0.921	0.146	0.214
3157.800	0.979	0.137	0.206
3158.100	1.04	0.155	0.216
3158.400	0.903	0.131	0.203
3158.700	0.841	0.128	0.198
3159.000	0.679	0.125	0.194
3159.300	0.7	0.115	0.186
3159.600	0.812	0.135	0.197
3159.900	0.815	0.123	0.192
3160.200	0.819	0.135	0.199
3160.500	1.02	0.138	0.203
3160.800	1.06	0.153	0.214
3161.100	0.994	0.135	0.205
3161.400	0.987	0.135	0.202
3161.700	1.03	0.151	0.212
3162.000	0.951	0.133	0.203
3162.300	0.876	0.14	0.205
3162.600	0.931	0.132	0.2
3162.900	0.989	0.149	0.211
3163.200	1.15	0.147	0.212
3163.500	1.15	0.147	0.213
3163.800	0.985	0.149	0.214
3164.100	0.977	0.136	0.205
3164.400	0.968	0.148	0.212
3164.700	0.954	0.135	0.204
3165.000	0.939	0.147	0.21
3165.300	0.945	0.135	0.204
3165.600	0.942	0.135	0.202
3165.900	0.923	0.146	0.209
3166.200	0.919	0.133	0.202
3166.500	0.897	0.144	0.208
3166.800	0.953	0.135	0.204
3167.100	1.01	0.152	0.214
3167.400	0.911	0.132	0.203
3167.700	0.893	0.144	0.208
3168.000	0.881	0.13	0.2
3168.300	0.897	0.13	0.198
3168.600	0.992	0.151	0.211
3168.900	0.96	0.135	0.204
3169.200	0.929	0.146	0.21
3169.500	0.822	0.125	0.197
3169.800	0.802	0.136	0.201
3170.100	0.849	0.128	0.197
3170.400	0.894	0.129	0.196
3170.700	1.1	0.157	0.216
3171.000	1.03	0.139	0.208
3171.300	0.954	0.146	0.211
3171.600	0.932	0.132	0.202
3171.900	0.911	0.143	0.207
3172.200	0.869	0.127	0.198
3172.500	0.849	0.126	0.194
3172.800	0.792	0.133	0.198
3173.100	0.785	0.121	0.192
3173.400	0.75	0.13	0.195
3173.700	0.726	0.117	0.188
3174.000	0.702	0.126	0.192
3174.300	1.01	0.14	0.202
3174.600	1.02	0.141	0.206
3174.900	0.74	0.129	0.199
3175.200	0.766	0.12	0.191
3175.500	0.918	0.144	0.205
3175.800	0.946	0.134	0.202
3176.100	0.975	0.149	0.212
3176.400	0.957	0.135	0.204
3176.700	0.953	0.148	0.211
3177.000	1	0.139	0.206
3177.300	0.994	0.138	0.205
3177.600	0.91	0.144	0.209
3177.900	0.993	0.137	0.205
3178.200	1.08	0.157	0.218
3178.500	0.973	0.136	0.207
3178.800	0.871	0.141	0.207
3179.100	0.82	0.125	0.196
3179.400	0.826	0.125	0.194
3179.700	0.91	0.144	0.206
3180.000	0.821	0.125	0.196
3180.300	0.737	0.131	0.197
3180.600	0.844	0.127	0.195
3180.900	0.96	0.148	0.209
3181.200	0.947	0.134	0.203
3181.500	0.944	0.134	0.201
3181.800	0.94	0.146	0.209
3182.100	0.967	0.134	0.203
3182.400	1.11	0.157	0.218
3182.700	1.06	0.141	0.21
3183.000	1.02	0.151	0.214
3183.300	1.02	0.137	0.207
3183.600	1.02	0.151	0.214
3183.900	0.774	0.119	0.195
3184.200	0.775	0.119	0.189
3184.500	1.02	0.151	0.21
3184.800	0.835	0.125	0.197
3185.100	0.671	0.123	0.193
3185.400	0.806	0.124	0.192
3185.700	0.836	0.137	0.2
3186.000	0.77	0.121	0.192
3186.300	0.789	0.122	0.19
3186.600	0.972	0.149	0.208
3186.900	0.955	0.135	0.203
3187.200	0.938	0.147	0.21
3187.500	0.848	0.128	0.199
3187.800	0.763	0.133	0.199
3188.100	0.776	0.123	0.193
3188.400	0.81	0.124	0.192
3188.700	0.992	0.151	0.21
3189.000	0.968	0.137	0.205
3189.300	0.856	0.141	0.206
3189.600	0.866	0.129	0.199
3189.900	0.876	0.141	0.205
3190.200	0.86	0.128	0.198
3190.500	0.851	0.127	0.195
3190.800	0.823	0.136	0.201
3191.100	0.852	0.126	0.195
3191.400	1.02	0.151	0.211
3191.700	1.07	0.141	0.208
3192.000	1.13	0.159	0.22
3192.300	0.892	0.129	0.202
3192.600	0.852	0.139	0.205
3192.900	0.802	0.123	0.195
3193.200	0.824	0.124	0.192
3193.500	1	0.151	0.21
3193.800	1.01	0.138	0.206
3194.100	1.01	0.152	0.215
3194.400	0.941	0.134	0.205
3194.700	0.873	0.142	0.207
3195.000	1.05	0.144	0.209
3195.300	1	0.142	0.208
3195.600	0.65	0.124	0.196
3195.900	0.757	0.122	0.191
3196.200	0.873	0.143	0.204
3196.500	0.919	0.133	0.201
3196.800	0.966	0.149	0.211
3197.100	1.01	0.138	0.206
3197.400	1.01	0.138	0.205
3197.700	0.953	0.147	0.211
3198.000	0.955	0.134	0.204
3198.300	0.965	0.148	0.211
3198.600	0.904	0.131	0.201
3198.900	0.845	0.139	0.204
3199.200	0.966	0.136	0.203
3199.500	0.992	0.15	0.212
3199.800	0.992	0.137	0.206
3200.100	0.969	0.136	0.203
3200.400	0.863	0.14	0.205
3200.700	0.908	0.13	0.199
3201.000	0.954	0.146	0.208
3201.300	0.849	0.112	0.189
3201.600	0.803	0.134	0.197
3201.900	0.933	0.133	0.199
3202.200	0.956	0.133	0.2
3202.500	0.926	0.144	0.207
3202.800	0.921	0.131	0.2
3203.100	0.916	0.143	0.207
3203.400	0.837	0.125	0.197
3203.700	0.762	0.131	0.198
3204.000	0.806	0.124	0.193
3204.300	0.801	0.124	0.192
3204.600	0.732	0.129	0.195
3204.900	0.766	0.12	0.19
3205.200	0.965	0.148	0.207
3205.500	0.993	0.137	0.204
3205.800	1.02	0.152	0.214
3206.100	0.844	0.125	0.199
3206.400	0.813	0.136	0.201
3206.700	0.904	0.131	0.199
3207.000	0.919	0.132	0.198
3207.300	0.9	0.143	0.206
3207.600	0.894	0.13	0.199
3207.900	0.888	0.142	0.206
3208.200	0.848	0.126	0.197
3208.500	0.84	0.138	0.202
3208.800	0.951	0.134	0.201
3209.100	0.96	0.135	0.201
3209.400	0.888	0.142	0.206
3209.700	0.86	0.128	0.198
3210.000	0.833	0.138	0.203
3210.300	0.856	0.128	0.197
3210.600	0.879	0.143	0.206
3210.900	1.09	0.146	0.21
3211.200	1.09	0.146	0.211
3211.500	0.888	0.144	0.21
3211.800	0.888	0.131	0.201
3212.100	0.885	0.143	0.207
3212.400	0.878	0.13	0.2
3212.700	0.872	0.142	0.206
3213.000	0.745	0.12	0.193
3213.300	0.754	0.12	0.189
3213.600	0.939	0.148	0.207
3213.900	0.939	0.135	0.203
3214.200	0.941	0.148	0.211
3214.500	0.942	0.135	0.204
3214.800	0.944	0.148	0.211
3215.100	0.859	0.129	0.2
3215.400	0.843	0.141	0.205
3215.700	0.893	0.132	0.201
3216.000	0.908	0.133	0.2
3216.300	0.93	0.147	0.209
3216.600	0.961	0.135	0.204
3216.900	0.992	0.15	0.212
3217.200	0.84	0.125	0.198
3217.500	0.813	0.136	0.201
3217.800	0.793	0.122	0.193
3218.100	0.806	0.123	0.191
3218.400	0.9	0.143	0.204
3218.700	0.869	0.128	0.198
3219.000	0.839	0.138	0.202

3219.300	0.861	0.127	0.197
3219.600	0.883	0.141	0.204
3219.900	0.812	0.123	0.195
3220.200	0.806	0.123	0.192
3220.500	0.841	0.138	0.201
3220.800	0.826	0.125	0.195
3221.100	0.752	0.132	0.198
3221.400	0.658	0.114	0.187
3221.700	0.572	0.117	0.185
3222.000	0.861	0.132	0.195
3222.300	0.871	0.133	0.198
3222.600	0.615	0.121	0.192
3222.900	0.672	0.114	0.185
3223.200	1.08	0.157	0.213
3223.500	0.865	0.13	0.201
3223.800	0.679	0.126	0.195
3224.100	0.762	0.122	0.191
3224.400	0.78	0.135	0.198
3224.700	0.699	0.116	0.189
3225.000	0.702	0.116	0.186
3225.300	0.802	0.137	0.199
3225.600	0.838	0.128	0.196
3225.900	0.876	0.143	0.206
3226.200	0.866	0.13	0.199
3226.500	0.856	0.141	0.205
3226.800	0.818	0.125	0.196
3227.100	0.837	0.126	0.194
3227.400	0.992	0.15	0.21
3227.700	0.96	0.136	0.204
3228.000	0.818	0.136	0.203
3228.300	0.818	0.125	0.195
3228.600	0.818	0.137	0.201
3228.900	0.96	0.136	0.202
3229.200	0.995	0.137	0.203
3229.500	1	0.151	0.213
3229.800	0.98	0.137	0.206
3230.100	0.876	0.142	0.208
3230.400	0.925	0.133	0.202
3230.700	0.976	0.149	0.212
3231.000	0.753	0.119	0.194
3231.300	0.716	0.129	0.195
3231.600	0.839	0.128	0.195
3231.900	0.918	0.131	0.197
3232.200	1.23	0.168	0.224
3232.500	0.975	0.137	0.209
3232.800	0.757	0.133	0.202
3233.100	0.756	0.121	0.193
3233.400	0.756	0.132	0.197
3233.700	0.884	0.131	0.198
3234.000	0.885	0.131	0.198
3234.300	0.76	0.132	0.199
3234.600	0.77	0.121	0.192
3234.900	0.781	0.133	0.198
3235.200	0.8	0.123	0.193
3235.500	0.819	0.137	0.2
3235.800	0.93	0.133	0.2
3236.100	0.925	0.133	0.2
3236.400	0.794	0.135	0.201
3236.700	0.803	0.123	0.194
3237.000	0.851	0.139	0.202
3237.300	0.874	0.128	0.197
3237.600	0.898	0.143	0.206
3237.900	0.718	0.116	0.19
3238.200	0.688	0.125	0.192
3238.500	0.752	0.12	0.189
3238.800	0.753	0.12	0.188
3239.100	0.693	0.126	0.192
3239.400	0.713	0.117	0.187
3239.700	0.733	0.129	0.194
3240.000	0.825	0.126	0.193
3240.300	0.845	0.139	0.202
3240.600	0.867	0.128	0.197
3240.900	0.856	0.128	0.196
3241.200	0.785	0.135	0.2
3241.500	0.871	0.129	0.197
3241.800	0.962	0.148	0.209
3242.100	0.871	0.129	0.2
3242.400	0.786	0.135	0.201
3242.700	0.826	0.126	0.195
3243.000	0.824	0.126	0.194
3243.300	0.778	0.133	0.198
3243.600	0.806	0.123	0.193
3243.900	0.96	0.147	0.207
3244.200	0.922	0.132	0.201
3244.500	0.885	0.141	0.206
3244.800	1.06	0.142	0.208
3245.100	1.1	0.144	0.209
3245.400	1.07	0.156	0.218
3245.700	1.05	0.142	0.211
3246.000	0.942	0.147	0.212
3246.300	0.903	0.132	0.202
3246.600	0.866	0.141	0.206
3246.900	0.747	0.119	0.193
3247.200	0.726	0.129	0.195
3247.500	0.972	0.138	0.202
3247.800	0.977	0.138	0.203
3248.100	0.747	0.131	0.199
3248.400	0.828	0.125	0.195
3248.700	0.914	0.144	0.206
3249.000	0.831	0.125	0.196
3249.300	0.753	0.131	0.198
3249.600	0.954	0.136	0.201
3249.900	0.964	0.136	0.202
3250.200	0.801	0.136	0.203
3250.500	0.699	0.117	0.19
3250.800	0.606	0.12	0.188
3251.100	0.731	0.12	0.188
3251.400	0.872	0.142	0.202
3251.700	0.906	0.132	0.2
3252.000	0.903	0.132	0.199
3252.300	0.854	0.139	0.204
3252.600	0.862	0.127	0.197
3252.900	0.904	0.142	0.205
3253.200	0.919	0.131	0.2
3253.500	0.935	0.144	0.207
3253.800	0.887	0.128	0.199
3254.100	0.878	0.14	0.204
3254.400	0.935	0.133	0.201
3254.700	0.931	0.133	0.2
3255.000	0.854	0.139	0.204
3255.300	0.884	0.129	0.198
3255.600	0.914	0.144	0.207
3255.900	0.871	0.128	0.199
3256.200	0.829	0.137	0.202
3256.500	1.06	0.143	0.207
3256.800	1.05	0.142	0.208
3257.100	0.807	0.136	0.204
3257.400	0.869	0.129	0.198
3257.700	0.933	0.146	0.208
3258.000	0.809	0.124	0.196
3258.300	0.697	0.126	0.195
3258.600	0.973	0.137	0.201
3258.900	0.98	0.138	0.203
3259.200	0.73	0.129	0.198
3259.500	0.78	0.12	0.191
3259.800	1.11	0.157	0.215
3260.100	0.801	0.124	0.198
3260.400	0.552	0.113	0.186
3260.700	0.814	0.126	0.191
3261.000	0.88	0.141	0.203
3261.300	0.995	0.137	0.203
3261.600	0.944	0.135	0.202
3261.900	0.645	0.122	0.193
3262.200	0.75	0.12	0.189
3262.500	0.865	0.141	0.203
3262.800	1.05	0.143	0.207
3263.100	1.09	0.158	0.219
3263.400	0.851	0.128	0.201
3263.700	0.815	0.126	0.196
3264.000	0.834	0.139	0.203
3264.300	0.882	0.13	0.199
3264.600	0.931	0.147	0.209
3264.900	0.781	0.123	0.196
3265.200	0.648	0.123	0.192
3265.500	0.695	0.116	0.186
3265.800	0.735	0.117	0.186
3266.100	0.908	0.143	0.203
3266.400	0.879	0.129	0.198
3266.700	0.749	0.131	0.198
3267.000	0.705	0.116	0.188
3267.300	0.662	0.123	0.189
3267.600	0.763	0.121	0.189
3267.900	0.768	0.121	0.189
3268.200	0.688	0.125	0.192
3268.500	0.715	0.116	0.186
3268.800	0.874	0.141	0.201
3269.100	0.873	0.128	0.197
3269.400	0.873	0.14	0.204
3269.700	0.87	0.128	0.197
3270.000	0.869	0.14	0.204
3270.300	0.858	0.127	0.197
3270.600	0.863	0.127	0.195
3270.900	0.895	0.142	0.204
3271.200	0.81	0.124	0.195
3271.500	0.731	0.129	0.196
3271.800	0.9	0.131	0.197
3272.100	1.09	0.157	0.216
3272.400	0.826	0.124	0.199
3272.700	0.82	0.124	0.193
3273.000	1.05	0.153	0.212
3273.300	0.933	0.132	0.203
3273.600	0.825	0.137	0.203
3273.900	0.845	0.126	0.196
3274.200	0.866	0.14	0.204
3274.500	0.81	0.124	0.195
3274.800	0.809	0.124	0.193
3275.100	0.859	0.141	0.203
3275.400	0.866	0.129	0.198
3275.700	0.906	0.146	0.208
3276.000	0.865	0.13	0.2
3276.300	0.824	0.14	0.204
3276.600	0.93	0.136	0.203
3276.900	0.953	0.15	0.212
3277.200	0.831	0.127	0.2
3277.500	0.828	0.127	0.196
3277.800	0.931	0.148	0.209
3278.100	0.882	0.131	0.201
3278.400	0.835	0.14	0.205
3278.700	0.832	0.127	0.197
3279.000	0.831	0.139	0.203
3279.300	0.757	0.121	0.193
3279.600	0.75	0.121	0.19
3279.900	0.785	0.136	0.199
3280.200	0.816	0.126	0.195
3280.500	0.848	0.14	0.203
3280.800	0.82	0.126	0.196
3281.100	0.793	0.136	0.2
3281.400	0.803	0.124	0.194
3281.700	0.774	0.122	0.191
3282.000	0.637	0.12	0.189
3282.300	0.658	0.111	0.182
3282.600	0.779	0.132	0.194
3282.900	0.811	0.123	0.192
3283.200	0.845	0.138	0.201
3283.500	0.96	0.135	0.201
3283.800	0.985	0.149	0.211
3284.100	0.937	0.133	0.203
3284.400	0.933	0.133	0.2
3284.700	0.956	0.147	0.209
3285.000	0.937	0.134	0.203
3285.300	0.918	0.145	0.209
3285.600	0.844	0.128	0.199
3285.900	0.83	0.14	0.204
3286.200	0.878	0.132	0.2
3286.500	0.9	0.133	0.2
3286.800	0.961	0.15	0.211
3287.100	0.913	0.133	0.203
3287.400	0.866	0.143	0.207
3287.700	0.792	0.124	0.196
3288.000	0.722	0.13	0.197
3288.300	0.947	0.137	0.201
3288.600	0.968	0.138	0.203
3288.900	0.824	0.139	0.204
3289.200	0.849	0.128	0.197
3289.500	0.99	0.152	0.212
3289.800	0.912	0.133	0.203
3290.100	0.838	0.14	0.205
3290.400	0.685	0.115	0.19
3290.700	0.679	0.114	0.185
3291.000	0.794	0.136	0.197
3291.300	0.792	0.124	0.193
3291.600	0.78	0.135	0.199
3291.900	0.975	0.137	0.202
3292.200	1.2	0.165	0.223
3292.500	0.791	0.122	0.199
3292.800	0.732	0.131	0.198
3293.100	0.865	0.13	0.197
3293.400	0.886	0.131	0.198
3293.700	0.844	0.14	0.204
3294.000	0.824	0.126	0.196
3294.300	0.804	0.136	0.201
3294.600	0.803	0.124	0.194
3294.900	0.802	0.136	0.2
3295.200	0.957	0.136	0.202
3295.500	0.984	0.137	0.203

3295.800	0.944	0.147	0.21
3296.100	0.874	0.129	0.2
3296.400	0.808	0.136	0.202
3296.700	0.81	0.125	0.195
3297.000	0.812	0.137	0.201
3297.300	0.998	0.139	0.204
3297.600	1.03	0.14	0.206
3297.900	0.985	0.15	0.213
3298.200	0.955	0.136	0.205
3298.500	0.821	0.137	0.204
3298.800	0.918	0.132	0.201
3299.100	1.02	0.153	0.214
3299.400	0.731	0.117	0.194
3299.700	0.685	0.126	0.193
3300.000	0.878	0.131	0.196
3300.300	0.949	0.134	0.199
3300.600	1.09	0.157	0.217
3300.900	0.927	0.134	0.205
3301.200	0.781	0.135	0.202
3301.500	0.877	0.131	0.199
3301.800	0.898	0.144	0.207
3302.100	1.06	0.143	0.208
3302.400	1.03	0.142	0.208
3302.700	0.781	0.135	0.203
3303.000	0.802	0.125	0.195
3303.300	0.824	0.139	0.202
3303.600	0.796	0.125	0.195
3303.900	0.768	0.135	0.199
3304.200	0.869	0.132	0.199
3304.500	0.91	0.134	0.2
3304.800	1.01	0.155	0.215
3305.100	0.992	0.14	0.209
3305.400	0.905	0.147	0.211
3305.700	0.858	0.13	0.201
3306.000	0.812	0.139	0.204
3306.300	0.919	0.135	0.203
3306.600	0.942	0.149	0.212
3306.900	0.858	0.13	0.201
3307.200	0.815	0.128	0.197
3307.500	0.69	0.129	0.197
3307.800	0.801	0.127	0.195
3308.100	0.922	0.148	0.209
3308.400	0.957	0.137	0.205
3308.700	0.964	0.151	0.213
3309.000	0.689	0.115	0.192
3309.300	0.648	0.113	0.185
3309.600	0.654	0.124	0.189
3309.900	0.721	0.118	0.187
3310.200	0.793	0.136	0.198
3310.500	0.82	0.126	0.195
3310.800	0.847	0.14	0.203
3311.100	0.758	0.121	0.193
3311.400	0.777	0.122	0.191
3311.700	0.989	0.153	0.211
3312.000	0.996	0.14	0.207
3312.300	1.04	0.157	0.218
3312.600	0.977	0.139	0.209
3312.900	0.916	0.147	0.212
3313.200	0.995	0.14	0.208
3313.500	0.99	0.14	0.206
3313.800	0.889	0.144	0.209
3314.100	0.887	0.132	0.201
3314.400	0.877	0.143	0.207
3314.700	0.893	0.132	0.201
3315.000	0.909	0.146	0.209
3315.300	0.899	0.133	0.202
3315.600	0.897	0.145	0.209
3315.900	0.823	0.127	0.198
3316.200	0.819	0.127	0.195
3316.500	0.871	0.143	0.205
3316.800	0.99	0.139	0.206
3317.100	1.12	0.162	0.222
3317.400	0.978	0.139	0.21
3317.700	0.848	0.143	0.209
3318.000	0.875	0.137	0.205
3318.300	0.882	0.139	0.205
3318.600	0.886	0.163	0.222
3318.900	0.922	0.151	0.218
3319.200	0.959	0.168	0.229
3319.500	0.767	0.138	0.211
3319.800	0.601	0.134	0.203
3320.100	0.964	0.157	0.217
3320.400	1.03	0.16	0.223
3320.700	0.891	0.162	0.226
3321.000	0.897	0.148	0.217
3321.300	0.93	0.166	0.227
3321.600	0.883	0.148	0.217
3321.900	0.837	0.158	0.222
3322.200	0.95	0.155	0.221
3322.500	0.975	0.171	0.232
3322.800	0.977	0.156	0.224
3323.100	0.962	0.156	0.222
3323.400	0.893	0.164	0.227
3323.700	0.839	0.145	0.215
3324.000	0.787	0.153	0.218
3324.300	1.02	0.16	0.223
3324.600	1.07	0.178	0.238
3324.900	0.742	0.134	0.211
3325.200	0.689	0.132	0.202
3325.500	0.68	0.144	0.208
3325.800	0.814	0.144	0.209
3326.100	0.965	0.171	0.229
3326.400	0.9	0.151	0.22
3326.700	0.838	0.16	0.224
3327.000	1.07	0.166	0.229
3327.300	1.09	0.167	0.231
3327.600	0.953	0.17	0.234
3327.900	0.917	0.153	0.222
3328.200	0.762	0.151	0.218
3328.500	0.742	0.134	0.205
3328.800	0.723	0.144	0.209
3329.100	0.772	0.125	0.197
3329.400	0.781	0.136	0.201
3329.700	0.649	0.113	0.187
3330.000	0.666	0.113	0.183
3330.300	0.924	0.148	0.205
3330.600	0.799	0.126	0.197
3330.900	0.685	0.128	0.196
3331.200	0.879	0.134	0.199
3331.500	0.925	0.149	0.21
3331.800	0.936	0.137	0.205
3332.100	0.942	0.137	0.204
3332.400	0.963	0.152	0.214
3332.700	0.832	0.129	0.201
3333.000	0.713	0.131	0.199
3333.300	0.744	0.122	0.192
3333.600	0.775	0.136	0.2
3333.900	0.958	0.139	0.204
3334.200	0.972	0.139	0.205
3334.500	0.844	0.142	0.207
3334.800	0.847	0.13	0.2
3335.100	0.859	0.144	0.207
3335.400	0.864	0.131	0.2
3335.700	0.868	0.144	0.207
3336.000	0.931	0.136	0.204
3336.300	0.923	0.136	0.203
3336.600	0.826	0.14	0.205
3336.900	0.834	0.128	0.198
3337.200	0.877	0.144	0.207
3337.500	0.926	0.135	0.203
3337.800	0.976	0.152	0.213
3338.100	0.822	0.127	0.199
3338.400	0.795	0.137	0.203
3338.700	0.622	0.111	0.186
3339.000	0.644	0.112	0.182
3339.300	0.992	0.154	0.21
3339.600	0.892	0.134	0.203
3339.900	0.797	0.139	0.204
3340.200	0.78	0.125	0.196
3340.500	0.763	0.136	0.201
3340.800	0.943	0.14	0.205
3341.100	0.978	0.141	0.207
3341.400	0.946	0.152	0.215
3341.700	0.939	0.139	0.208
3342.000	0.903	0.149	0.213
3342.300	0.951	0.139	0.207
3342.600	1	0.155	0.217
3342.900	0.86	0.131	0.203
3343.200	0.865	0.131	0.199
3343.500	1.03	0.157	0.216
3343.800	1.02	0.143	0.211
3344.100	0.974	0.153	0.217
3344.400	0.931	0.137	0.207
3344.700	0.89	0.148	0.212
3345.000	0.927	0.138	0.206
3345.300	0.935	0.152	0.214
3345.600	0.728	0.121	0.196
3345.900	0.722	0.121	0.191
3346.200	0.887	0.147	0.207
3346.500	0.846	0.131	0.2
3346.800	0.806	0.14	0.205
3347.100	0.896	0.135	0.202
3347.400	0.992	0.155	0.216
3347.700	0.87	0.132	0.204
3348.000	0.884	0.133	0.201
3348.300	1.09	0.163	0.221
3348.600	1.13	0.151	0.217
3348.900	1.17	0.168	0.229
3349.200	1.07	0.147	0.217
3349.500	0.976	0.154	0.219
3349.800	1	0.143	0.211
3350.100	0.985	0.142	0.209
3350.400	0.866	0.146	0.211
3350.700	0.879	0.134	0.203
3351.000	0.947	0.152	0.214
3351.300	0.948	0.139	0.208
3351.600	0.948	0.152	0.215
3351.900	0.959	0.14	0.209
3352.200	0.961	0.153	0.216
3352.500	0.782	0.126	0.2
3352.800	0.774	0.126	0.195
3353.100	0.9	0.149	0.21
3353.400	0.895	0.136	0.205
3353.700	0.89	0.149	0.212
3354.000	0.867	0.134	0.204
3354.300	0.845	0.145	0.209
3354.600	0.842	0.131	0.201
3354.900	0.844	0.131	0.199
3355.200	0.861	0.145	0.208
3355.500	0.919	0.136	0.204
3355.800	0.98	0.154	0.215
3356.100	0.906	0.136	0.206
3356.400	0.836	0.143	0.208
3356.700	0.872	0.134	0.203
3357.000	0.884	0.134	0.201
3357.300	0.912	0.15	0.212
3357.600	0.894	0.136	0.205
3357.900	0.807	0.142	0.207
3358.200	0.82	0.13	0.2
3358.500	0.833	0.144	0.207
3358.800	0.773	0.126	0.197
3359.100	0.762	0.137	0.202
3359.400	0.757	0.124	0.195
3359.700	0.749	0.124	0.192
3360.000	0.713	0.132	0.197
3360.300	0.678	0.118	0.189
3360.600	0.645	0.126	0.192
3360.900	0.89	0.136	0.199
3361.200	0.95	0.152	0.213
3361.500	0.982	0.141	0.208
3361.800	0.958	0.14	0.207
3362.100	0.822	0.142	0.208
3362.400	0.856	0.132	0.201
3362.700	0.89	0.148	0.21
3363.000	0.898	0.136	0.204
3363.300	0.906	0.149	0.212
3363.600	0.873	0.133	0.203
3363.900	0.869	0.133	0.201
3364.200	0.88	0.147	0.21
3364.500	0.886	0.135	0.204
3364.800	0.92	0.15	0.212
3365.100	0.937	0.138	0.207
3365.400	0.955	0.152	0.215
3365.700	0.977	0.141	0.209
3366.000	0.937	0.139	0.207
3366.300	0.745	0.137	0.204
3366.600	0.723	0.124	0.195
3366.900	0.618	0.132	0.198
3367.200	0.754	0.137	0.202
3367.500	0.913	0.168	0.225
3367.800	0.774	0.141	0.212
3368.100	0.749	0.153	0.216
3368.400	0.774	0.142	0.21
3368.700	0.794	0.143	0.209
3369.000	0.874	0.164	0.224
3369.300	0.906	0.152	0.219
3369.600	0.939	0.169	0.23
3369.900	0.897	0.151	0.22
3370.200	0.857	0.162	0.225
3370.500	1.05	0.165	0.228
3370.800	1.05	0.165	0.229
3371.100	0.847	0.162	0.227
3371.400	0.858	0.148	0.218
3371.700	0.917	0.168	0.229
3372.000	0.918	0.154	0.222

3372.300	0.918	0.169	0.231
3372.600	0.875	0.15	0.219
3372.900	0.885	0.15	0.217
3373.200	0.985	0.175	0.234
3373.500	0.968	0.159	0.226
3373.800	0.889	0.167	0.23
3374.100	0.859	0.15	0.219
3374.400	0.83	0.162	0.225
3374.700	0.861	0.154	0.221
3375.000	0.868	0.17	0.231
3375.300	0.956	0.166	0.231
3375.600	0.998	0.171	0.234
3375.900	1.13	0.22	0.273
3376.200	1.05	0.194	0.261
3376.500	0.966	0.204	0.266
3376.800	0.905	0.18	0.249
3377.100	0.847	0.189	0.252
3377.400	0.799	0.162	0.233
3377.700	0.794	0.159	0.226
3378.000	0.811	0.16	0.226
3378.300	0.84	0.148	0.217
3378.600	1	0.178	0.236
3378.900	0.872	0.152	0.222
3379.200	0.753	0.156	0.221
3379.500	0.759	0.143	0.212
3379.800	0.788	0.145	0.211
3380.100	0.95	0.175	0.232
3380.400	0.958	0.16	0.227
3380.700	1	0.179	0.239
3381.000	0.904	0.156	0.226
3381.300	0.813	0.164	0.228
3381.600	0.812	0.155	0.222
3381.900	0.812	0.171	0.232
3382.200	0.805	0.167	0.232
3382.500	0.777	0.167	0.231
3382.800	0.659	0.167	0.232
3383.100	0.661	0.155	0.223
3383.400	0.662	0.172	0.233
3383.700	0.71	0.164	0.23
3384.000	0.76	0.187	0.246
3384.300	0.844	0.211	0.268
3384.600	0.835	0.214	0.275
3384.900	0.695	0.214	0.276
3385.200	0.904	0.221	0.282
3385.500	1.15	0.271	0.324
3385.800	1.09	0.241	0.306
3386.100	1.03	0.256	0.316
3386.400	0.883	0.215	0.285
3386.700	0.887	0.215	0.279

FOS Composite Quasar Spectrum

This is a mean quasar spectrum, between 350 and 3000 Å, constructed from 2 84 FOS obser vations of 101 quasars with redshifts $z > 0.33$, as described in **Zheng, W., et al. 1997 ApJ,475,469**, from the 1 Feb issue of *The Astrophysical Journal*. This reduced archival data is made available courtesy of Wei Zheng .

The spectrum is available as a flat ASCII file:

- **Uncompressed** (409.96 kbytes)
- **Unix compressed** (93.087 kbytes)
- **gzip compressed** (78.277 kbytes)

(Your browser should attempt to save the above files to disk, rather than displa ying them.)

The table columns are:

- **Rest wavelength (Å)**
- **Relative flux F(λ)**
- **Error**
- **RMS**

GHRS Observations of 10 Lac

Wavelength range (Å)	Observation Rootname	Reduced GHRS Data	Line ID List	Atlas Fig. #
1180-1350	Mosaic-1	Data	IDs	1
1350-1500	Mosaic-2		IDs	1
1500-1650	Mosaic-3		IDs	1
1650-1780	Mosaic-4		IDs	1
1181-1199	Z2MB010D	Data	IDs	2a
1199-1217	Z2MB010G		IDs	2b
1210-1228	Z2MB010H	Data	IDs	3a
1229-1247	Z3650308		IDs	3b
1238-1256	Z2MB010I	Data	IDs	4a
1256-1274	Z365030B		IDs	4b
1266-1284	Z2MB010L	Data	IDs	5a
1284-1302	Z3650307		IDs	5b
1294-1312	Z2MB010M	Data	IDs	6a
1312-1330	Z0IX010R		IDs	6b
1321-1339	Z0IX010J	Data	IDs	7a
1340-1357	Z13J010M		IDs	7b
1349-1367	Z13J510M	Data	IDs	8a
1367-1385	Z28H010M		IDs	8b
1378-1396	Z0G7010J	Data	IDs	9a
1395-1414	Z0IX010B		IDs	9b
1406-1423	Z16C0107	Data	IDs	10a
1423-1441	Z16C0108		IDs	10b
1435-1452	Z16C0108	Data	IDs	11a
1452-1470	Z16C0108		IDs	11b
1462-1479	Z16C0108	Data	IDs	12a
1480-1497	Z16C0108		IDs	12b
1491-1508	Z16C0108	Data	IDs	13a
1508-1526	Z16C0108		IDs	13b
1518-1535	Z16C0108	Data	IDs	14a
1535-1553	Z16C0108		IDs	14b
1546-1564	Z16C0108	Data	IDs	15a
1564-1581	Z16C0108		IDs	15b
1575-1592	Z16C0108	Data	IDs	16a
1592-1610	Z16C0108		IDs	16b
1603-1620	Z16C0108	Data	IDs	17a
1621-1638	Z16C0108		IDs	17b
1630-1647	Z16C0108	Data	IDs	18a
1647-1665	Z16C0108		IDs	18b
1658-1675	Z16C0108	Data	IDs	19a
1675-1693	Z16C0108		IDs	19b
1686-1703	Z16C0108	Data	IDs	20a
1704-1721	Z16C0108		IDs	20b
1714-1731	Z16C0108	Data	IDs	21a
1731-1748	Z16C0108		IDs	21b
1743-1760	Z16C0108	Data	IDs	22a
1761-1778	Z16C0108		IDs	22b

Wavelength (A)	Flux (ergs/cm^2/s/A)
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1180.9229	3.228468e-09
1180.9412	3.250129e-09
1180.9595	3.206927e-09
1180.9778	3.232280e-09
1180.9961	3.255109e-09
1181.0144	3.176336e-09
1181.0327	3.201497e-09
1181.0510	3.262274e-09
1181.0693	3.168626e-09
1181.0876	3.057524e-09
1181.1059	3.187817e-09
1181.1242	3.231215e-09
1181.1424	3.196460e-09
1181.1607	3.258574e-09
1181.1790	3.144254e-09
1181.1973	3.175668e-09
1181.2156	3.209553e-09
1181.2339	3.183035e-09
1181.2522	3.148258e-09
1181.2705	3.026012e-09
1181.2888	3.119722e-09
1181.3071	3.149019e-09
1181.3254	3.091817e-09
1181.3437	3.034600e-09
1181.3620	3.116435e-09
1181.3803	3.051173e-09
1181.3986	3.070565e-09
1181.4168	3.147999e-09
1181.4351	3.122674e-09
1181.4534	3.330225e-09
1181.4717	3.255100e-09
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1181.5449	3.105770e-09
1181.5632	3.026243e-09
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1181.5997	2.554033e-09
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1181.6729	2.151169e-09
1181.6912	2.238688e-09
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1181.7460	2.681796e-09
1181.7643	2.744779e-09
1181.7826	2.694670e-09
1181.8009	2.659666e-09
1181.8192	2.540375e-09
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1181.8557	2.110503e-09
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1181.9289	1.630569e-09
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1181.9654	1.901856e-09
1181.9837	2.151791e-09
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1187.9642	2.192188e-09
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1188.2552	3.465689e-09
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1188.4007	3.130418e-09
1188.4189	3.223469e-09
1188.4371	3.270560e-09
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1188.4916	3.234760e-09
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Title: The Incidence of Damped LY alpha Systems in the Redshift Interval 0 < Z < 4
Authors: Rao, Sandhya M.; Turnshek, David A.; Briggs, Franklin H.
Journal: Astrophysical Journal v.449, p.488 (ApJ Homepage)
Publication Date: 08/1995
Origin: APJ; KNUDSEN
ApJ Keywords: GALAXIES: EVOLUTION, GALAXIES: QUASARS: ABSORPTION LINES
Bibliographic Code: 1995ApJ...449..488R

Abstract

The determination of the incidence and column density distribution of damped Lyα systems from QSO absorption-line surveys in the redshift interval $0 < z < 1.65$ is crucial for constraining the evolution of neutral gas in galaxies. This redshift interval corresponds to a time interval of ~62% of the age of the universe for $q_0 = 0$ (77% for $q_0 = 0.5$). However, because damped Lyα systems are relatively rare in spectra, a sensitive UV spectroscopic survey would consume considerable telescope time. We have therefore undertaken a new approach that takes advantage of the fact that all damped Lyα systems studied so far are found to have corresponding Mg II metal-line absorption. For redshifts $z < 1.65$ we have used available UV data to study the Lyα absorption line corresponding to 43 Mg II systems. After accounting for possible biases, we find that at a mean redshift of $\langle z \rangle = 0.8$ the number of damped Lyα absorption lines with neutral hydrogen column density $N(\mathrm{H\ I}) \geq 2 \times 10^{20}$ cm^{-2} per unit redshift is $n_{\mathrm{DLy}\alpha}(z = 0.8) \leq 0.12$. A similar analysis based on studying the Lyα line in Lyman-limit systems is consistent with this result.

This limit on the observed number density at $z \approx 0.8$ is consistent with the trend at higher redshift as well as the number density at the current epoch inferred from H I cross sections of nearby disk galaxies. The result that $n(z)$ in the redshift interval $0 < z < 1.65$ conforms to a trend established by three different observing techniques over three redshift regimes provides evidence that this trend actually traces the evolution of neutral gas in galaxies. The data at $z > 1.65$ combined with the constraint from nearby galaxies at redshift $z = 0$ result in a parameterization that is valid from redshift $z \approx 4$ to the present epoch: $n_{\mathrm{DLy}\alpha}(z) = (0.015 \pm 0.004)(1 + z)^{2.27 \pm 0.25}$. The power-law index of 2.27 ± 0.25 indicates that damped Lyα absorbers undergo evolution, either in size or in number density, from a redshift of about 4 to the present epoch.

Subject headings: galaxies: evolution — quasars: absorption lines

StarView

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StarView version 7.0 is now available

StarView is an astronomical database browser and research analysis tool. Developed in Java, StarView provides an easy to use, highly capable user interface that runs on any Java enabled platform as a standalone application.

The main tasks starview is used for are:

1. Searching the MAST archive for scientific data including HST, FUSE, IUE, and EUVE data.
2. Examining the calibrations used for a particular data set
3. Looking at proposal information for past HST projects

New features in StarView version 7 include:

- Multiple archives available in StarView (HST, IUE, FUSE, EUVE and more to come)
- Improved "smart" cross qualification now can automatically cross qualify on coordinates or object name
- Ability to enter coordinates in equinox other than J2000 in the Target Resolver tool (query's are still done in J2000 and results are diplayed in J2000)
- Improved performance (faster queries)
- Retrieval now loaded from the archive at run-time so changes in retrieval do not require an upgrade to the program
- Save SQL allows user to have StarView create SQL for them to use in another environment or to see how a query is being done
- Attribute table formatting can now be saved with the form so when you select the table button from a form, the resulting table view of the results will be in the saved field order and column widths
- Pull-down menus are restructured to include all button bar functionality with associated hot keys to allow for more keyboard driven functionality
- Recent news from the archives and StarView is now available. News items are displayed upon startup if there is new or unread information. News items are always accessible from the Tools pull-down menu
- Once available, StarView will support th enew retrieval options such as CD and DVD

[Download and install] the latest StarView.

Last Modified: *undefined, undefined NaN, NaN*

FUSE

Observer's News and Frequently Asked Questions

This page provides access to our electronic Newsletter for FUSE Users (started in September 1998), FAQ pages, and other information of general interest to Observers.

For general information, see Observer's Frequently Asked Questions.

For information on Reaction Wheels, see Frequently Asked Questions about Reaction Wheels.

For Phase 1 proposal questions, see Phase 1 Frequently Asked Questions.

Astrophysics Data Facility

The Astrophysics Data Facility (ADF), located at the NASA Goddard Space Flight Center (GSFC), is responsible for designing, developing, and operating data systems that support the processing, management, archiving and distribution of NASA mission data. The ADF serves three broadly-defined astrophysics disciplines: high-energy astrophysics, UV/optical astrophysics, and infrared/submillimeter/radio astrophysics. The ADF, part of the Space Science Data Operations Office (SSDOO), collaborates with the GSFC Laboratory for High Energy Astrophysics (LHEA) and the Laboratory for Astronomy and Solar Physics (LASP) in managing data for specific missions. The ADF staff also support the astrophysics community's access to multi-mission and multi-spectral data archives in the National Space Science Data Center (NSSDC).

ADF Facilities and Services

- AscaDF: Advanced Satellite for Cosmology and Astrophysics (ASCA) Data Facility
- ADC: Astronomical Data Center
- COBE: Cosmic Background Explorer (COBE) Project
- FITS: Flexible Image Transport System Support Office
- IRAS: Infrared Astronomical Satellite Archive Interface
- MDSS: Mission Data Staging System
- USRSDC: U.S. Roentgen Satellite (ROSAT) Science Data Center
- WISARD: Web Interface for Searching Archival Research Data
- XSDC: X-ray Timing Explorer (XTE) Science Data Center

Astrophysics Data Facility Data Search and Access Tools

- AMASE: Astrophysics Multi-Spectral Archive Search Engine
- IMPReSS: IMage PeRimeters of Sky Surveys
- WISARD: Web Interface for Searching Archival Research Data

Astrophysics Data Facility Research and Development Projects

- AMASE: Astrophysics Multi-Spectral Archive Search Engine

NASA Missions with ADF participation

- High Energy missions
- Ultraviolet and Optical missions
- Infrared, Submillimeter, and Radio missions
- Solar missions from the Space Physics Data System

ADF Educational Outreach

- Multiwavelength Milky Way
- Science Sites for Students and Teachers
- Astronony Educational Resources

ADF ISO 9001 links

ADF Staff

ADF Staff Biographies

ADF Staff Scientific Work

Other Astrophysics Resources on the WWW

SSDOO: Space Science Data Operations Office Homepage

GSFC: Goddard Space Flight Center Homepage

NASA/Goddard Projects and Organizations

GSFC Strategic Planning Team Homepage

NASA: National Aeronautics and Space Administration Homepage

NASA Strategic Plan

Web Curator and Responsible NASA organizations/officials

Updated: 27 January 2000

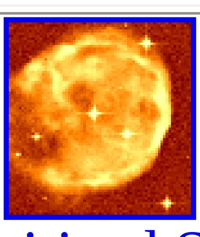
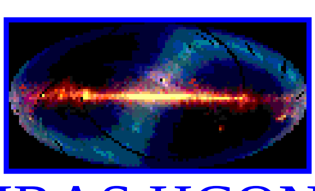
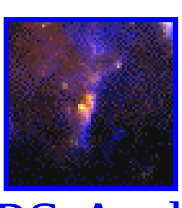
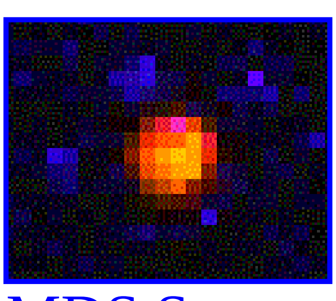
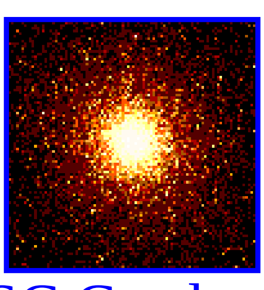
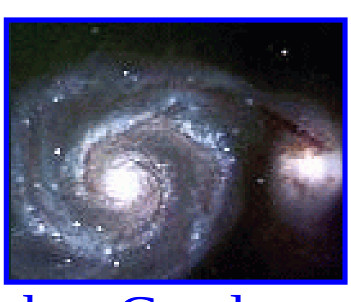
HERZBERG INSTITUTE OF ASTROPHYSICS

CANADIAN ASTRONOMY DATA CENTRE

FRANÇAIS

CADC is hosting ADASS XI in 2001.

What is new at CADC (DEC 16, 2001)

 HST Archive	 CFHT Archive	 JCMT Archive
 Digitized Sky Survey	SIMBAD WWW Access	 IRAS HCON Access
CD-ROM Access	Canadian Vizier Clone	Astronomical Meetings
 CGPS Archive	ESO Archives	 LaPalma Archives
 AAT Archives	 ATNF Archives	 SN1987A Archives
USNO Guide Star	 UKIRT archive	 MDS Survey
 Hipparcos Catalogue	 GSC Catalogue	 Other Catalogues
the ESO skycat tool ESO/CADC SKYCAT TOOL		

Register with the CADC

About CADC

The **CADC** is located at the Dominion Astrophysical Observatory in Victoria, B.C., Canada, part of the Herzberg Institute of Astrophysics under the National Research Council of Canada.

The **CADC** was established in 1986 as one of three world-wide distribution centres for data from the Hubble Space Telescope HST archive is possible trough a grant from the Canadian Space Agency.

Most of the CADC software development is done in collaboration with the European Southern Observatories located in Garching, near Munchen, Germany and the Space Telescope - European Coordinating Facilities .

The CADC is also responsible for archiving data from the Canada France Hawaii Telescope.

If you used the CADC for your research, please include the following acknowledgment:

Guest User, Canadian Astronomy Data Centre, which is operated by the Herzberg Institute of Astrophysics, National Research Council of Canada.

If you want to know more about the CADC mandate.

Policies and Registration

Any users are free to download and run our software. There is no charge to browse through the different catalogues and to use the preview system.

However, in order to retrieve archive data, users must register. **Please read our data distribution policy before registering**. Use this form to register.

Here is the CADC staff

Canada

Please report any problems to
cadc@hia.nrc.ca

NRC·CNRC

Science Archive Facility

[SEARCH] [NEWS] [HELP] [FAQ]

ST-ECF

The ESO/ST-ECF Science Archive is a joint collaboration of the European Southern Observatory (ESO) and the Space Telescope - European Coordinating Facility (ST-ECF).
ESO observational data can be requested after the proprietary period by the astronomical community of the ESO member states and Chile. Please read the official 'ESO Data Access Policy' statement for more information.
The entire HST archive is available world-wide. To request data you have to register as an ESO/ST-ECF Archive user. Please acknowledge the use of archive data in your publications.

On-Line Services

Archive User Profile

Off-line User Registration

go

ESO Databases

VLT Science Archive

go

Hubble Space Telescope Data

HST Science Archive

go

Catalogs & DSS

Digitized Sky Survey

go

Tools & Development

ESO's Data Interface

go

Related External Services

The Vizier catalogs, CDS

go

ESO & HST Image Galleries

ESO Photo Gallery

go

News and updates

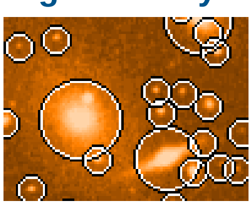
- **UVES query screen is now available.**
- **ESO PI service mode data distribution to take place primarily on DVD starting with Period 68.** A description of the compatibility of our disks with common DVD readers is available.
- **Query forms to access the VLT Science Archive:**
  - A new WFPC2 association scheme is in place. We are still working issues related to the background to the edges of the products.
  - A General form, specially suitable when searching across wavelength range.
  - A FORS1 and a FORS2 forms, giving access to optical images and spectra.
  - An ISAAC form, giving access to the stacks of frames observed in the infrared.

  These new query functions feature FITS headers viewers, DIMM seeing viewers, together with automatic selection of suitable calibrations for FORS1, FORS2, ISAAC and UVES data

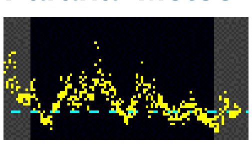
- Dedicated Page with the Public Datasets now including **VINCI** commissioning data.
- Stand-alone FITS tools in ANSI-C available. Among the tools, `hierarch28` can convert `HIERARCH ESO` header keywords to IRAF keywords.
- Having trouble using the Science Archive Facility? Pay a visit to our FAQ section (frequently asked questions).
- The Archive Brochure, advertising our services, available in PDF format (1.1MB).

Public Datasets

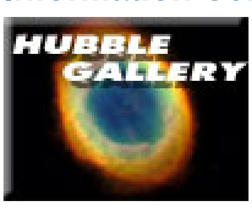
Digitized Sky



Paranal Meteo



Hubble European Space Agency Information Centre



ASTROVIRTEL

AVO

Send comments to <catalog@eso.org>
Last modified: Fri Jan 25, 2001

HOME INDEX SEARCH HELP NEWS

Collaborations of ESO and ST-ECF Archive staff members with the Canadian Astronomy Data Centre (CADC) and the Centre des Données astronomiques de Strasbourg (CDS) take place in the areas of software development and data reduction.

For comments or help, e-mail: ledas-help@star.le.ac.uk

Welcome to LEDAS (LEicester Database and Archive Service)

LEDAS provides an on-line astronomical database service and access to archive data from high energy astrophysics missions. In particular, **LEDAS** provides the primary means of access for the UK astronomical community to the ROSAT Public Data Archive, the *ASCA* Public Data Archive, the *Ginga* Products Archive and now to the Chandra Science Archive.

NEW USERS: For an overview of the services provided by **LEDAS**, user guides, contact details and further help, please see the INFO section of the **LEDAS** site. To go directly to any of our mission archives, software distribution sites or other services, click on the relevant link in the navigation bar.

LEDAS News: MORE

03/02:	Display BLASTA catalogues in GAIA **[more>]**
02/02:	LEDAS Newsletter #16
02/02:	Planned changes to LEDAS captive account **[more>]**
02/02:	New ARNIE database tables **[more>]**
02/02:	Chandra CALDB 2.12 now available for download **[more>]**
02/02:	Chandra data on isolated neutron star RXJ1856-375 now mirrored **[more>]**
02/02:	LEDAS mirror of ASCA Public Archive now complete **[more>]**
02/02:	HEASoft upgraded to version 5.1A (bug fix for Linux & Solaris). **[more>]**
02/02:	PIMMS updated to version 3.2d, required for Chandra Cycle 4. **[more>]**
12/01:	CIAO 2.2.1 and CALDB 2.10 now available for download **[more>]**
12/01:	System maintenance
11/01:	LEDAS Newsletter #15
11/01:	WebPIMMS and PIMMS updated to latest version v3.2c **[more>]**
10/01:	CIAO 2.2 and CALDB 2.9 now available for download **[more>]**
10/01:	BLASTA now supports 2MASS and GSC-ACT **[more>]**
09/01:	WebPIMMS (previously W3PIMMS) updated to latest version v3.2 to support XMM AO-2 **[more>]**
09/01:	VIZIER Search now in beta-test **[more>]**
09/01:	XMM pre-AO2 target listings now in ARNIE **[more>]**

Service Announcements:

All services operating,
no downtime scheduled.

LEDAS Services: MORE

- **X-RAY DATA ARCHIVES:** Online data archives for ROSAT, Ginga, ASCA and Chandra.
- **CATALOGUES:** 3000+ astronomical catalogues searchable via ARNIE, BLASTA and VIZIER.
- **IMAGES:** Sky images from Digitised Sky Survey.
- **BIBLIOGRAPHY:** Search references from SIMBAD bibliography.
- **SOFTWARE:** Download X-ray data reduction/analysis software.

Help with LEDAS MORE

If you are having problems with this web site or with any other aspect of **LEDAS**, please contact the **LEDAS** Helpdesk at *ledas-help@star.le.ac.uk*

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LEDAS Site Search

SEARCH

◉ Search WWW ○ Search LEDAS

LEDAS is located in the X-ray and Observational Astronomy group of the Department of Physics and Astronomy at the University of Leicester, UK.

Japanese | English

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oIUE Newly Extracted Spectra

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New Java-based Multiband Astronomical Imaging Service ON-line (jMAISON)
oDigitized Sky Survey/IRAS Sky Survey Atlas/Green Bank Sky Map
New Digitized Sky Survey Wide Field

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oUniversity of Chicago Press (AJ, ApJ, PASP) $B%_%i!< (B
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ADAC Webmaster <data_center@dbc.nao.ac.jp>

$Id: index.html.ja,v 1.9 2001/10/25 10:40:22 baba Exp $

*C*entre de *D*onnées astronomiques de *S*trasbourg

CDS · *Simbad* · *VizieR* · *Aladin* · *Catalogues* · *Nomenclature* · ***B****iblio* · *StarPages* · *AstroWeb*

New: Job opportunities
Astrophysical Virtual Observatory: Press Release
CDS Tutorial

Astronomical databases

Simbad (Fr - US)
VizieR (Fr - Canada - US - Japan - India - UK - Russia)
Astronomer's Bazaar - Submission guidelines
Aladin sky atlas
TOPbase database of the OPACITY project
First DENIS data release
Dictionary of Nomenclature (Fr - Japan - Russia)
INES Archive of IUE ultraviolet spectra

Bibliography

CDS bibliographical service
ADS* abstract service and scanned articles
*Astronomy & Astrophysics - CDS site**
AJ* - ApJ* - PASP* mirror site at CDS
A&A, A&AS and PASP abstracts
A&A document map - ApJ document map

Projects, Standards, and Tools

Projects to which CDS contributes
Astrophysical Virtual Observatory (AVO) (ESO site)
IDHA project
Interoperability Standards and Tools for the Virtual Observatory
GLU development site

Yellow-page services

AstroWeb (CDS - UK - STScI - NRAO)
StarPages
AstroGLU resource discovery tool
CFHT* Web pages

Information about CDS

General description
CDS Tutorial
The CDS and NASA ADS resources
The staff
Phone directory
What's new ? (Electronic Newsletter)
Observatoire de Strasbourg

(*) Mirror Web service hosted at CDS - Strasbourg

en Français

Astronomical Data Center

Access to Astronomy Data and Catalogs

Astronomy Data (Catalogs & Journal Tables)
How To...
News
About Us
Site Map
Search
FAQ
Feedback
Links

The **ADC** has been an important resource for astronomy data, catalogs, and journal tables since 1977. We have thousands of published data sets available.

If your research benefits from the use of ADC's services, please acknowledge the ADC in your publication to ensure continuation of our services. See our recommended acknowledgement for suggested wording.

It is with profound sadness that we announce the untimely death of our dear friend and colleague, Dr. Thomas J. Sodroski, who worked at the ADC from 1998 until January 2002. Please visit our **"Tribute to Tom Sodroski" web site**.

Help Desk: help@adc.gsfc.nasa.gov
Curators: James Gass & Gail Schneider
NASA Official: Dr. Cynthia Y. Cheung
Revised: Friday, 01-Mar-2002 16:10:07 EST

FEATURES

Find data by topic with Quick Reference Pages

Sort, subset data with ADC Data Viewer

Plot table data with CatsEye

A graphical interface to astronomical databases IMPReSS

ADC's XML Resources

Data Mining & the Virtual Observatory

VizieR data service

Search with AMASE

ADC for Amateur Astronomers

ADC for Students & Educators

Software collection:
- ○ Package descriptions
- ◉ Document collection

Telescope manual collection:
- ○ Site Descriptions
- ○ Manuals collection

Quick Search

More Options

To ASDS home
Software packages
Software documents

The ASDS Project:
- Project Architecture
- Related publications
- ASDS Team
- Brochure: PS, PDF
- Final report: HTML, PDF

List your software
Access statistics

Related sites

Astronomical Software & Documentation Service

Welcome to ASDS, a collection of on-line astronomical documents indexed for full-text searching.

The **software collection** is made up of:

Packages: Packages have a description page, outlining their capabilities, requirements, and availability. Search them for general properties. Browse to see everything.

Documents: The document collection consists of user guides, programmer guides, on-line help files, etc., made available by the software providers. Search the document collection to find more detailed requirements. Search results are linked to the associated package description. (Not all packages have associated documents).

The **telescope manuals collection** NEW! consists of

Sites: Each site has a description page, with links to more information, and thumbnail sketches of each manual in the collection. Search the site descriptions for general information.

Manuals: Telescope manuals, intrumentation manuals, and user guides, indexed for searching. Search the manuals collection for particular requirements.

Announcements

- **Chandra Electronic Bulletin No. 13** 03/07/02
- **ACIS Gain Caveat** 03/04/02
- **4th Chandra/CIAO Workshop announced, 20-22 May 2002** 2/21/02
- **CALDB 2.12** now available for **download** 02/14/02
- New Versions of ChaSeR and Web ChaSeR are now available. (Release Notes) 2/13/02
- **Notice to all Chandra Proposers** about the OSS Proposal Web Site 2/12/02
- **New Chandra Fellows** 02/11/02
- **The Chandra Cycle 4 NRA has been released. The deadline will be 15 March 2002.** Software and documents relating to this proposal cycle are NOW AVAILABLE
- **CIAO2.2.1** released and ready to download 12/13/01

Chandra X-ray Observatory (AXAF)

WHAT'S NEW

(Last updated: 03/05/02)

Chandra Links

- Fellowship Program
- Chandra Public Info
- Inflight Status Report
- Mirror site at LEDAS (UK)
- Press Releases
- The Emission Line Project
- Past Conferences

Chandra Data Analysis and Processing

- Observations Processing Status
- Caveats for data in archive
- Custom Processing
- Reprocessing Information
- Visitor Sign-up
- CIAO 2.2 Science Threads
- Contributed Software Exchange
- Chandra Special Calls: Associated Data

Chandra Target and Scheduling Info

- TOO/DDT Submission Instructions
- Director's Discretionary Program
- Target and Archive Help Page: FAQs
- User interaction for observation scheduling
- Target lists and Scheduling information
- Web ChaSeR, Chandra Search and Retrieval Interface
- Target Search Page (includes non-Java Search Facility)
- Web Interface to ObsVis: Roll and Visibility Plots
- Long-term Schedule
- Short-term Schedule
- Cycle2/Cycle3 TOO periods

Chandra Users

- E-mail Bulletin
- CXC Users' Guide
- User Database: enter/update your address and/or subscribe to our mailing list
- Chandra Users' Email Discussion Group
- Guidelines for preparation of press releases and Chandra-discovered source naming convention
- Cost Proposal and Funding Information
- Chandra Users' Committee
- Contact Scientists

Last modified: 03/07/02

60 Garden Street, Cambridge, MA 02138 USA
Webmaster

All About FUSE
- Mission Overview
- Science Summaries
- FAQs
- Personnel
- Photo File
- Animations
- Press Materials
- French Site
- Public Outreach

Mission Operations
- Status Report
- FUSE Operations
- Status Archive

Proposer Info
- Cycle 3 Info
- Observer's Guide
- Publications
- Planning Tools
- NASA GI Site

User Support
- Observer's News
- Data Archive
- Data Analysis
- MPS Plots
- Orbital Elements
- Visitor Info

Webmaster

FUSE is a NASA-supported astronomy mission that was launched on June 24, 1999, to explore the Universe using the technique of high-resolution spectroscopy in the far-ultraviolet spectral region. The Johns Hopkins University has the lead role in developing and now operating the mission, in collaboration with The University of Colorado at Boulder, The University of California at Berkeley, international partners the Canadian Space Agency (CSA) and the French Space Agency (CNES), and corporate partners. **FUSE** is part of NASA's *Origins* Program under the auspices of NASA's Office of Space Science.

OGLE

THE OPTICAL GRAVITATIONAL LENSING EXPERIMENT

1.3m Warsaw Telescope - Las Campanas Observatory, Chile
(control building to the left)

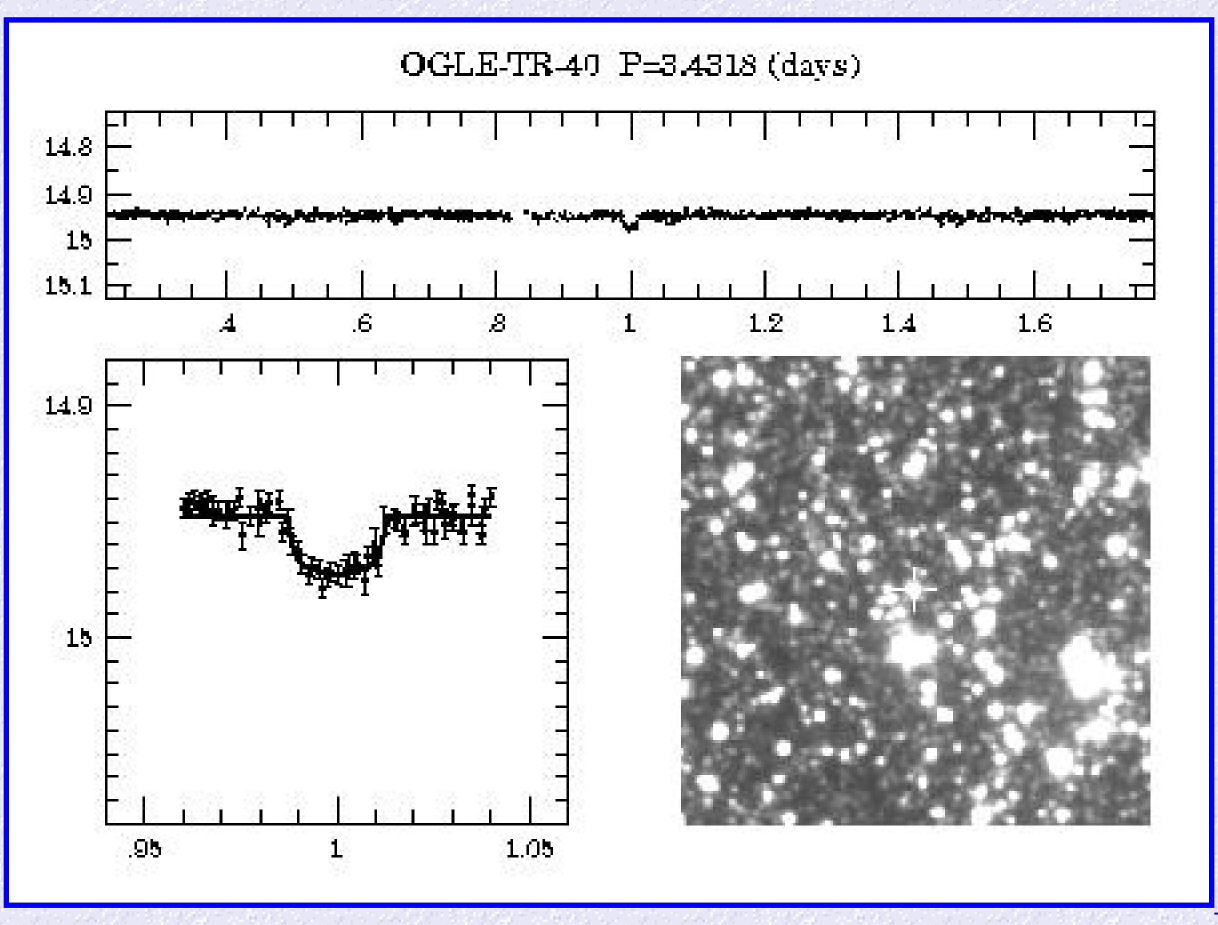
- The main OGLE Homepage in Warsaw
- The mirror OGLE Homepage in Princeton (faster for US users).
  Please note the US server change.

** OGLE (III) IS BACK IN OPERATION **

On the night of June 11/12 2001, the Optical Gravitational Lensing Experiment entered its third phase, OGLE III, and resumed regular observations at the Las Campanas Observatory, Chile. Observations are collected with the new "second generation" CCD mosaic camera, commisioned in May 2001. The 8kMOSAIC camera consists of eight thin SITe 2048x4096 CCD chips (8192x8192 pixels of 0.26"/pixel) giving the total field of view equal to 35' x 35'. The readout time of the camera is 98 seconds with readout noise of 6-9 e (depending on chip) and the gain of 1.3 e/ADU.

LATEST RESULTS of OGLE-III

Planetary and Low-Luminosity Object Transits



LATEST RESULTS of OGLE-II

- Variable stars in Magellanic Clouds
- Cepheids in the Galaxy IC1613
- Double-Mode Cepheids in the LMC
- BVI Maps of the OGLE-II LMC Fields
- Catalog of Microlensing Events in the Galactic Bulge
- Cepheids in Star Clusters from the Magellanic Clouds
- OGLE Catalog of Star Clusters from the LMC
- OGLE Catalog of Cepheids from the SMC
- OGLE Catalog of Cepheids from the LMC
- UBVI Photometry of Stars in Baade's Window
- Results of Analysis of Clusters in the SMC
- Photometry of Optical Counterpart of GRB990510
- Monitoring of QSO 2237+0305 (Huchra's lens)
- Single-Mode Second Overtone Cepheids in the SMC
- Double-Mode Cepheids in the SMC
- Photometry of Possible Counterpart of RX J0052.1-7319
- Catalog of Eclipsing Binary Stars in the Small Magellanic Cloud

- Real time microlensing detection system EWS running in OGLE-2 experiment

- General description and history (including OGLE-I, previous generation of the experiment)
- Telescope and instrumentation
- Data pipeline
- Main results
- Archives (maps, catalogs, images etc.)
  - OGLE fields
  - Stellar Photometric Map of the Small Magellanic Cloud.
  - Catalog of clusters in the Small Magellanic Cloud.
  - Difference Image Analysis of the OGLE-II Data

- DATABASE of OGLE-I results

- Publications
  - OGLE-II
  - OGLE-I
  - OGLE related
- Links to other Microlensing Teams
  - AGAPE
  - DUO
  - EROS
  - MACHO Project
  - MOA
  - PLANET Collaboration
- Miscellaneous information
  - Meteo Monitor at La Silla
  - astro-ph
  - Electronic Journals and ADS
  - List of all publications related to gravitational lensing (including microlensing).

Last updated: 11.12.2001

Branches
Missions
Add'l Activities
Personnel by Org
Charter
Annual Reports
Summer Student Program
ISO 9000 and LASP GSFC Only

SPARTAN Satellite being placed into orbit by Space Shuttle Discovery

Author/Curator
Edward Sullivan
(301)286-8808

INES

IUE Newly Extracted Spectra

INES Principal Centre

Welcome to the INES Principal Centre operated by the Laboratory for Space Astrophysics and Theoretical Physics (LAEFF)

INES stands for "IUE Newly Extracted Spectra". The purpose of the INES System is to reach the maximum number of scientists and to provide IUE spectra in a form that does not require a detailed knowledge of the instrumental characteristics. INES data have been obtained through processing of the IUE Final Archive output products. The INES distribution system is structured in three levels: a Principal Centre (and its Mirror), several National Hosts and unlimited End Users [more...].

What is new in INES VERSION 3.0

The INES PR Brochure [choose the lenguage] New!

The NASA ADS now includes links to INES spectra [see details]

Spanish INES Data Server (Version 3.0)	INES National Hosts

The INES System	INES FAQ
INES Scientific Papers New!	Publications
Examples of use of INES Data	How to read INES Data
About IUE	INES in the Media
INES Principal Centre Staff	INES Usage Statistics

Final Archive data are temporarily supplied through the NEWSIPS Data Server.

The INES System has been developed by the ESA IUE Project at VILSPA. Data and access software are distributed and maintained by INTA through the INES Principal Center at LAEFF.

Please, send your comments and questions to the INES HelpDesk

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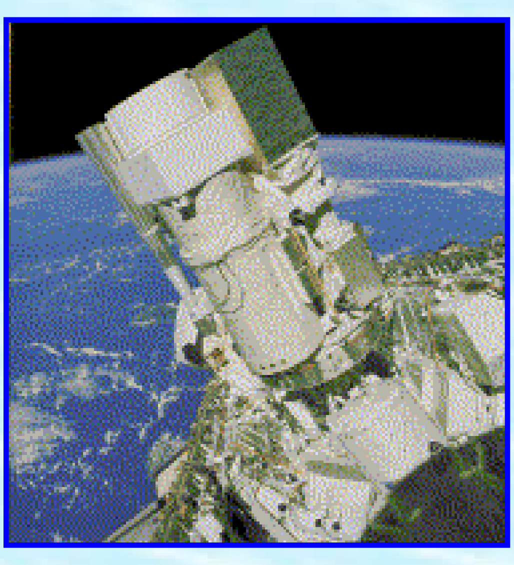
LAEFF | VILSPA

This Page in Spanish

Last update: 12 March 2002

The Hopkins Ultraviolet Telescope Project

ASTRO-1 *ASTRO-2*

This page has been reconfigured with NETSCAPE enhancements...
but the previous version is still available.

[What is HUT?] [Astro Observatory] [Science Results] [Publications]
[Personnel] [Photo Gallery] [Technical Info] [Spectral Atlas]

Welcome to the home page of the Hopkins Ultraviolet Telescope (HUT) project at The Johns Hopkins University. HUT was conceived, designed, and built by astronomers and engineers at JHU to perform astronomical observations in the far-ultraviolet portion of the electromagnetic spectrum, wavelengths of light that are inaccessible to ground-based telescopes.

HUT's primary purpose is to observe wavelengths of light that are too short to be seen with the Hubble Space Telescope, although overlap is provided to allow direct comparison. The telescope has flown twice aboard the space shuttle, once in December 1990 and again in March 1995, as part of a package of instruments called the Astro Observatory. HUT has been used to observe hundreds of objects, ranging from nearby stars and planets to the most distant objects known in the Universe, the quasars.

Using the buttons below, you can access a wide range of popular level information about the telescope and its two space shuttle flights. Links to technical information are provided for those who are interested in more detail. We hope you enjoy browsing these pages and learning about HUT.

- **What is HUT and What Does it Do?**
  Click here to learn more about the telescope, what it was designed to do, and why. Includes line diagrams and photos as part of your personalized guided tour!

- **HUT and the Astro Observatory**
  This section places HUT in the context of the Astro Observatory, describing some of the project's history, and providing links to information about the other instruments in the package. Special pages specific to the Astro-1 and Astro-2 missions are also available.

- **Scientific Results from HUT**
  Click here to learn about some of the exciting results achieved with HUT, described at a popular level. Links to more technical descriptions are provided. This section is weighted toward Astro-1 results, but Astro-2 information is being added as it becomes available, so watch this space!

- **Publications involving HUT**
  This section contains reference listings for all of the articles published or in press that report findings from HUT. Many of the articles have abstracts on-line and we are working to get the entire papers on line, especially for papers currently being added. Click here to get right to the Astro-2 papers!

- **The People Who Made it Happen**
  Use this page to learn about many of the people involved in designing, building, and flying HUT on the space shuttle.

- **The Photo Gallery**
  Although photos are linked in elsewhere throughout our pages, we have assembled the best in one place! Check out images of the launches, the astronauts and telescopes on-orbit, and various earth views.

- **Technical Information About HUT**
  Project personnel (or interested bystanders) can use this button to get directly to technical information about the telescope and/or data reduction.

- **HUT Quick Look Spectral Atlas**
  Many of the spectra obtained with HUT during Astro-1 are on-line. The top page contains links to "example" spectra of various types of objects for the casual user. A separate page will allow you to search the actual observation log and select specific objects of interest.

More information on HUT and the Astro missions is available at these sites:

- Marshall Space Flight Center
- Kennedy Space Center (STS-35, Astro-1)
- Kennedy Space Center (STS-67, Astro-2)
- The Johns Hopkins University Office of News and Information

Want to know more about how astronomers analyze light and actually learn about distant objects in the Universe? Check out the educational Web site:

"What are Those Squiggly Lines? Learning from Light"
put together by HUT astronomer Bill Blair.

Look here for Other Interesting Web Sites

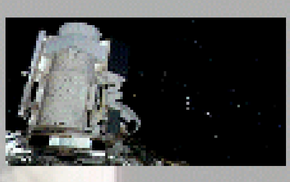
[What is HUT?] [Astro Observatory] [Science Results] [Publications]
[Personnel] [Photo Gallery] [Technical Info] [Spectral Atlas]

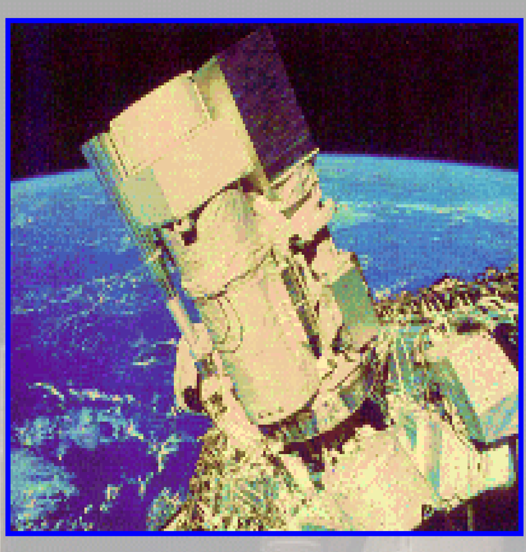
Please send us your Comments, Questions, and/or Suggestions.

Our logo provides a return to the HUT home page.

Mary Romelfanger (mary@pha.jhu.edu) or Bill Blair (wpb@pha.jhu.edu)

Home
Astro-1
Astro-2
Instrument
Calibration/Performance
Sounds of WUPPE
Picture Gallery
People
Operations
WUPPE GSE
Data Reduction
Science
Publications
WUPPE Atlas
Objects/Classes
HPOL
HPOL Publications
Polarization Databases
Data Archive
Outreach
Other Links





Wisconsin Ultraviolet Photo-Polarimeter Experiment

The Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE) was a pioneering effort to explore polarization and photometry in the ultraviolet (UV) spectrum. It was the first and most comprehensive effort to exploit the unique powers of polarimetry at wavelengths not visible on Earth. The instrument was designed and built at the University of Wisconsin Space Astronomy Laboratory in the 1980's.

WUPPE flew on two NASA Space Shuttle missions: ASTRO-1 and ASTRO-2. WUPPE was one of three ultraviolet telescopes (the Hopkins Ultraviolet Telescope (HUT) and the Ultraviolet Imaging Telescope (UIT) were the others) and one x-ray telescope (the Broad Band X-Ray Telescope (BBXRT)) on the ASTRO-1 payload which flew aboard the Space Shuttle Columbia December 2 -11, 1990. WUPPE, HUT & UIT were reflown in March 2 -18, 1995 on board the Space Shuttle Endeavour which set the record for the longest Shuttle mission at that time (16 days).

WUPPE-1 and WUPPE-2 obtained ultraviolet spectropolarimetry (and spectra) for 121 objects (183 observations) and spectra-only for 65 objects (77 observations).

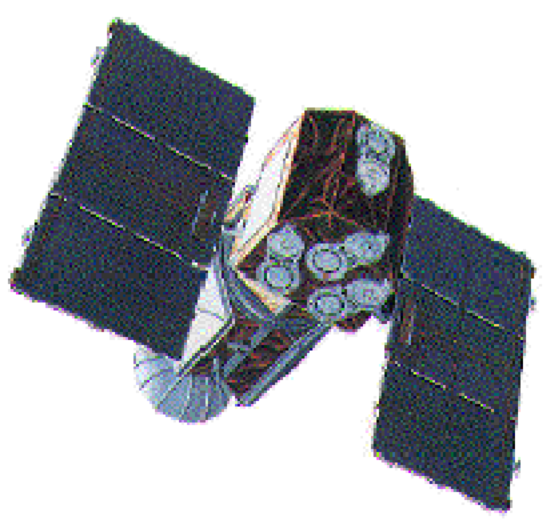
WUPPE has been retired and is now on display at SpacePlace, the Department's public outreach facility.

The UW Pine Bluff Observatory(PBO) spectropolarimeter (HPOL) provides key ground-based observations in support of WUPPE.

Principal Investigator: Dr. Arthur D. Code

WUPPE is supported by NASA contract NAS5-26777.
This page has been accessed times since October 28, 1996.

The WUPPE web site is maintained by Marilyn Meade .



All About The Extreme Ultraviolet Explorer

Please note: the Center for EUV Astrophysics is now closed.

- **OBSERVING WITH EUVE**
- **EUVE SCIENCE RESOURCES**
  - EUVE Science Highlights
  - EUVE Bibliography
- **EUVE ARCHIVE**
  - Order Pointed Data
- **EDUCATION**

EUVE is having an End-of-Mission Conference in July 2001.
See the details here.

[HomePage]

Last modified 03/23/01

The Infrared Space Observatory (ISO) is an European Space Agency (ESA) mission with the participation of ISAS (Japan) and NASA (USA). This Web server is maintained at the ISO Data Centre, which is based at Villafranca, Madrid, and is part of the Science Operations and Data Systems Division of the Research and Scientific Support Department.

► What's new: Second announcement (19/Mar/2002)
Exploiting the ISO Data Archive - Infrared Astronomy in the Internet Age

Data Archive

- General user access to ISO data
- General user access to ISO data (via IPAC, US)
- Advanced user access to ISO data
- ISO Data Analysis Software

Science

- Scientific Publications
- Conferences and Meetings
- Science Results Gallery
- Other ISO Science web sites

Users Information

- ISO Documentation
- The ISO Data Centre
- ISO Data Centre Visitor Information
- Post-Operations and Active Archive Phase

Outreach

- What is ISO? Some ISO facts
- Press Releases
- Background Articles
- Images and Movies of ISO

ASI Science Data Center
ASDC

The ASI Science Data Center (ASDC) is a facility of the Italian Space Agency established in November 2000

Quick data retrieval
Enter source name or RA,DEC (e.g. NGC4151 or 12 10 32.4,+39 24 20.5 or 182.635,39.406) Submit

(•) 2000 ( ) 1950 Equinox

Site Links

- ASDC News
- Blazar workshop

BeppoSAX
AGILE
Swift
DAVID

- ASDC Overview
- Multi-Mission archive
- Catalog browser
- X-ray simulator

- ASDC Staff
- ASDC Location

- ASI Science
- ASI Main page
- Helpdesk

ASDC responsibilities

- Support ASI scientific missions for all matters concerning the management and the archival of scientific space data
- Generate and maintain a permanent data archive of all ASI scientific missions
- Act as the interface between the ASI scientific missions and the users' community
- Support the Italian (and the general) community in the field of data analysis and archival research
- Maintain a permanent scientific and technical expertise for the processing and interpretation of the data hosted
- Provide on-line access to the data hosted
- Host a copy of non-ASI public data archives that are of interest in the Italian scientific community
- Develop and maintain (also in collaboration with other institutions) software systems for the access, analysis and comparison of archival data
- Establish links with other data centers for the exchange of public data, software and expertise

The ASDC is located at the European Space Agency's establishment of ESRIN, Frascati, Italy

Versione Italiana

EGRET

The Energetic Gamma Ray Experiment Telescope

launched on

The Compton Gamma Ray Observatory

April 5, 1991

The EGRET Instrument

- Instrument Description and Scientific Goals
- Picture of the Instrument
- Schematic Diagram of the Instrument

Institutions Involved in EGRET

- NASA Goddard Space Flight Center
- Stanford University, Stanford, CA
- Max-Planck-Institut für extraterrestrische Physik, Garching, Germany
- Northrop Grumman, Bethpage, NY
- Hampden-Sydney College, Hampden-Sydney, VA
- Landessternwarte Koenigstuhl, Heidelberg, Germany
- Guest Investigator Institutions

EGRET Scientific Results

- Major EGRET Discoveries
- EGRET Pictures
- EGRET Papers in Refereed Journals
- Current Preprints

- Miscellaneous EGRET Pictures

The Compton Gamma Ray Observatory

 The CGRO Mission

Accessing EGRET data

- EGRET and the Compton Observatory Science Support Center

Web Curator: Laura McDonald

A service of the Laboratory for High Energy Astrophysics (LHEA) at NASA's GSFC

-- Astronomy Questions??? Ask a High Energy Astronomer.
-- NASA specific Questions??? Try the NASA Homepage or start at the NASA site map.
-- LHEA Web related Questions and Comments to: webmaster, Eunice Eng, eunice.eng@gsfc.nasa.gov

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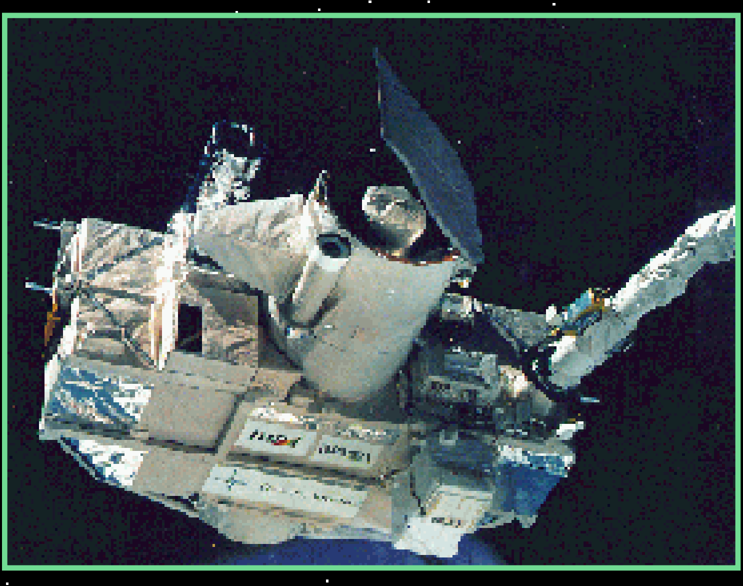
THE BERKELEY EXTREME AND FAR-ULTRAVIOLET SPECTROMETER (BEFS)



Welcome to the home page of the Berkeley Extreme and Far-Ultraviolet Spectrometer (BEFS), a project of the Space Astrophysics Group of the University of California, Berkeley. Designed for high-resolution spectroscopy in the far and extreme ultraviolet, BEFS flew in space twice, in 1993 and 1996. BEFS is part of ORFEUS, the Orbiting and Retrievable Far and Extreme Ultraviolet Spectrometers, a joint project of NASA and the German space agency.

NEW! BEFS spectra from both the 1993 and 1996 missions are now available from the Multimission Archive at STScI (MAST).

- For a good overview of the ORFEUS-II mission, thumb through the 10 June 1998 issue of the Astrophysical Journal (Letters), dedicated to first results from the Berkeley spectrometer.
- Bibliography of Berkeley spectrometer papers

The On-line ORFEUS-I Spectral Data Browser

Request archival BEFS data from MAST

ORFEUS/DARA Homepage

ORFEUS/GFSC Homepage

ORFEUS/KSC Homepage

This page was last updated on 8 June 2001. Address questions or comments to vand@ssl.berkeley.edu

Institut für Astronomie und Astrophysik

EBERHARD KARLS UNIVERSITÄT TÜBINGEN

Abteilung Astronomie

Sand 1, D-72076
Tübingen, Germany
New Address! --
Neue Adresse!

Welcome to the Home Page of the ORFEUS-Group at Tübingen.

Orbiting and	**O**rbitales und
Retrievable	**R**ückführbares
Far and	**F**ern- und
Extreme	**E**xtrem-
Ultraviolet	**U**ltraviolett
Spectrometer	**S**pektrometer

ORFEUS is a 1 m normal incidence telescope for spectroscopic investigations of cosmic sources in the far and extreme ultaviolet spectral range.
The instrument is integrated into the freeflyer platform ASTRO-SPAS.

ORFEUS-SPAS I was launched Sept. 12, 1993 with space shuttle DISCOVERY on mission STS-51.

ORFEUS-SPAS II was launched Nov. 19, 1996 with space shuttle COLUMBIA on mission STS-80.

The project is part of a collaboration between the Federal Republic of Germany represented by DARA (now DLR) and the United States of America represented by NASA.
The scientific institutes participating in the development of the instruments and the scientific preparations of the mission are:

Institute for Astronomy and Astrophysics (Department Astronomy) of the University of Tübingen

- Scientific Project Management
- Development and construction of Echelle Detector and Echelle Electronics

Landessternwarte Heidelberg (LSW)

- Optical design of Echelle Spectrometer

and

Space Science Laboratory of the University of California at Berkley (SSL)

- Development and construction of Berkeley Spectrometer

More IAA-ORFEUS Pages

Access to the ORFEUS II Echelle data

NEW ORFEUS II Echelle data are now available for download in FITS format, together with overview plots of the spectra as GIF images and JPEG Echelle images (also as interactive JAVA applet) from the list of the Echelle observations.

- ORFEUS II Echelle data reduction and FITS data format
- List of all ORFEUS II Echelle observations
- List of all ORFEUS II Echelle targets
- Access to ORFEUS data at MAST: Multimission Archive at STScI

ORFEUS II

- **ORFEUS II (News, Links)**.
- Daily news during theORFEUS II mission.
- Servicing of the Echelle Detector.
- Liste der NASA-TV Bilder (auf deutsch).
- Some images of ORFEUS-SPAS II in Space
- 2 Examples of ORFEUS II Measurements / 2 Beispiele für ORFEUS II Messungen

Instrument

- The ORFEUS Telecope / Das ORFEUS-Teleskop
- The Echelle Spectrometer / Das Echelle-Spektrometer
- The Echelle Detector / Der Echelle-Detektor
- Mounting of the Echelle Detector / Montage des Echelle-Detektors
- The High Voltage Supply of the Echelle Detector / Die Hochspannungsversorgung des Echelle-Detektors
- The Echelle Electronics Box / Die Echelle-Elektronikbox
- ORFEUS-SPAS in Detail / ORFEUS-SPAS im Detail

Informationen für das DARA Schulprojekt

- Interaktives Echelle-Spektrum / Interactive Echelle Spectrum (JavaScript!).
- Verzeichnis mit Beispiel-Dateien
- Beispiel-Spektren aus ORFEUS I

Bilder und Videos

- NASA-Bilder von der ORFEUS II Mission (Beschreibungen dazu: captions.txt)
- Videos der ORFEUS II Mission
- Bilder von NASA-TV während der ORFEUS II Mission

IAA-ORFEUS-Team

- Staff: Names, Telephone Numbers.
- List of Publications of IAA and LSW.

ORFEUS I

- Some scientific Highlights of the ORFEUS I Mission.
- Some pictures of the STS-51 Mission.
- Access to ORFEUS I data at the Astrophysics Data Facility at NASA (not supported any longer).
- Access to ORFEUS data at MAST: Multimission Archive at STScI

ORFEUS-Address:

Universität Tübingen
Institut für Astronomie und Astrophysik
Abteilung Astronomie
Dr. N. Kappelmann
Sand 1
D-72076 Tübingen

Please send email to: kappelmann@ait.physik.uni-tuebingen.de

Jürgen Barnstedt (barnstedt@astro.uni-tuebingen.de)
Last modified 05 Nov 2001

W3C HTML 4.0

Next Generation Space Telescope

A Key Element in NASA's Origins Program

NGST Short Cuts: Short Cuts...

Home | News | Science | Technology | Project Office | FAQs | Search

This is NASA's official web site for news and information about the space agency's Next Generation Space Telescope (NGST), a powerful space telescope that will replace the highly successful Hubble Space Telescope (HST) when it retires near the end of this decade. Scheduled for launch in 2009, the telescope will carry cameras and spectrographs sensitive to infrared radiation. Over the telescope's 5-10 year lifetime astronomers hope to observe the farthest reaches of the universe.

Science

Public Information & Education

Science goals
Introduction to some specific science aims

Origins program goals
Science plan for the NASA Origins program

Origins Education Forum
Educator and student resources for Origins

NGSTSite
Overview of NGST at STScI.

Working Group

Home-page, Documents, meetings
Interim Science Working Group information

Instrumentation

science instruments studies for NGST.
Integrated Science Instrument Module (ISIM)

recommended instruments and capabilities.

Project Office

Who's who
Contacts and project organization

Schedule
Project timelines and calendars

Engineering Teams
Links to groups working on NGST details

Online documents

Monograph Series
Methodology of and results from engineering design studies.

Procurements

Flight Investigations AO *(closed)*
Phase 2 Observatory RFP ***(closed)***

NGST Partners

Canadian Space Agency
European Space Agency
Lockheed-Martin
TRW/Ball Aerospace

Technology

Observatory Designs
See potential designs, capabilities and download images

Key Technology Challenges

Lightweight Optics
Deployable Structures
Improved Detectors
Cryogenic Actuators & Mirror control
Reduced Cost Operations (e.g., Scientist's Expert Assistant)

News Updates

NGST email lists:
Keep up to date with project progress

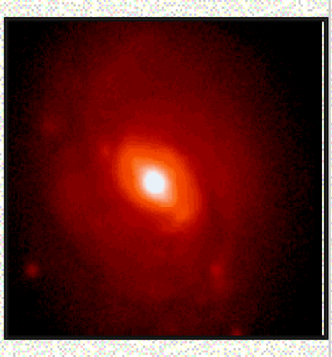
Search: search Advanced Search   Get document # ID#

Please submit questions and comments about this site via our feedback form.

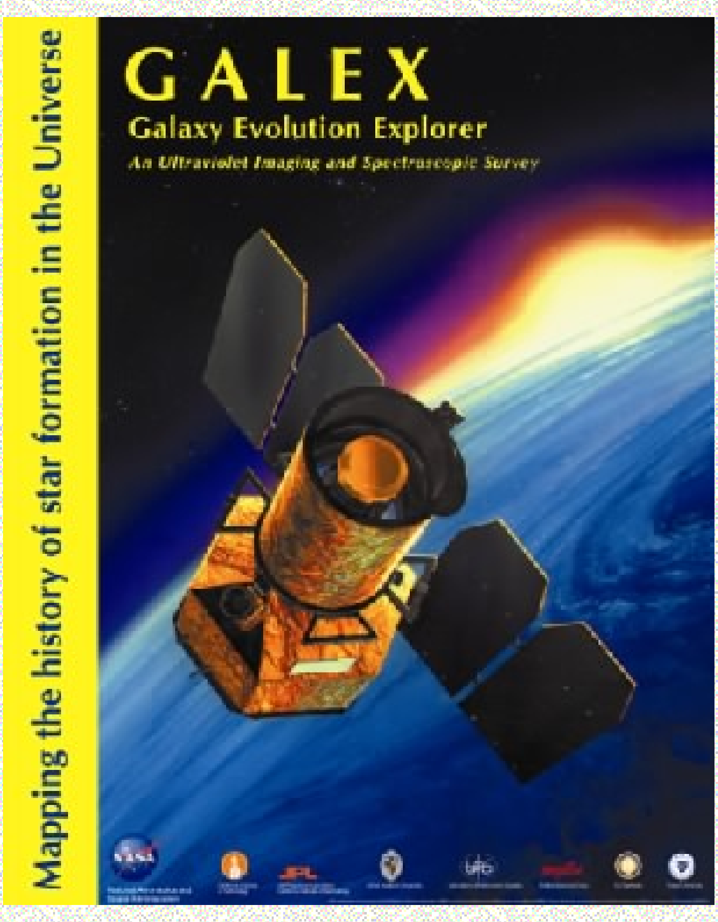
This page was last modified on Tuesday, 19-Mar-2002

Curator: Joel D. Offenberg
Responsible NASA Official: James D. Blackwood

GALEX - The Galaxy Evolution Explorer



GALEX, the Galaxy Evolution Explorer, is a NASA UV imaging and spectroscopic survey mission designed to map the global history and probe the causes of star formation and its evolution over the redshift range 0<z<2.



Science: History of star formation over 0<z<2, 80% of history of universe, when galaxies & gas evolve dramatically. Z=0 UV investigation.

Technical: UV 1350-3000Å, 50 cm telescope, 2 Microchannel plate detectors, Rotating grism

Mission: Launch May, 2002. Pegasus XL, 28 month mission, 3-axis S/C, nighttime exposures, all-sky survey, deep surveys, 28 deg/690 km orbit, X-band ground station

Data Release: 2003-2004

Cosmic Hot Interstellar Plasma Spectrometer

A University-Class Explorer (UNEX) Mission

The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) is a University-Class Explorer (UNEX) mission funded by NASA. It will carry out all-sky spectroscopy of the diffuse background at wavelengths from 90 to 260 Å with a peak resolution of $\lambda/150$ (about 0.5 eV). CHIPS data will help scientists determine the electron temperature, ionization conditions, and cooling mechanisms of the million-degree plasma believed to fill the local interstellar bubble. The majority of the luminosity from diffuse million-degree plasma is expected to emerge in the poorly-explored CHIPS band, making CHIPS data of relevance in a wide variety of Galactic and extragalactic astrophysical environments. The CHIPS instrument will be carried into space aboard CHIPSat, a dedicated spacecraft to be built by SpaceDev, Inc., and launched from the second stage of a Delta rocket in April of 2002.

Page last updated: September 6, 2000

For more information about CHIPS please send an e-mail to Dr. Mark Hurwitz. If you have questions about or problems with this web page, please send an e-mail to the webmaster.

We gratefully acknowledge the generous support of the following sponsors:

CHIPS on-orbit science data processing is powered by AEROFLEX UTMC

University of California, Space Sciences Laboratory
Grizzly Peak @ Centennial Drive, Berkeley, CA 94720-7450, USA
phone: 510-643-2098, fax: 510-643-9729
chips@ssl.berkeley.edu

Last updated 2/5/02

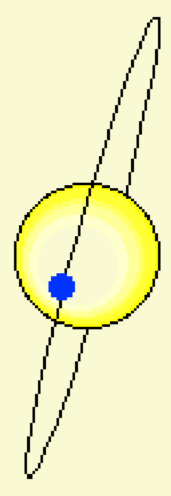
Welcome To The *Kepler Mission*

What is the *Kepler Mission?*

It is a special purpose space mission in the NASA Headquarters Discovery Program for detecting terrestrial planets, that is, rocky and Earth-size around other stars.

How can extrasolar terrestrial planets be detected?

When a planet passes in front of its parent star, as seen by us, it blocks a small fraction of the light from that star. If the dimming is truly caused by a planet, then the transits must be repeatable. Measuring three transits all with a consistent period, duration and change in brightness provides a rigorous method for discovering and confirming planets - planets even smaller than the Earth.



From the brightness change the planet size can be calculated. From the period the orbital size can be calculated and the planet's temperature estimated.

Kepler was selected

as one of the two new Discovery missions ! ! ! !

See the NASA Ames press release
and the NASA Headquarters press release

The following is a Table of Contents = Site Map

Kepler Mission Description:

Educational Information:

Frequently Asked Questions (FAQ) (Animated)
Download SUMMARY Two color pages in PDF format (New version Nov 2001)
Interactive Educational Materials and Links
Free Software. New version (1.4) released in Jan 12, 2001 Also a list of other educational links and information.
Johannes Kepler His Life. His Laws (animated). His Times.
Links to Other Sites Relating to Johannes Kepler His Laws, biographical info, books, etc.
Additional Reading on Planet Detection Popular articles, books and hot links.
Links to Other Sites on Planet Detection
Extrasolar planet humor
Build Your Own Kepler Spacecraft Model (Should be available by the end of Feb.2002)

Details, Details...

Team Members
Downloadable Illustrations and Animations (All new Nov 2001)
Technical Papers
References Used in Discussions
Acronyms, Abbreviations and Units

Status:

Kepler was selected on Dec 21, 2001 as one of the next two Discovery missions ! ! ! !
See the NASA Ames press release, the NASA Headquarters press release and the Discovery Newsletter.

On July 20, 2001 NASA HQ received our Concept Study Report (Step 2 proposal) for the the next new Discovery Mission. Two competing proposals (Dawn and Inside Jupiter) were also due by July 24.

On Mar 22, 2001 a kick-off meeting was held at NASA HQ for the three candidate missions to begin their 4 month studies leading to a down-selection of one mission for flight.

On Jan 4, 2001 the *Kepler Mission* was selected as one of three candidate missions for the next Discovery mission. Final selection for flight will be done towards the end of 2001. See the attached NASA HQ Announcement. Further details are contained in the NASA Ames Press Release

We have updated this web site to reflect what has been proposed to NASA.

We received funding in 1999 to perform a technology demonstration. This is described in several new papers on the Technical Papers page and in several new web pages Technology Demonstration.

Go to The First Topic

Note: If you continue to click on the above finger icon,
you will cover all the pages (37) in this web site sequentially.

Home Page

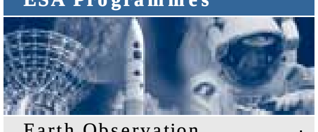
Home Page

Curator: David Koch, dkoch@mail.arc.nasa.gov

Privacy Statement

About ESA...
- Introduction to ESA
- Headquarters
- ESTEC
- ESOC
- ESRIN
- EAC
- ESA Tracking Stations

ESA Programmes



- Earth Observation
- Human Spaceflight
- Launchers
- Navigation & Telecom
- Space Science
- Technology

Multimedia
- Multimedia gallery

Media Centre
- Press Releases
- Information Notes
- ESA Television

Business with ESA...
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- General Studies
- ISS commercialisation
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National News

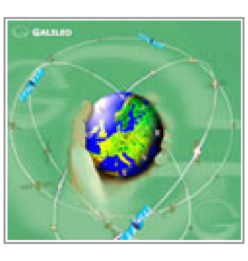
Renewal of the Director of Launchers mandate

22 March 2002 PR N° 17-2002 At its 156th meeting, held on 20 and 21 March in Paris, the ESA Council decided to renew the terms of office of Jean-Jacques Dordain, Director of Launchers, for a period of four years, from 1 May 2003 to 30 April 2007.

For further information, please contact :

ESA Media Relations Office
Tel.: +33(0)1.53.69.7155
Fax: + 33(0)1.53.69.7690

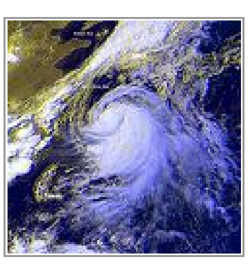
Full story



ESA welcomes conclusions of the Barcelona European council on Galileo

20 March 2002 ESA PR 15-2002. "Space can do a lot for European citizens. Our global satellite navigation system Galileo is now only a step away from taking wing and fly high", said Antonio Rodotà, the Director General of the European Space Agency, welcoming the conclusions of the European Council held on 15 and 16 March in Barcelona.

Full story



ESA and the Commission kick off action plan for Global Monitoring for Environment and Security

19 March 2002 ESA PR 14-2002. Antonio Rodotà, ESA's Director General and Philippe Busquin, Research Commissioner and responsible for space policy, today opened the first meeting of the GMES Steering Committee in Brussels.

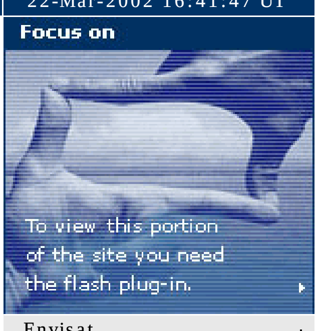
Full story

More News

- "The first check-up of the Earth" - Media event at ESA/ESRIN, Frascati, Italy
- European and Canadian space agencies announce communications contract for International Space Station
- Sci-Tech - Couldn't be without it!
- An invitation to meet Vega
- Roberto Vittori's Training Diary 1: the story so far

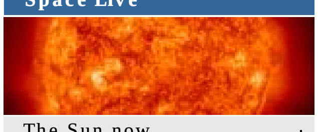
Previous News

Focus on



- Envisat
- Launchers' story
- Martian spots?
- 'Focus on' Archive

Space Live



- The Sun now
- Ozone watch
- Where is Envisat?
- Ask an astronaut

Education
- Info for teachers
- Education & Outreach

Careers in Space
- Jobs & Training at ESA

What is the SSDS?

The Space Science Data System is the confederation of groups supported by NASA's Office of Space Science to provide public access to and to ensure the usability of science data from OSS missions and selected other data. Some SSDS groups develop tools and services for finding and using these data. Long-term data accessibility is ensured by SSDS archiving and preservation of the data.

Who are SSDS' customers?

The SSDS customer community ranges from the NASA and international space science research communities to students, educators and the general public.

ADCCC

Astrophysics Data Centers Coordination Council

Site Search

The Astrophysics Data Centers Coordination Council is comprised primarily of representatives from the NASA's major astrophysics data centers. The key activities of the ADCCC include:

- **Improving the interoperability of the services offered** by the individual data centers, making it easier and more practical to carry out interdisciplinary research in astrophysics.
- **Establishing and/or enhancing archive interface standards**.
- **Shared development of data access tools and utilities**.
- **Advising NASA HQ on guidelines for mission archive requirements** and data standards.

In addition, the ADCCC explores mechanisms to extend connections to other Space Science disciplines, through interaction with the Space Science Data Systems Technical Working Group.

At the end of 2001, the ADCCC was restructured as the Astrophysics Data Centers Executive Council (ADEC). The ADEC page gives more information regarding the reorganization and new priorities.

FUSE Data Analysis

CalFUSE v2.0 Is Here!

CalFUSE v2.0, the FUSE calibration pipeline, is now available for general use. It features the following improvements over v1.8.7:

- Corrected heliocentric wavelength scale
- Detection and removal of event bursts
- Walk correction (for low-pulse-height events)
- Improved scattered-light model
- Astigmatism correction
- Optimal (weighted) spectral extraction
- Improved wavelength and flux calibrations

For more information or to download the software, see the CalFUSE homepage.

Software

We have written several IDL routines to read and display FUSE data (11/06/2000). The spectral manipulation program XIPLOT, an IDL-based program, is available at the French FUSE site (2/20/2001).

Using IRAF to Manipulate FUSE Data, a PDF file from Jerry Kriss (from the Data Workshop, see below).

IRAF scripts: Some IRAF scripts from Jerry Kriss to go with the IRAF/FUSE demo (5/31/2000).

CalFUSE v2.0.5 is now the standard version of the FUSE calibration pipeline software package (10/10/2001).

v_{HEL} correction Discussion of v_{HEL} correction error in CalFUSE prior to v2.0. NEW (7/16/2001)

Steve McCandliss's H2ools page. All sorts of tools and support materials for modeling molecular hydrogen (3/06/2001).

Documentation

FUSE Data Handbook, version 1.1 can be viewed on-line or downloaded. Dated 2/08/2000.

Mission Planning Schedule Timeline Plots, Use these plots to see when each of your exposures were taken (in orbital day/night, SAA, limb angle, etc)

The CalFUSE Pipeline Reference Guide, v1.1, provides detailed information on CalFUSE v2.0.5.

Reference Guide for the FUSE IDL tools, provides detailed information on the availability and use of the IDL based tools for data inspection and analysis. Routines include FUSE_SCAN for display and manipulation of the 2D raw data as well as FUSE_ANALYSIS for analysis of the 1D extracted data. By Don Lindler, Dated February 14, 2001.

FUSE Data Analysis Cookbook, version 1.0 can either be viewed on-line or downloaded. Dated 2/19/2001.

Miscellaneous

High Resolution FUV Spectroscopy of Terrestrial Day Airglow with FUSE, a paper on FUSE observations of airglow lines published in the Journal of Geophysical Research, 106, 8119 (2001), by Feldman et al. In addition, here are 2 additional plots of orbital daytime airglow spectra which are extensions of figure 7 in this paper. In these plots, the top panel (a) contains spectra of the earth limb, the middle panel (b) is "downward looking" spectra, and the bottom panel is "sideways or upward looking" spectra: figure 1, and figure 2.

FUSE Airglow Spectra, Downloadable "upward looking" FUSE airglow spectra

Cool Star Line List and Spectrum, A line list of emission lines in cool stars, as determined from observations of Capella, courtesy of the FUSE Cool Star team and Tom Ake. NEW

Hot Star Line Lists and Spectral Atlases, Line lists appropriate for hot stars and a set of spectral atlases for hot stars in the FUV, courtesy of the FUSE Hot Star team and Alex Fullerton. NEW

Data Workshop, Feb 2000
Data Workshop, Feb 2001

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Last modified Wednesday, October 10, 2001
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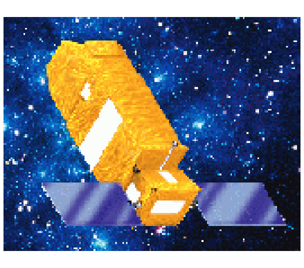

FUSE

Publications

[FUSE Paper Summary and On-line Links]

One-Stop Shopping for all publications related to FUSE, and links to on-line sources. (Courtesy Alex Fullerton; updated approximately monthly).

[Preprints]

A dynamic page listing links to the latest FUSE submissions; to have a paper listed or suggest a change or update, contact [the Webmasters...]

[Scientific Overviews]

Links to reference and overview papers about the FUSE Science program.

[Technical Papers]

Links to technical papers about the FUSE Instrument or it's predicted and/or actual performance.

[Early Release Observation Papers]

These are all in the refereed literature, but for convenience, here are quick links.

[Ph.D. Theses]

NASA FUSE Far Ultraviolet Spectroscopic Explorer JHU

FUSE *Photo File*

This page provides links to photos and diagrams of FUSE and its major components. See especially the "FUSE Integration and Test Photos" page for pictures of the satellite being assembled at the JHU Applied Physics Laboratory in Laurel, MD, and tested at NASA/Goddard Space Flight Center!

- **The Best of FUSE!! One-stop shopping for a sampling of our best instrument pictures! UPDATED 6/15/99**
- **FUSE Publication Quality Graphics and Photos Many of our "Best of FUSE" pictures and graphics at higher resolution. NEW 5/29/01**
- **FUSE Launch Pix!) Images of final pad processing and launch of FUSE!!! UPDATED 6/27/99**
- **Photos from AAS 195 Poster Session! NEW 2/17/2000**
- **FUSE JHU Launch Day Photo Album!) UPDATED 6/29/99**
- **FUSE KSC Launch Photo Album!) UPDATED 7/2/99**
- **FUSE Launch Preparation Photos (KSC/CCAS) UPDATED 6/11/99**
  - **More FUSE KSC Processing Pictures!, Added here UPDATED 8/29/99**
  - **FUSE Final KSC Processing Pix!, from June 13-16, 1999! UPDATED 6/18/99**
  - **FUSE Delta Rocket Assembly Pix! from June 6, 1999! UPDATED 6/09/99**
- **FUSE Integration and Test Photos (JHU/APL) UPDATED 2/18/99**
  - **Get directly to final Thermal Vac Testing sequence.**
  - **Get directly to satellite assembly sequence.**
- **FUSE Ground Stations UPDATED 6/26/00**
- **FUSE Mirrors**
- **FUSE Detectors**
- **FUSE Spectrograph**
- **FUSE Gratings**
- **FUSE Fine Error Sensor**
- **FUSE Spacecraft UPDATED 2/18/98**
- **FUSE Satellite Control Center UPDATED 2/19/98**
- **Delta II Launch Vehicle**

FUSE
SiteGuide

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FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER

GUEST INVESTIGATOR PROGRAM

Goddard Space Flight Center

Welcome to the FUSE Guest Investigator Program Homepage

The FUSE Science and Data Workshop will take place at Johns Hopkins University during 2002 March 2022. See the abstract book, meeting schedule, and other important details here.

FUSE is back in business! As of March 1st, FUSE has resumed science operations. Regular updates on FUSE's status are posted at the Current FUSE Mission Status website at the FUSE Science Center at Johns Hopkins University.

For further information on FUSE activities since launch, please see this table of important dates.

This is the official website for the FUSE Guest Investigator (GI) Program. The GI program is administered jointly by NASA Headquarters and the NASA Goddard Space Flight Center.

The list of items in the frame to the left provides a site guide for navigating the information available on this website.

Generally, your best source for technical information on FUSE will be the JHU FUSE Science Center at the Johns Hopkins University in Baltimore, Maryland.

Go to the top of this webpage

Responsible NASA Official: *George Sonneborn*
Curator: *Hal Weaver*
Last updated: *2002 March 5*

Catalogs and Surveys Branch

Archive, Catalogs and Data Services Division | Space Telescope Science Institute

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Last Updated 28-Feb-2002

Composite image (F and J) of the Rosette Nebula from the DSS-II

News

GSC-II Consortium Annual Meeting Oct.19-20

GSC-II Release Schedule

GSC 2.2 : NOW AVAILABLE!

GSC 2.3:
Planned Public Release Jan 2003

DSS-II Update

The entire sky has now been scanned in both the F and J bandpasses....

Guide Star Catalog

[STScI](#) • [ACDSD](#) • [MAST](#) • [CASB](#)

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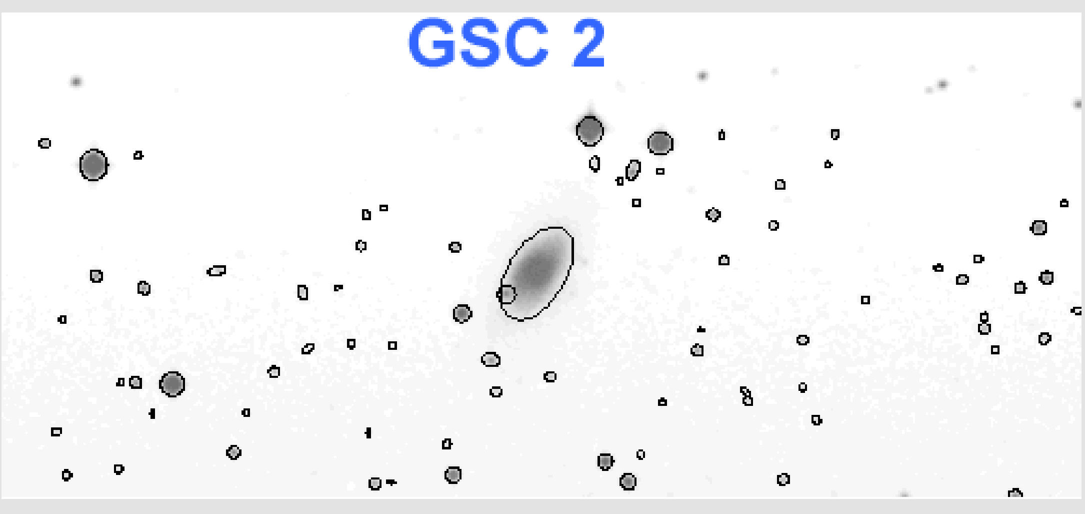
Last Updated Jan 2001

GSC-I	GSC-II	GSC2.2 Release Notes	Background	Plate Material	Catalog Properties	Data Access

998,402,801 unique GSCII Objects and counting!



The above image illustrates the deeper magnitude limit of the GSC2 compared to the GSC 1.

The Catalogs and Surveys Branch of the Space Telescope Science Institute has been digitizing the photographic Sky survey plates from the [Palomar](#) and [UK Schmidt](#) telescopes to produce the GSC and DSS. These catalogs support ground and space-based telescope operations and provide a valuable scientific resource to the astronomical community.

The Guide Star Catalog II ([GSC II](#)) is an all-sky catalog based on 1" resolution scans of the photographic Sky Survey plates, at two epochs and three bandpasses, from the Palomar and UK Schmidt telescopes ([DSS](#)). With more than 998 million unique objects in the database thus far, construction of the complete GSC-II is still in progress. The GSC2.2 is an all-sky, magnitude-selected subset of the complete catalog designed to support Telescope Operations. It contains positions, classifications, and magnitudes for 435,457,355 objects, and is now [available](#) to the community via the WWW.

The Guide Star Catalog I ([GSC I](#)) is an all-sky optical catalog of positions and magnitudes of approximately 19 million stars and other objects in the 6th to 15th magnitude range. GSC I catalog is used for the control and target acquisition of the Hubble Space Telesope. The GSC I paper by [Lasker et al, 1990](#), was selected as the greatest breaking article in astrometry published during the 1900s, and was included in the AAS Centennial Issue of the Astrophysical Journal.

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Getimage	Headers	Real Sky	DSS Coverage	Tools	Availability	Calibrations

In order to support HST operations and provide a service to the astronomical community, CASB has been digitizing the photographic Sky Survey plates from the Palomar and UK Schmidt telescopes. Each plate covers 6.5 x 6.5 degrees of the sky and have been digitized using a modified PDS microdensitometer with a pixel size of either 25 or 15 microns (1.7 or 1.0 arcsec respectively). These images are 14000x14000 (0.4GB) or 23040x23040 pixels (1.1GB) in size and are difficult to access quickly. To provide convenient access to these data, the images have been compressed using a technique based on the H-transform to reduce the data volume. Although the technique is lossy, it is adaptive so that it preserves the signal very well. We typically compress the data by a factor of 7, but much higher compression ratios are possible. These compressed data are then placed on CDROM and placed into a jukebox for rapid access. Users can then easily retrieve image data for any part of the sky. The first epoch images have already been published on CDROM, and the second epoch POSS-II and SES surveys will be distributed widely to the community once they are completed. Currently CDROMs of the prepublication data are only being distributed to a small number of institutions who are supporting the CASB effort to digitize and compress these survey plates.

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Guide Star Photometric Catalog

STScI • ACDSD • MAST • CASB

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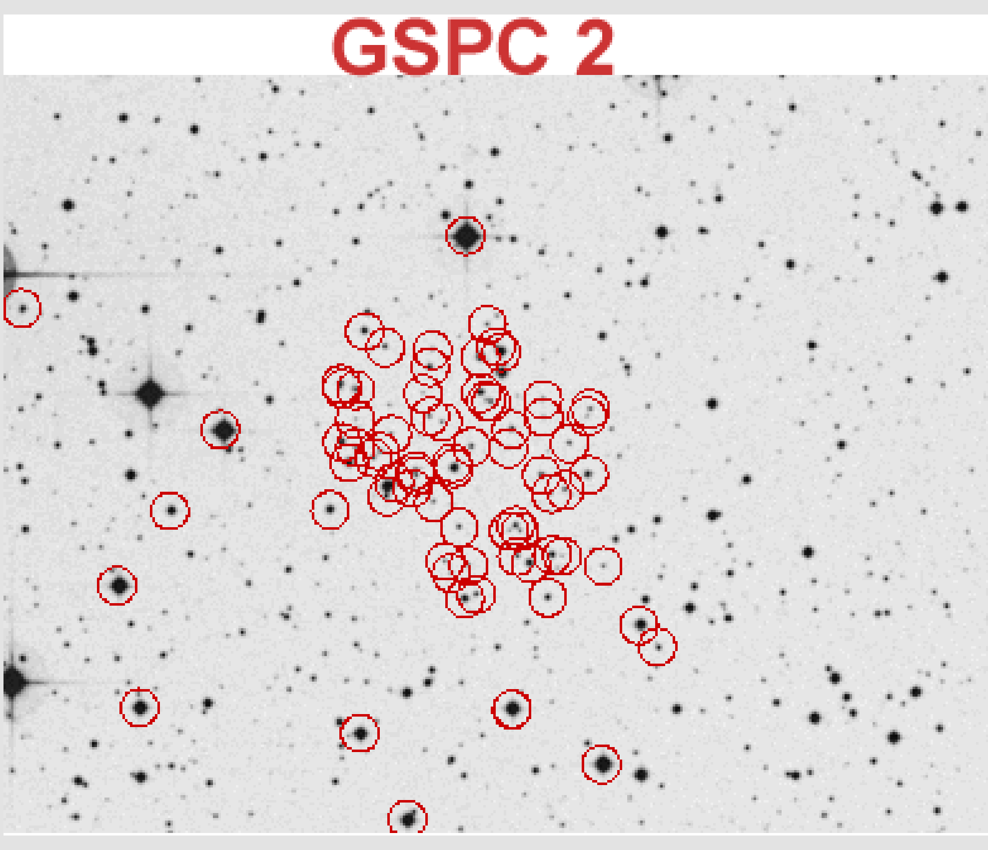
GSPC I	GSPC II	GSPC II Sky Coverage	Data Access

The primary effort of the Catalogs and Surveys Branch of the Space Telescope Science Institute has been the construction of the Guide Star Catalog, both GSC-I and GSC-II. To support photometric calibration of these catalogs, CASB produced the Guide Star Photometric Catalog (GSPC-I) and now in collaboration with Osservatorio Astronomico di Torino are producing its extension GSPC II.



GSPC I is an all-sky set of photoelectrically determined BV sequences in the magnitude range from 9 to 15, generally near the centers of the fields of the GSC-I plates.

GSPC II is generally an extension of GSPC I sequences to V=19 in (B), V and R passbands based on CCD photometry. Its purpose is the calibration of the GSC-II. New northern sequences are being added to support the POSS-II currently in production and the first release (624 sequences) is now available to the public through data access. These sequences represent about one third of the total number of GSPC-II target fields. Our present efforts are focusing on quality control of the remainder of the in-house data, and on (re-)observations of the missing sequences, with the primary goal of publishing photometric calibrators for the entire sky in (B), V, and R passbands.

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Journal Articles	Conference Proceedings	Meeting Presentations
GSC II Consortium Annual Meetings		GSC II Publicity

Copies of new papers published in the astronomical literature by members of our branch will be made available via the WWW. Old publications will be added as resources permit.

All papers are copyrighted by the respective publisher.

Journal Articles:

GSPC 2.1: An all-sky set of (B)-V-R photometric calibrators for Schmidt surveys, GSPC 2.1: First release
Bucciarelli, B, et al 2001

GSC 1.2 -- The Guide Star Catalog, Version 1.2: An Astrometric Recalibration and Other Refinements.
(2M postscript)
J.Morrison, S.Roser, B.McLean, B.Bucciarelli and B.Lasker

Development of the Astronomical Image Archive and Catalog Database for Production of GSC-II
(or 750k Word Presentation)
G.Greene, B.McLean and B.Lasker
1998 Journal of Future Generation Computing Systems.

Completing the Local Sample with TYCHO
(42k Postscript)
R.L.Smart, R.Pannunzio, M.G.Lattanzi and B.J.McLean
XXIIIrd IAU General Assembly, JD10
1998 Highlights in Astronomy, 11. In Press

Faint Photometric BVR CCD Sequences : The North Galactic Pole and the Anticenter
(160k postscript)
A. Spagna, M.G. Lattanzi, B.J. McLean, G. Massone and B.M. Lasker
1998 Astron.Astrophys.Supp. **130**, 359

Membership and Proper Motions of the Open Cluster Stock 2 from the GSC-II Plate Material
(800k postscript)
G.Hawkins, A.Spagna and F.Favata
1997 Mem.S.A.It, 68,4

A Schmidt Plate Coma-like Term
(400k postscript)
J.E.Morrison, S.Roser, B.M.Lasker, R.L.Smart and L.G.Taff
1996 Astron.J., **111**, 1405

Galactic Structure along the Main Meridional Section of the Galaxy I - The North Galactic Pole (N321) Field
(2M postscript)
A. Spagna, M.G. Lattanzi, B.M. Lasker, B.J. McLean, G. Massone and L. Lanteri
1996 Astron.Astrophys, **311**, 758

Conference Proceedings:

The Second Generation Guide Star Catalog
B.McLean
ADASS X, Boston November 2000

DSS-II and GSC-II : STScI All-Sky Image and Catalog Databases
B.M.Lasker, G.R.Greene, M.G.Lattanzi, B.J.McLean and A.Volpicelli
1998 Proceedings of Workshop "Astrophysics and Algorithms : a DIMACS Workshop on Massive Astronomical Datasets.

The GSC-I and GSC-II Databases : An Object-Oriented Approach
(2.5M postscript)
G. Greene, B.J. McLean, B. Lasker, D. Wolfe, R. Morbidelli and A. Volpicelli
1997 IAU Symposium 179, p.474

Contents, Test Results, and Data Availability for GSC 1.2
(66k postscript)
S. Roeser. J. Morrison, B. Bucciarelli, B. Lasker and B.J. McLean
1997 IAU Symposium 179, p.420

GSPC-II: A Catalog of Photometric Calibrators for the Second Generation Guide Star Catalog
(50k postscript)
M. Postman, B. Bucciarelli, C. Sturch, T. Borgman, R. Casalegno, J. Doggett and E. Costa
1997 IAU Symposium 179, p.379

Techniques for Schmidt Plate Reductions with Application to GSC 1.2
(53k postscript)
J. Morrison and S. Roeser
1997 IAU Symposium 179, p.381

Galactic Structure with GSC-II Material : The North Galactic Pole and the Stock-2 Cluster Regions
(660k postscript)
A. Spagna, M.G. Lattanzi, G. Massone, B.J. McLean and B.M. Lasker
1997 IAU Symposium 179, p.228

The Second Guide Star Catalogue
(45k postscript)
B.J. McLean, G. Hawkins, A. Spagna, M. Lattanzi, B.M. Lasker, H. Jenkner and R. White
1997 IAU Symposium 179, p.431

Comparisons with Galaxy Models in the NGP Field
(440k postscript)
A. Spagna, M.G. Lattanzi and B.Lasker
To be published in the proceedings of **Proper Motions and Galactic Astronomy** meeting in Minneapolis.
ASP Conference Series - in press

The Palomar - STScI Digitized Sky Survey (POSS-II) : Preliminary Data Availability
(65k postscript)
B.M.Lasker, J.Doggett, B.McLean, C.Sturch,S.Djorgovski, R.DeCarvalho and I.N.Reid
To be published in the proceedings of the Fifth Annual Conference on Astronomical Data Analysis Software and Systems
1996 ASP Conference Series, p88.

Meeting Presentations:

OCtoo: A Decision Tree Program
V.G. Laidler
Presented at the AURA Software Workshop, STScI, 2002

GSC2.2 vs SDSS EDR: Astrometry, Photometry, Classification
V.G. Laidler
Presented at the 199th Annual Meeting of the American Astronomical Society Meeting, Washington, D.C. 1/02

Canaries in the Data Mine? Using Imprinting to Enhance Supervised Classification Techniques
V. G. Laidler
Presented at the 2001 annual meeting of the Classification Society of North America, St Louis, MO 06/01

Review of Ground-Based Wide-Area Surveys
B.McLean
Review of Ground-Based Wide-Area Surveys, NVO Workshop Caltech June 2000

Predicted Deep Near-IR Starcounts for the NGST Guide Star System
(5MB Postscript)
A.Spagna
Preliminary findings for an NGST study presented to NGST Operations Concept committee 4/99

Photometric Calibration of the STScI Digitized Sky Survey
J.Doggett, M.Postman, B.Lasker and M.Meakes
Abstract for paper presented at the January 1997 AAS Meeting in Toronto

Potential Applications of GSC-II for GAIA Operations
(1.4M postscript)
B.M.Lasker, B.J.McLean, H.Jenkner, M.G.Lattanzi and A.Spagna
"Future Possibilities for Astrometry in Space", 1995 ESA SP-379 pg.137

Annual Project Meetings:

Proceedings of 6th Annual GSC-II Meeting
held nearBaltimore Oct 19-20 2000

Proceedings of 7th Annual GSC-II Meeting
to be held nearTorino Oct 22-23 2000

GSC II Publicity:

GSC2.2 Public Release Announcement from the 198th AAS meeting

GSC2.2 Handout from the 198th AAS meeting

Data Access

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Last Updated Jan 2001

NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW

Access GSC 2.2.01 by coordinate:

GSC2.2.01 is a bugfix release of the GSC2.2. Please see the known limitations page for a description of the differences and the remaining known problems with the GSC2.2.01.

Coordinates : (separated by colons, eg, 01:22:33 +45:33:22)

Right Ascension [ ] Declination [ ]

Annulus : Inner Radius [0] (arcmin): Outer Radius [5] (arcmin):

Mag.Range : Brightest [0.0] Faintest [19.5]

Max.N returned : [5000]

Submit Request | Clear Form

GSC 2	GSC 1	DSS	GSPC	HST Phase 2	Utilities
GSC 2.2.01 through the MAST interface	**GSC 1.2 by coordinate**	**Download images**	Download GSPC 2.1 (624 sequences)	Download the Astronomer's Proposal Tool for use with the DSS and GSC2.2	Coordinate Conversion tool
Download beta version of ShowSky, visualization software for GSC 2.2, DSS, and other selected catalogs	**GSC 1.1 by coordinate**	DSS Plate Finder shows target position on all available DSS plates	Download GSPC1 from the Astronomical Data Center	Phase 2 finder charts generated by CASB after requested by PRESTO. Files are removed after completion of proposal .	Astronomical Calendar tools@imagiware.com
Download version of **GSC 2.2 Query**	**GSC 1.1 by Guide Star ID**	DSS Availability.	**GSPC 1 by coordinate**	Program Information for approved HST proposals.	.
GSC 2.1 (CASB only).	Astronomical Society of the Pacific publishes the GSC 1.1 on CDROM.	.	.	Information on providing HST Phase 2 target coordinates..	.

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Collaborators:

- Osservatorio Astronomico di Torino
- Astrophysics division of ESA
- GEMINI
- ST-ECF

Organizational

- IAU Working Group on Sky Surveys (formerly Wide-Field Imaging) Schmidt.

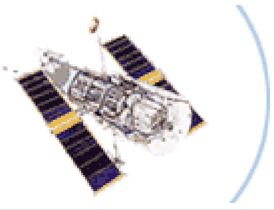
Telescopes

- Oschin Schmidt at Palomar Observatory.
- UK Schmidt Telescope at the Anglo-Australian Observatory.

Plate Scanning Facilities

- SuperCOSMOS at the Royal Observatory Edinburgh.
- The Precision Measuring Machine at the USNO Flagstaff.
- The Automated Plate Scanner at the University of Minnesota.

Hubble Space Telescope



Hubble-V in NGC6822

Resembling curling flames from a campfire, this magnificent nebula in a neighboring galaxy is giving astronomers new insight into the fierce birth of stars as it may have more commonly happened in the early universe.

Read More HUBBLESITE

Calendar

April 02, 2002
Hubble's Science Legacy Workshop

April 05, 2002
Cycle 11 E/PO Grant Program deadline

Program Status

Prop ID: [ ] Go

Mission Highlights

Cycle 11 Calibration Program
The HST instrument teams are in the process of preparing the Cycle-11 Calibration program. The starting point for this plan will be the Cycle-10 calibration program described in the instrument handbooks and on the instrument web sites. The plans
More...

HST Servicing Mission 3b
During Hubble Servicing Mission 3b, the Shuttle will rendezvous with capture HST to perform a series of upgrades increasing the telescope's
More...

HST Servicing Mission 3b Update Following the successful release of HST on March 9, the Space Telescope Science Institute and the Space Telescope Operations and Control Center have
More...

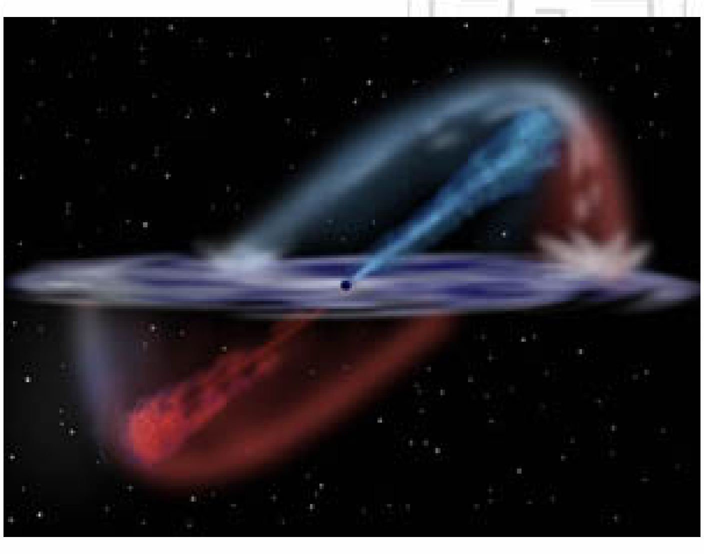
New HST Data Handbook
The HST Data Handbook has been revised and updated, with significant changes both in style and content. Our aim was that the updated version also be
More...

Exposure Time Calculators

ACS • NICMOS • STIS • WFPC2

The Gemini Observatory

Providing complete and unobstructed coverage of both the Northern and Southern skies



Gemini Observatory Captures Multi-Dimensional Movie of Active Galaxy's Core Using Integral Field Technology on Gemini North

---

GSMT Book Now Available

Gemini Probes the Chemical Evolution of a Milky Way Satellite Galaxy

Semester 2002B Call for Proposals Announced

Semester 2001B Report and Update on GMOS Status

Announcement to 2002A T-ReCS Users

Semester 2002A Queue Summary Summary Updated

Flamingos-I Science Observations

Semester 2001B report and update on NIRI status.

Einstein, Relatively Speaking, Drops in on Hawaii

Massive Star Pair Raises Dust While Doing the Tango

Astronomers Discover Edge-On Protoplanetary Disk in Quadruple Star System

Galactic Center Workshop (Kona, HI) - November 3-8, 2002; sponsored by Gemini.

Announcements and Meetings List

December 2001 Gemini Observatory Newsletter

Science Operations

New to Gemini?
Publications
Governance Oversight, Support and Planning
How to observe with Gemini
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Public Information and Outreach

Public Entrance
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Gemini North | *Gemini South*
Newsletters
Giant Segmented Mirror Telescope

*Administrative Note: Please note that **FTP** to ftp.gemini.edu is no longer available; please access via a Web browser instead, to http://ftp.gemini.edu.*

Search this site!

Gemini is an international partnership managed by the Association of Universities for Research in Astronomy under a cooperative agreement with the National Science Foundation.

Contact Information

Gemini Observatory **Tucson Project Office** **950 N. Cherry Avenue** **Tucson, Arizona, 85719, USA** **Phone: (520) 318-8545** **Fax: (520) 318-8590**	**Gemini Observatory** **Northern Operations Center** **670 N. A'ohoku Place** **Hilo, Hawaii, 96720, USA** **Phone: (808) 974-2500** **Fax: (808) 935-9235**	**Gemini Observatory** **Southern Operations Center** **c/o AURA, Casilla 603** **La Serena, Chile** **Phone: 56-51-205-600** **Fax: 56-51-205-650**

Mirror Sites and Other Useful Links

Site Statistics
File Transfer Server
UK mirror site
US mirror site

Australian mirror site
Chilean mirror site
Brazilian mirror site
Argentine mirror site

AURA's New Initiatives Office

Virginia M. Smith / web@gemini.edu / March 21, 2002

The Very Large Telescope Project

ESO is building what will be the World's largest optical telescope array, The Very Large Telescope (VLT). The VLT Project organisation is responsible for the design and construction of the Unit Telescopes, including enclosures, optics, adapter-rotators and coating unit. It is based at the ESO Headquarters in Garching, Germany.

The VLT Project

The ESO Very Large Telescope will consist of four 8-meter telescopes which can work independently or in combined mode. In this latter mode the VLT provides the total light collecting power of a 16 meter single telescope, making it the largest optical telescope in the world. The four 8-m telescopes supplemented with 3 auxilliary 1 m telescopes may also be used in interferometric mode providing high angular resolution imaging. The useful wavelength range extends from the near UV up to 25 microns in the infrared.

The Paranal Observatory is located on Cerro Paranal in the Atacama Desert, northern Chile. Science operation with the first unit telscope (UT1) is scheduled for the first half of 1999. Full operations of all telescopes is expected shortly after the turn of the century. The latest news, press releases, and other information material about the VLT can be found in a separate web document.

The following links provide information about the VLT Project, in particular concerning the engineering aspects and the on-going construction activities.

- **Layout of the Observatory**
- **Unit Telescopes**
  - Unit Telescopes Overview
  - Main Primary mirror (M1)
  - M1 Mirror Cell and M3 Tower
  - Secondary mirror (M2 Unit)
  - Adapter-Rotators
  - Enclosure
- **Auxiliary Telescopes**
- **Coating Unit**
- **Environmental Specifications**

- **The VLT Internal Work pages** provide links to the VLT software problem reporting system, information about work schedules, and daily reports. These links can only be access by a login procedure and have restricted access.

Related Projects and Information

- **VLT Interferometer (VLTI)**
- **VLT Survey Telescope (VST)**
- **VLT Software Development**
- **VLT Data Flow System**

The NGST Web-site has moved!

Wait 10 seconds, or proceed now to the NEW NGST SITE.

If you have trouble finding what you need on the new site, please contact ngstinfo@stsci.edu.

NGST Overview
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Working Group
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Instrument Module
Science Instruments
Guider
Detectors
Operations
Proposals
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Data Release
Document Archive
Document Finder
Glossary

Next Generation Space Telescope

Spacecraft Two potential designs for the NGST.

Sensitivity information for NGST is provided. Detailed exposure time calculations and mission completion time estimates can be generated by the NGST Mission Simulator.

Simulations of NGST observations have been created to demonstrate the scientific capabilities of this new space-based observatory.

NGST SITE PUBLIC INFORMATION

Down-to-Earth info about the Next Generation Space Telescope. Discover what the NGST Mission is all about, without all the confusing astronomy jargon.

Project Highlights

JPL selected to implement MIRI NASA Headquarters has selected JPL as the implementing center for the NGST Mid-Infrared Instrument (MIRI). This selection comes after a brief, competitive round of oral and written proposals More...

NASA selects micro-shutter technology for NGST NIRSpec NASA has selected the micro-electromechanical (MEMs) micro-shutter technology for further development and use in the Next Generation Space More...

Calendar

May 26, 2002
Origins 2002 Workshop

Schmidt Plate Archive & Scanning Facility

STScI • ACDSD • MAST • CASB

Scanning Machines	Plates	Plate Vault	History	Documentation

CASB maintains an archive of several thousand Schmidt survey plates in a secure, environmentally controlled plate vault. Original plates of the POSS-II and SES surveys pass through our facility for digitization on one of our two GAMMA scanning machines. These machines, which started life in 1983 as standard Perkin-Elmer PDS 2020G microdensitometers, were modified in the early 1990s for multichannel operation. Each can automatically scan an entire Schmidt plate at 1 arcsecond resolution in less than seven hours.

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System Requirements	Export Catalog	Architecture	Object Model	Sky Partitioning (HTM)	Status Codes

COMPASS is an object oriented database designed for the production of the second generation Guide Star Catalog (GSC-II). The database project is a collaborative effort between the Space Telescope Science Institute, USA and the Osservatorio Astronomico di Torino, Italy.

It will contain approximately two billion stars, galaxies, and other objects based on measurements of about 6000 sky survey plates. The data consists of:

- Measurements and calibrations of individual astronomical objects up to 5 plates
- Parameters of the individual plates
- Externally produced catalogs with cross-indexing on which the physical calibrations are based on
  - Tycho
  - GSPC2
  - PPM
- Full calibrations of the measured data
  - Positions
  - Brightnesses
  - Colors
  - Proper Motions

The object-oriented schema is built upon the commercial database, Objectivity, using a C++ binding for persistent objects. COMPASS storage hierarchy is based on 32768 sky areas, i.e. region databases, with links to a separate Plate database. The sky tessellation has been selected as part of a proposed community effort to construct a common partitioning of the celestial sphere. The intent of the common partitioning scheme is to ensure large-scale astronomical databases remain as interoperable as possible.

Products

GSC

DSS

GSPC

Science

Publications

Data Access

Related Science

Missions

HST

GEMINI

VLT

NGST

XMM

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Mission Statement
CASB is committed to producing and distributing all-sky digital images, deep object catalogues, and software tools to support operations of current and future ground and space based astronomical observatories, and to provide a research and educational resource to the community.

All staff may be contacted via e-mail as username@stsci.edu
Phone numbers are (410) 338-xxxx

For general information or questions about the GSC2 or DSS2, please contact the help desk.

Name	Title	Username	Room	Phone	Notes
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Gretchen Greene	Engineering Physicist	GREENE	S207	4852	-
Barry Lasker	-	-	-	-	-
Charlie Loomis	CSC Analyst	LOOMIS	133	5093	-
Brian McLean	Scientist	MCLEAN	120	4900	Branch Chief
Michael Meakes	Compression Analyst	MEAKES	133	4940	-
Amy Rosenberg	CASB Operator	AROSEN	N112c	4808	-
Conrad Sturch	CSC Operations Astronomer	STURCH	N101	4856	-

Additional contributors to the GSC-II project include:

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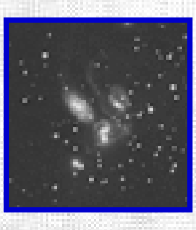
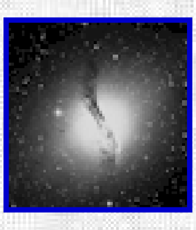
Last Updated 30-May-2001

GSC-II Image Gallery

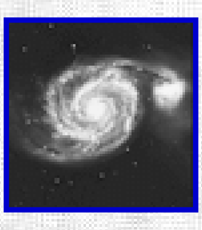
The following is a collection of images that caught our eyes while working with the scans of the photographic plates. Click on any thumbnail for a larger view. Return to [CASB Home](#).



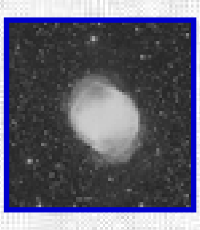
Stefan's Quintet



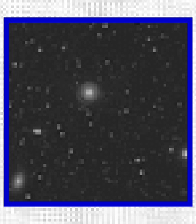
NGC 5128
Centaurus A



M51
A Seyfert 2, Sc galaxy

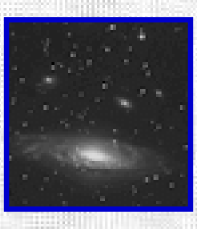


M27
Dumbbell Nebula

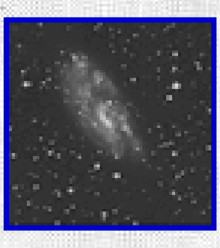


NGC 4622
An Sb galaxy

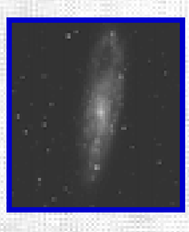
NGC 3621
An Sc galaxy



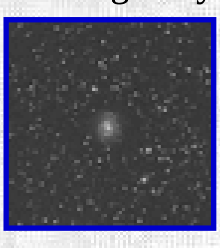
NGC 7331
An Sb galaxy



NGC 2427
An Sc galaxy

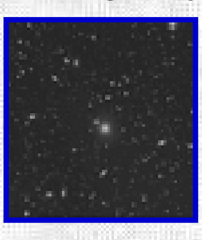


An S Galaxy in the Constellation Cetus.

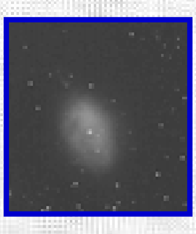


NGC 2223
An SBbc galaxy

NGC 5643
A Seyfert 2, Sc galaxy

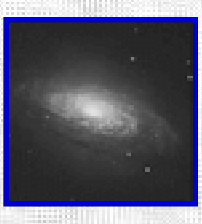


NGC 4709
in a cluster of galaxies

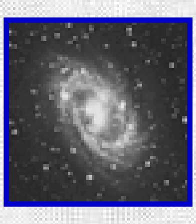


NGC 1360
Planetary Nebula

NGC 1302
An Sa galaxy

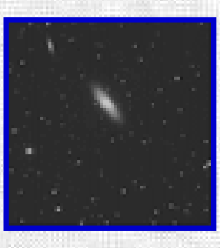


NGC 3521
An Sbc galaxy

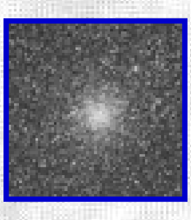


NGC 6300
An Sc (or possibly irregular) spiral galaxy

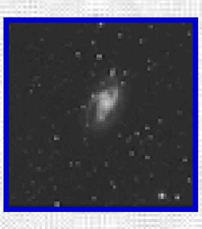
Cygnus Loop



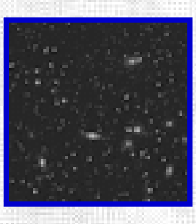
NGC 4856
An SB0a galaxy



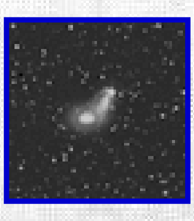
M71
A globular cluster



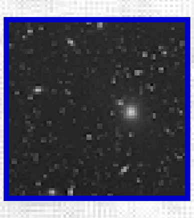
NGC 5054/NGC 5044 Group
An Sb galaxy



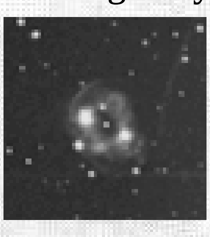
NGC 4743
and other galaxies



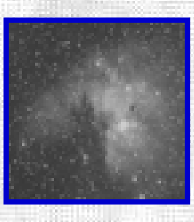
ESO 269-IG 074
An irregular S type pair



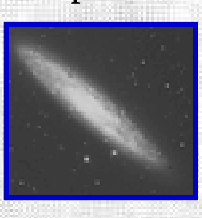
Centaurus Cluster
and several galaxies



ESO 256-19

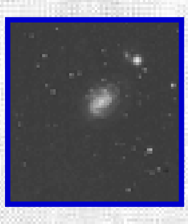


A nebula

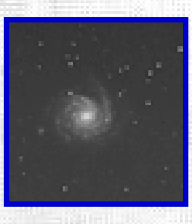


NGC 253
Sculptor Galaxy

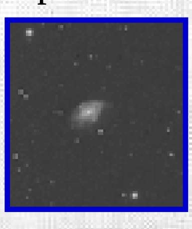
NGC 908
An Sc galaxy



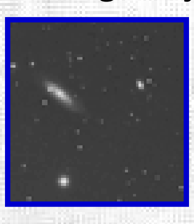
NGC 1187
An SBbc galaxy



NGC 1232
An Sc galaxy

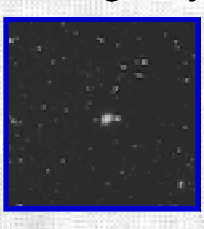


NGC 1255
An SBb/Sc galaxy

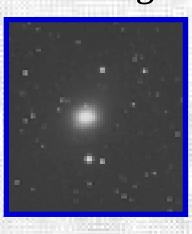


NGC 1325
An Sb galaxy

NGC 1332
An S0 galaxy

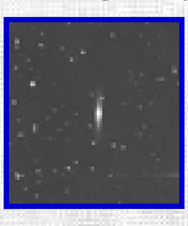


NGC 4727 and NGC 2724
There was a supernova here in 1965.

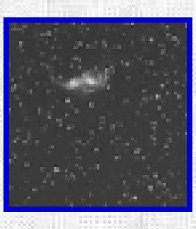


NGC 1395
An elliptical galaxy

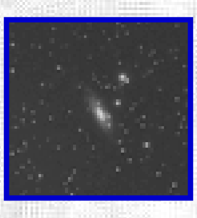
IC 2469
An Sc galaxy



NGC 3390
An S0a galaxy



NGC 2207
An Sc galaxy



NGC 1964
An Sb galaxy

GSC-II 6th Annual Meeting Agenda

October 19-20 2000

CBBC, Stevensville, MD

Meeting Summary	Photographs

Thursday 19th October

08:30 - 09:10 ***Welcome Refreshments***

Introductory

09:10 - 09:15	Fraher	Welcoming Remarks
09:15 - 10:00	McLean	Project Overview
10:00 - 10.15	Lattanzi	Science Overview
10:15 - 10:30	Greene	Database Overview
10:30 - 11:00	***Coffee Break***	

Production Management

11:00 - 11:20	Loomis/Sturch	Plate Processing Status
11:20 - 11:40	Morrison	Plate Calibration Status
11:40 - 12:00	Wolfe	Infrastructure – HSM/DB Backups/DSS
12:00 - 14:00	***Lunch***	
13:30	Conference photo and	Great Chesapeake Bay Schooner Race
		Schooner FAREWELL (Cpt.Meakes)

Astronomical Tasks

14:00 - 14:20	Morrison	Astrometry
14:20 - 14:40	Garcia	Photometry
14:40 - 15:10	Laidler	Classification
15:10 - 15:30	Bucciarelli/Garcia	GSPC-II Status
15:30 - 16:00	***Coffee Break***	

Quality Control

16:00 - 16:15	Lattanzi	OATo Global QA
16:15 - 16:30	Lattanzi	OATo QA
16:30 - 16:45	Mignani	Astrometric tests
16:45 - 17:00	Discussion	Additional QA tasks / implementation priorities

Management

17:00 - 17:30 McLean, Lattanzi, Greene, Takamiya, Wicenec – General discussion

19:00 ***Conference dinner at The Tavern on the Bay Restaurant***

Friday 20th October

08:30 - 09:15 ***Welcome Refreshments***

Telescope Operations

09:15 - 09:30	Greene	Export Catalog and User Interface
09:30 - 09:45	Garcia/Spagna	Color Transformations
09:45 - 10:00	Spagna	Guide Star Availability
10:00 - 10:15	Morrison	NGST/Nexus operations
10:15 - 10:30	Sturch	HST Bright Object Protection
10:30 - 11:00	***Coffee Break***	
11:00 - 11:15	Takamiya	GEMINI update
11:15 - 11:30	Wicenec	VLT update
11:30 - 12:00	Discussion	GSC-II Operational requirements
12:00 - 14:00	***Lunch***	

Science Activities

14:00 - 14:20	White	FIRST and GSC-II
14:20 - 14:40	Smart	CRA science update
14:40 - 15:00	Smart	Variable stars in GSC-II
15:00 - 15:30	Hawkins	Open cluster Blanco 1
15:30 - 16:00	***Coffee Break***	
16:00 - 16:15	Carollo	High Proper Motion White Dwarf Candidates
16:15 - 16:30	Mignani	ESO science projects using GSC-II

Summary

16:30 - 17:00	Jenkner	Summary of status
		Review action items
		Identify problem areas

Guide Star Catalog II

Products
- GSC
- DSS
- GSPC

Science
- Publications
- Data Access
- Related Science

Missions
- HST
- GEMINI
- VLT
- NGST
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Catalog Properties	GSC 2.2 Release Notes	Background	Plate Material
Image Processing	Calibrations	Science	Data Access

998,402,801 unique GSCII Objects and counting!

The GSC II is an all-sky catalog based on 1" resolution scans of the photographic Sky Survey plates, at two epochs and three bandpasses, from the Palomar and UK Schmidt telescopes (DSS). Positions, magnitudes, and classifications are produced for all objects on each plate. The objects are then loaded into the COMPASS database, where multiple observations of the same object are matched and assigned a unique name based on the HTM sky tesselation that has become a community standard. This provides the multi-wavelength, multi-epoch data necessary to produce colors and proper motions.

Construction of the complete GSC-II is still in progress. More than 998 million unique objects have been loaded into the COMPASS database thus far, based on plate-limited image processing and calibrations for all sky survey plates in two bandpasses (J and F) in both hemispheres. Processing of the near infrared plates and the POSS-I plates in the north is still ongoing.

The GSC2.2 is an allsky, magnitude-selected subset of this data that has been extracted to support telescope operations at the GEMINI and VLT telescopes. As of July 16, 2001, this Telescope Operations version 2.2.01 contains positions, classifications, and magnitudes for 455,851,237 objects, and is now available to the community via the WWW. The magnitude limits (18.5 in photographic F or 19.5 in photographic J) were implemented to ensure the photometric quality of the released data. Since bright objects are extremely overexposed on the Schmidt plates, we have replaced these bright objects with those from the Tycho-2 catalog. Please read the release notes for additional details on the GSC2.2, and check the catalog properties page to see how it updates and extends its predecessor, the GSC I.

The final version (GSC 2.3), expected to be released in 2002, will also contain proper motions.

The catalog will be used for operational support of HST, the GEMINI telescopes, ESO's Very Large Telescope (VLT) as well as future space missions such as the Next Generation Space Telescope (NGST).

Please note that GSC 2.2.01 is 40GB in size and that we do not have the resources to support downloads or make copies of the entire catalog for individual researchers or institutions at this time - only participating institutions. We are looking at options and costs for a mass distribution of GSC 2.3 on some media. The major data centers and observatories which contributed to the production of this catalog are also providing on-line access to the world-wide community.

Please read the fine print:

data copyrights • data use policy • data acknowledgements

The Guide Star Catalogue II is being constructed by the Catalogs and Surveys Branch of the Space Telescope Science Institute and the Osservatorio Astronomico di Torino in collaboration withthe Astrophysics division of ESA, the GEMINI project and the ST-ECF .

Barry Lasker, 1939-1999

Products

GSC

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GSPC

Science

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Dr. Barry Lasker was the most important single individual in the development of the Guide Star Catalogue and Digitized Sky Survey projects. He originated the concept of building a Guide Star Catalog to support guide star selection for HST. In the 1980s, he led the team that customized the Perkin-Elmer 2020G microdensitometers to bring them up to the positional and photometric accuracy standards required for the GSC I, and in the 1990s, he led the team that redesigned them entirely to permit rapid scanning of the second epoch surveys, at even finer resolution, for the GSC II. He was awarded the 1998 Van Biesbroeck Prize, which recognizes extraordinary service to the astronomical community, in recognition of his leadership and innovation in the production and distribution of the Digitized Sky Survey. He developed the international collaborations which have supported these projects. His creative scientific leadership of the GSC and DSS teams through the years was rivalled only by the generous friendship he shared with us all.

Barry's sudden passing, in February 1999, was a shock and a deep loss to all who knew him. We in the Catalogs & Surveys Branch were hit especially hard. The GSC2 project was still years from completion, and Barry was still deeply involved in almost every aspect of it. Somehow, we had to continue the work without his key insights and unfailing intuition (not to mention his uncanny knack with the scanning machines). It was a daunting prospect. But we were determined. Many of us said, in the first days after his death, that we were determined to do it *for* Barry: to pull it off somehow, to complete the grand project that was so much of his life's work.

Well, we're not finished yet. But the public release of GSC2.2 is a significant milestone, and we could not let it go public without talking about Barry.

Under the effective leadership of Dr. Brian McLean, who accepted the challenge of managing the group after Barry's death, we have completed a great deal of what, in 1999, was still to be done. The end of the project is clearly in sight.

And so at this time, we would like to say,

Barry,

These 435,457,355 catalog objects

are for you.

Vicki Laidler
on behalf of the entire GSC2 team
23 May 2001

- The text of the Van Biesbroeck award nomination letter
- Remembering Barry: reminiscences and photos contributed by friends and colleagues shortly after Barry's death
- The Man Behind the Guide Star Machine: a cartoon from the early days of the GSSS project
- Twas the Night Before GSC2.2: a Christmas poem, with apologies to Clement C. Moore

Guide Star Catalog I

Last Updated Jan 2001

"The GSC and the Digital Sky Survey (DSS), from which the GSC is derived, have transformed astrometry from an 'art form' practiced by a few professionals to a tool utilized by an ever-increasing number of astronomers, professionals and amateurs alike." - Dr. W. F. van Altena, ApJ 525:1283, Centennial Issue

The Catalogs and Surveys Branch of the Space Telescope Science Institute constructed the Guide Star Catalog I (GSC I) to support the pointing and target acquisition for the Hubble Space Telescope. For the last decade the GSC I has been used for numerous other purposes, for example, the observation planning for fiber optic spectrographs, the preparation of finding charts, and the operation of ground-based telescopes.

The GSC I catalog is an all-sky catalog of positions and magnitudes for approximately 19 million stars and other objects in the sixth to fifteenth magnitude range. The GSC is primarily based on an all-sky, single-epoch collection of Schmidt plates. For centers at +6° and north, a 1982 epoch "Quick V" survey was obtained from the Palomar Observatory, while for southern fields, materials from the UK SERC J survey (epoch = 1975) and its equatorial extension (epoch = 1982) were used. See plate material for more information on the plates.

All the plates were digitized at the Space Telescope Science Institute into 14000 X 14000 rasters at a 25 micron sampling interval using two modified PDS micro-densitometers. For more information on the plate processing consult Lasker et al., 1990, AJ, Vol 99, 6. This paper was selected as the groundbreaking article in astrometry published during the twentieth century, and was included in the AAS Centennial Issue of the Astrophysical Journal.

The GSC 1.1 is used for control and target acquistion of the Hubble Space Telescope.

The GSC 1.2 is an astrometric recalibration of the GSC 1.1, and should not be used for HST operations.

Please read the fine print:

The Guide Star Photometric Catalog (GSPC-I) is an all-sky set of 1477 photo-electrically determined BV sequences covering the magnitude range from 9 to 15. The GSPC was created to provide photometric calibrators for the Guide Star Catalog (GSC-I), which is a catalog of approximately 19 million stars and objects classified as non-stars needed to support the pointing of the Hubble Space Telescope.

GSPC-I sequences nominally contain (at least) six stars, each with a photometric precision of 0.05 mag. In practice, a small number of sequences contains fewer stars, and the precisions achieved for the faintest stars are more nearly 0.1 mag.

For more information about GSPC-I, go to the paper by Lasker, Sturch, et al., Ap. J. Supplement, Vol. 68, 1988 .

To view data from an enhanced version of GSPC-I, go to the ADC catalog.

Guide Star Photometric Catalog II

Last Updated Jan 2001

The Guide Star Photometric Catalog-II (GSPC-II) is being created by the STScI Catalogs and Survey Branch and the Osservatorio Astronomico di Torino (OATo) to provide photometric calibrators for the Guide Star Catalog-II (GSC-II). Most of the GSPC-II star sequences extend the GSPC-I sequences to a limiting magnitude of V = 19 or fainter based on CCD data in the V and R bandpasses of the Johnson-Kron-Cousins system. Where resources were available, which is for a large part of the southern hemisphere and for a few northern fields, a B band was also included, and the limiting magnitude brought to ~20. While the southern second-epoch plates used for GSC-II lie on the same 5 deg grid pattern used for for GSC-I and require no additional sequences, the northern POSS-II plates supporting GSC-II lie on a similar 5 deg grid which differs from the 6 deg grid used for GSC-I. This results in a number of POSS II plates being considerably shifted with respect to the original grid, and therefore poorly covered by the GSPC-I sequences. New northern sequences are being added in GSPC-II to support calibration of such POSS-II plates.

The observations were obtained with mostly one-meter class telescopes at ten observatories. Most of the northern GSPC-II sequences were imaged at the Kitt Peak and Wise Observatories, whereas southern declinations were covered by Cerro Tololo and ESO-La Silla observations. Data also were acquired at Mt. Hopkins, Mt. Laguna, Lowell, Mt. Megantic, McDonald and JKT La Palma observatories. The observation strategy was to take CCD frames centered on the faintest star of the corresponding GSPC-I sequence where one was available. When necessary, both long (~8-15 min) and short (<3 min) exposures were acquired in each field. Short exposures times were chosen to be appropriate for the typical 14.5 mag target star. For new POSS-II fields lacking GSPC-I sequences, the telescope was pointed to the nominal center of the corresponding survey plate, and the pointing adjusted to avoid bright stars.

For more information see: the journal article: "An All Sky Set of (B)- V-R Photometric Calibrators for Schmidt Surveys: GSPC2.1: First Release", Bucciarelli, et al. A&A 368, pp 335-346, 2001

Fri Mar 22 11:05:58 2002

Server	Institution	Connect Info	Status	Comments
Catalog Archive Server	Fermilab	sdssQT on sdssdp5.fnal.gov, ID fermiEDR,	OK	
Data Archive Server	Fermilab	http://sdssdp7.fnal.gov/cgi-bin/das/main.cgi	OK	8 imaging runs, 95 plates
SkyServer	Fermilab	http://skyserver.fnal.gov/	OK	

News

```
Oct 10, 2001:
At 11:58 am CDT the edr server was restarted with v2_3_13/v3_2_0
```

IUEDR-IUE Satellite Data Reduction Package

This system provides documentation, help and news for users of the IUE Satellite data reduction package IUEDR. The current page is an overview of the system and a summary of how to use it. There is a (slightly out of date) **imagemap** version of the menu list below.

Highlighted items indicate a reference to another page. To display that page simply click on the item.

iuedr Use the `iuedr` symbol to get back to this page at any point.

This is an "experimental" service. Feedback via WWW or e-mail to *mjc@star.ucl.ac.uk* are invited. All comments are welcome.

What's Available?

Here are the sub-topics covered by this system:

- **Support for IUEDR limited**
  Starlink support for IUEDR is already at the minimum level - no time is available for enhancements. It is expected that Starlink support for IUEDR will cease at the end of 1999.
- **What's new in the IUEDR pages**
  Recent changes and additions to these web pages.
- **Accessing NEWSIPS FITS files**
  Simple tools to access the NEWSIPS LORES products.
- **A data reduction tutorial**
  Based on Richard Tweedy's 'IUEDR data anlysis Tutorial'.
  Gets anyone started on realscience.
- **Help!**
  The Online HELP system pages for WWW.
- **IUEDR Web pages index**
  Search the IUEDR pages for a word.
- **Documentation**
  All the IUEDR documentation and more.
- **Data Reduction Cookies**
  Some scripts for processing multiple IUEDR datasets.
- **NASA IUE Merged Observing Log** / **STADAT IUE Account**
  On-line searchable versions of the IUE log.
- **NASA Archive Form** and **RAL Archive Pages** / **Directories**
  Access to the NDADSA and RAL IUE databases.
  You may be able to extract the datasets you need from here.
- **VILSPA/IUE homepage**
  Information about the spacecraft maintained at VILSPA.
  Newsletters and data on the IUEFA can also be found here.
- **NASA/IUE homepage**
  Information about the spacecraft maintained by NASA.
- **Comments** and **Bugs**
  A chance to report bugs and make comments and suggestions on IUEDR.
- **New features in IUEDR Vn. 3.2-0**
  What's new in the current release.
- **There is no beta release**
  Because the released version (3.2-0) is up to date!

Martin Clayton
mjc@star.ucl.ac.uk
Thu Sep 25 19:17:00 BST 1997

About NEWSIPS data handling

Introduction

Data processed with NEWSIPS are stored in FITS format and comprise:

- For Low Resolution Data:
  - raw image (`RILO` extension),
  - linearized image (`LILO` extension),
  - resampled spectral image (`SILO` extension) and
  - extracted and calibrated spectrum (`MXLO` extension).
- For High Resolution Data:
  - raw image (`RIHI` extension),
  - linearized image (`LIHI` extension),
  - resampled spectral image (`SIHI` extension) and
  - extracted and calibrated spectrum (`MXHI` extension).

Note: only resampled low dispersion images (`SILO`) and extracted and calibrated spectra (`MXLO,MXHI`) will be provided at the VILSPA NEWSIPS Data Server.

Reduction packages

NEWSIPS data can be analysed under MIDAS and IDL.

- **MIDAS** requires the **IUE context**, available at ftp://iuearc.vilspa.esa.es/pub/iuemidas/. MIDAS works under Ultrix (version 4.4) and VMS (version 6.2).
- **IDL** can be used with the IUERDAF package running on version 2.0 or higher. IUERDAF works in ULTRIX, SUN-UNIX, SOLARIS, Vax VMS or Windows. This package is available at ftp://iuewww.gsfc.nasa.gov/pub/software/
- FITS data produced by NEWSIPS can also be read by other packages, like the FITSIO and FTOOLS software of HEASARC or several other IDL FITS readers like READFITS + TBGET, FXBOPEN + FXBREAD or MRDFITS from the ASTRON library, and IFITSRD or READMX from the IUEDAC library

---

How to use the IUE context in MIDAS

This context is enabled with the command `set/context IUE` (see the on-line help for a more detailed explanation of the commands available under this contex). Examples of how to read and convert NEWSIPS low resolution and high resolution data in MIDAS format from disk and tape are briefly summarized below.

• Low Resolution Data

Example: How to read and work with the 1-D NEWSIPS Low Resolution spectrum (.MXLO)

```
convert/mxlo SWP32192 (without extension)
```

The command will create a MIDAS table with the extracted spectra as SWP32192L.tbl (for large aperture) and/or SWP32192S.tbl (for small aperture). The tables have the following columns:

```
 Col.    1:WAVELENGTH       Unit:ANGSTROM         Format:F10.3  R*8
 Col.    2:NET              Unit:FN               Format:E15.5  R*4
 Col.    3:BACKGROUND       Unit:FN               Format:E15.5  R*4
 Col.    4:SIGMA            Unit:ERG/CM2/S/A      Format:E15.5  R*4
 Col.    5:QUALITY          Unit:                 Format:I11    I*2
 Col.    6:FLUX             Unit:ERG/CM2/S/A      Format:E15.5  R*4
```

The comamnd `plot/mxlo` plots low dispersion NEWSIPS spectra in MIDAS table format. Three options are available as

```
PLOT/MXLO SWP32192L F     To plot flux and sigma spectra
PLOT/MXLO SWP32192L G     To plot gross, flags and background spectra
PLOT/MXLO SWP32192L N     To plot net and quality spectra
```

Example: How to read the NEWSIPS reduced files (.RILO/.LILO/.SILO)

`indisk/fits SWP32192.`*`EXT`* `SWP32192`

Where *.EXT* is the extension .RILO, .LILO or .SILO. This command converts FITS format on disk to standard MIDAS (`.bdf`) format creating the image `SWP32192.bdf` which allows you to use the standard MIDAS commands for images handling.

• High Resolution Data

(under construction)

How to use IUERDAF for IUE data

Examples: How to read 1-D NEWSIPS spectra (.MXLO/.MXHI)

For a single aperture low dispersion image:
`readmx,'swp32525.mxlo',main,wave,flux,flags,sigma,bkgrd,net`

To read the region of a high dispersion spectrum containing Mg II:
`readmx,'lwp12345.mxhi',h,w,f,q,s,wrange=[2790,2810]`

To output all extracted points for high dispersion order 100:
`readmx,'lwp12345.mxhi',h,w,f,q,s,orange=100`

The command `readmx` reads the IUE merged extracted spectra FITS file (.MXLO/.MXHI) and returns the header, wavelength, absolute flux, flags, sigma, background and net flux as IDL variables.

Example: How to read NEWSIPS raw images (.RILO/.RIHI)

`readri,'SWP32525.RILO',main,image`

This command reads IUE raw image FITS files and returns the primary FITS keywords, vicar label, history portion of the FITS header, and image as IDL variables.

Example: How to read NEWSIPS linearized images (.LILO/.LIHI)

`readli,'SWP32525.LILO',main,image,flags`

This command reads IUE linearized image FITS files and returns the primary FITS keywords, vicar label, history portion of the FITS header, image and NEWSIPS flags as IDL variables.

Example: How to read NEWSIPS resampled files (.SILO/.SIHI)

For a low dispersion image:
`readsi,'SWP32525.SILO',main,wave,image,flags`

For a high dispersion image:
`readsi,'SWP32525.SIHI',main,wave,image,flags,cri`

the wavelength vector for the first order in the SIHI file is:
`w1=wave(0,0)+wave(1,0)*findgen(768)`

The command `readsi` reads IUE resampled image FITS files and returns the header, wavelength, image and flags as IDL variables.

Handling flux calibration and sensitivity degradation files

When working with SILO files, for instance to reprocess spectra of extended objects, you need to fully calibrate the extracted spectrum. Inverse sensitivity functions as well as correction factors for both SWP and LWP cameras are available at ftp://iuearc.vilspa.esa.es/pub/calib/ . You are referred to the NEWSIPS Manual for information on absolute calibration derivation and on the application of time and temperature dependent sensitivity corrections.

Information related to NEWSIPS and IUE Final Archive Project

Newsips Processing Manual and general information about the Final Archive project are available on the WWW.

E. Solano, D. de Martino and N. Loiseau

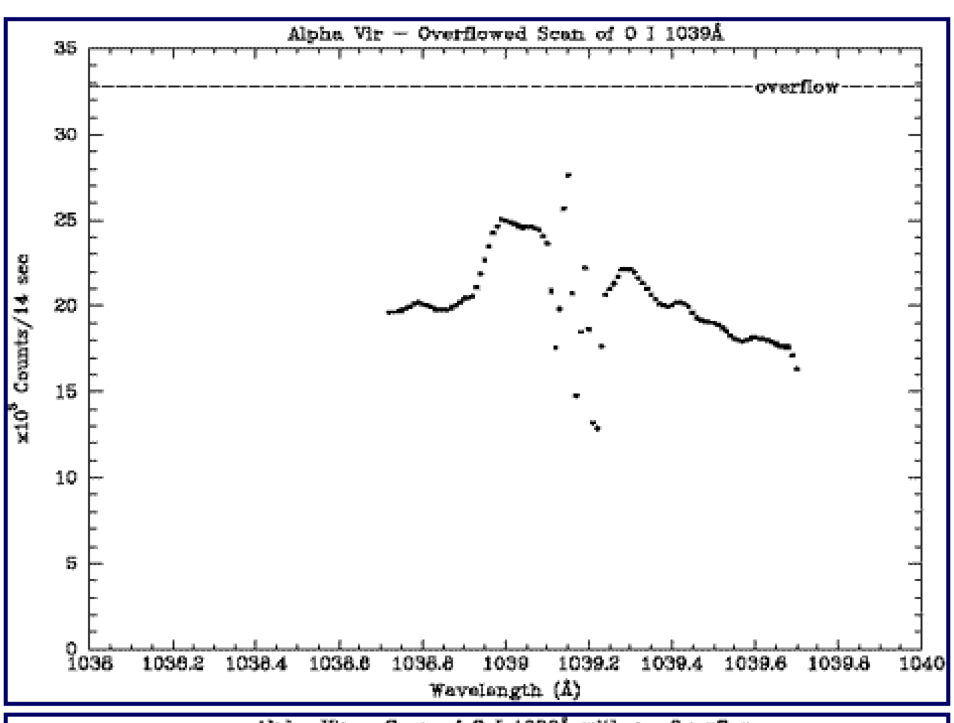
N. Loiseau & E. Solano

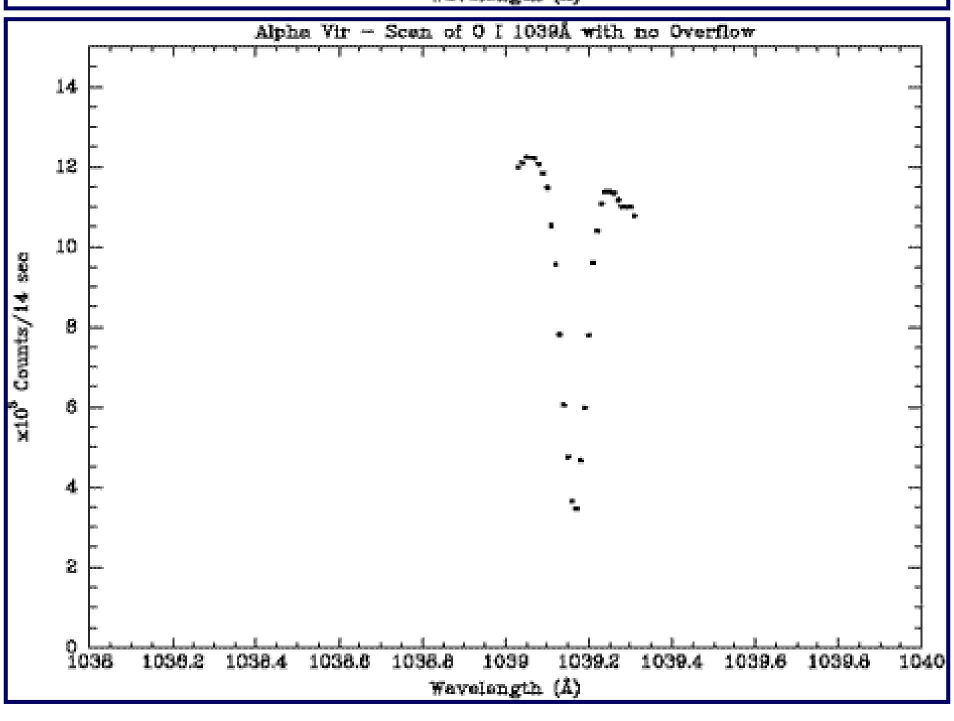
Last updated: Jul 7, 1999

Common Data Problems

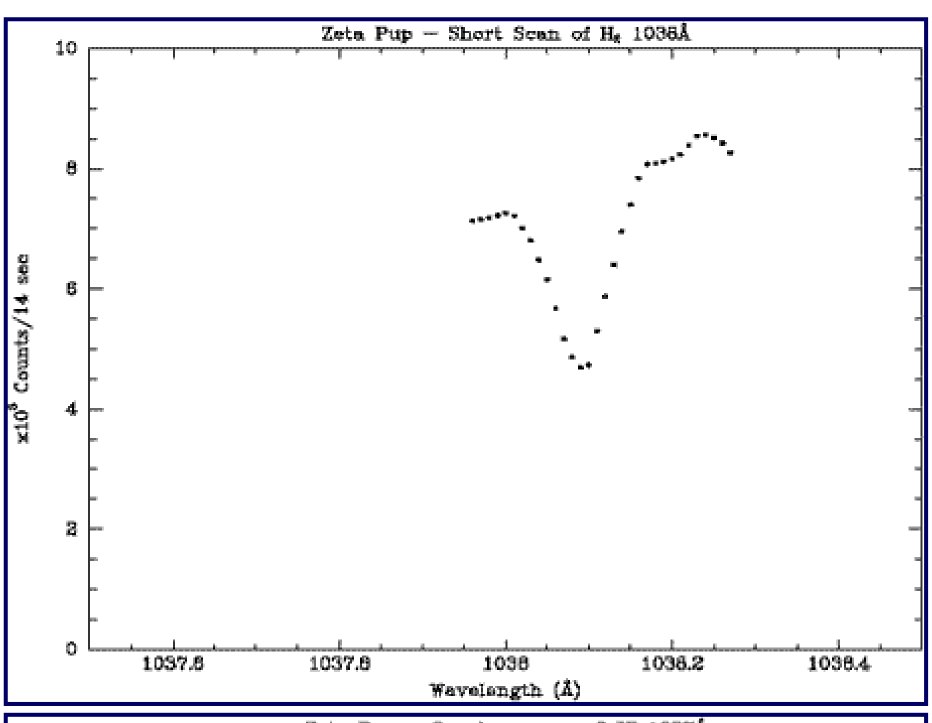
Data taken with the *Copernicus* spectrometer is usually quite easy to deal with after determining the background, however there are still a number of things that could go wrong that one has to watch out for when dealing with these datasets. **It is particularly important when using Copernicus data to look at the individual scans as well as the final stacked scan to be sure you do not miss any drifts, glitches, overflows, etc that can distort the final stacked output**. Some (but by no means all) of the problems that can occur in *Copernicus* data are shown in the examples that follow, as well as some suggestions for how to spot these problems.

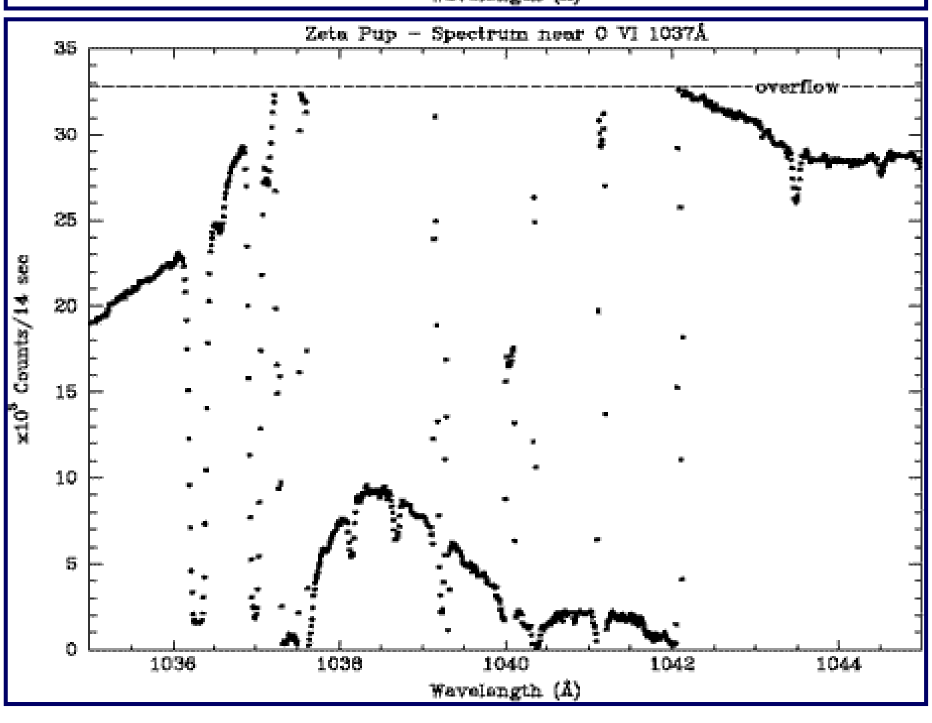
At the beginning of the mission the sensitivity of the instrument was quite high, occasionally the number of counts recorded during a scan exceeded the number of counts that could fit in the data buffer (32,767 counts in 14 seconds), when this occurred the counts "wrapped around" and restarted at zero. This can be most easily seen by comparing two scans of the same spectral region, the following figures show two scans of the O I line at 1039Å line towards the star alpha Vir, the first shows a scan where the continuum has overflowed the data buffer, and the second a scan taken at a later date when the instrument sensitivity had declined --





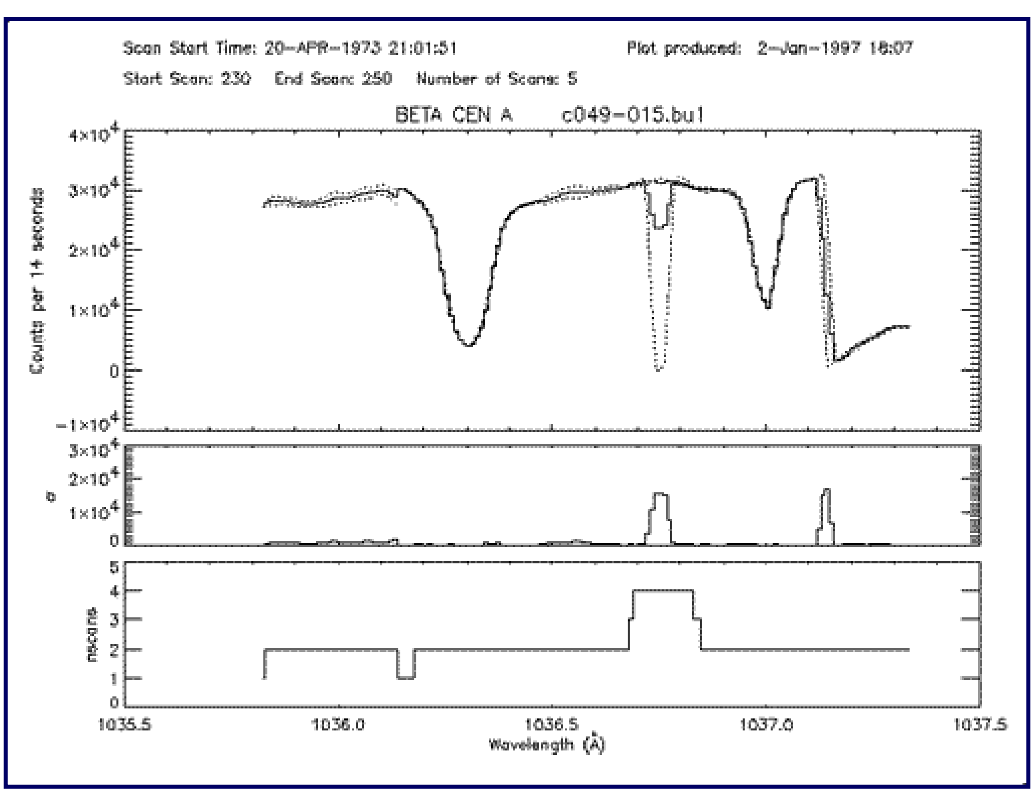
Since scans of single lines usually included only a small range of wavelengths (and thus sampled only a short section of the continuum) it can often be difficult to determine when an overflow has occurred. Since strong lines will be near zero in their cores and thus can only overflow in the wings of the line and in the continuum, one can find the approximate wavelength range over which overflows are likely to have occurred. The following two figures show a case where a scan of a (relatively weak) line does not provide enough information to identify this wavelength interval as one where the data registers overflowed, the continuous scan taken at roughly the same time shows that this data is in fact overflowed:





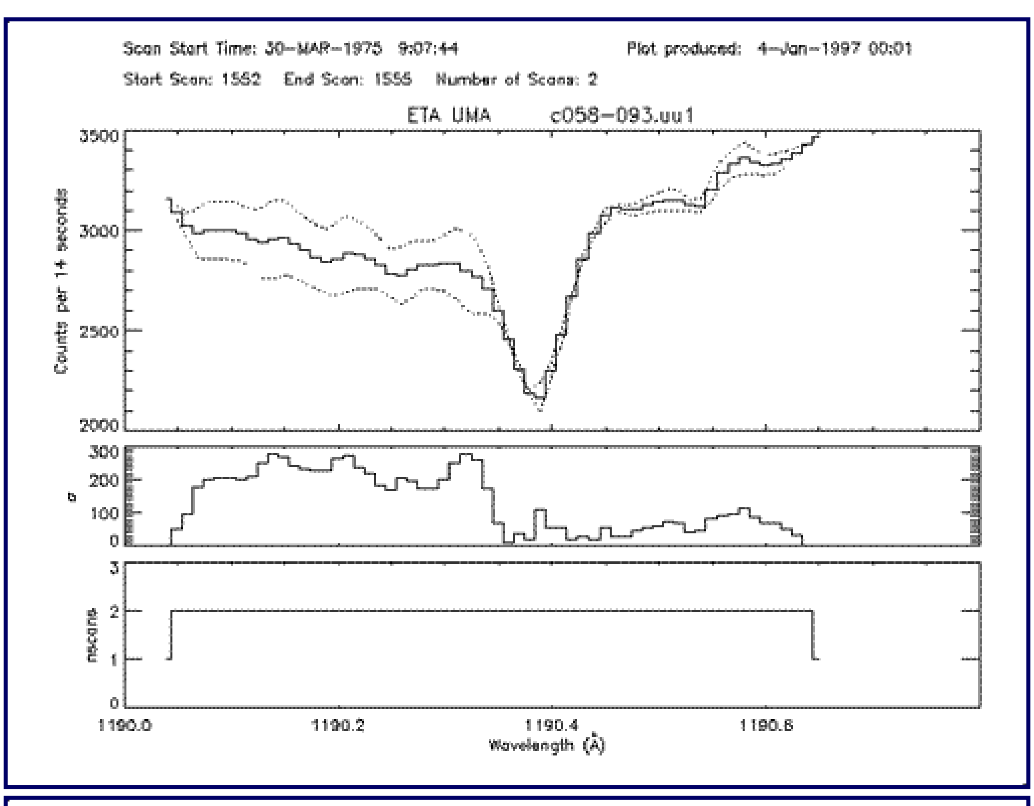
The correction for an overflow where only a section of the data in a stacked scan has overflowed (especially where the transition occurs within a line of interest) is in generally not possible unless the entire region of interest has overflowed. In cases (such as the scans of the 1039Å line towards alpha Vir) where the transition occurs in the middle of the region of interest one must go back to the raw (and thus un-interpolated) data, correct the overflow by adding 32767 counts to the appropriate fluxes, and then re-stack the data.

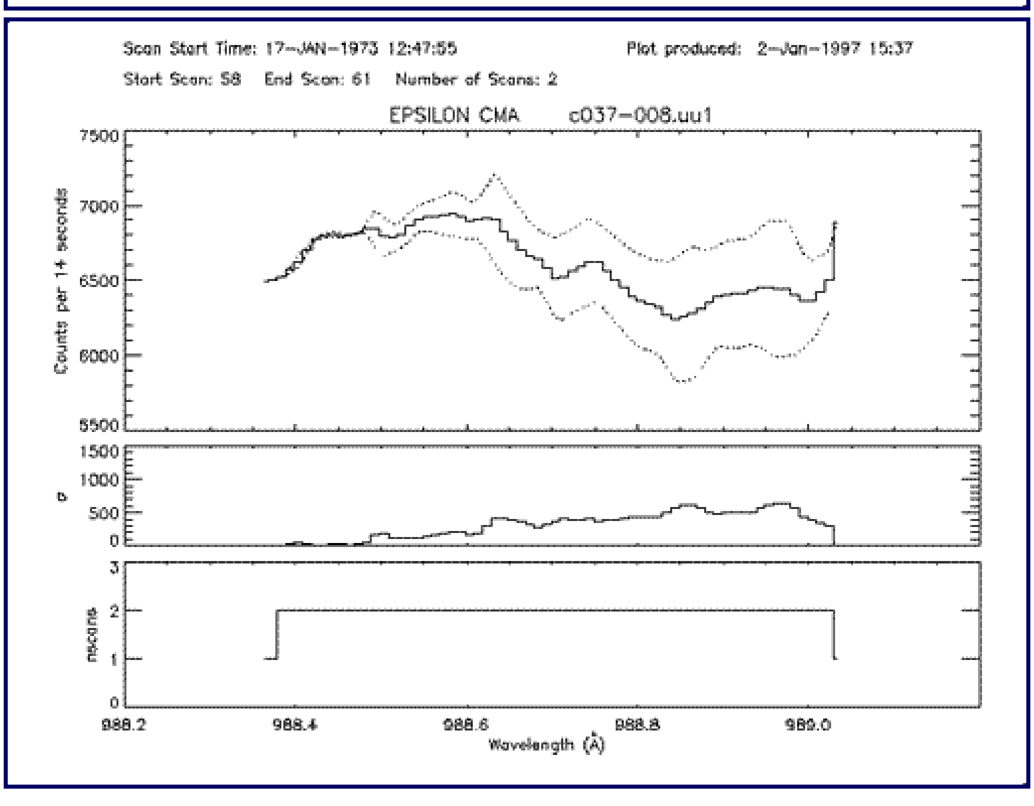
One must be very careful to check the individual scans for overflows whenever the countrate is near 32,000 counts per 14-second. Overflows of single wavelength points can occur in one or two of a group of scans and create a **false line** as is shown here:



Besides overflows there are also spurious decreases and/or increases in the countrates in some scans. The most likely cause of a decrease in the countrate is pointing error, while increases in the countrate are generally caused by a rise in the particle background (see below). In general such changes are not caused by variations in the amount of stray light being blocked by to carriage-2, although this can only be ruled out by a point-by-point comparison of the U1/V1 and U2/V2 positions with **Figure 9** of the Guest Investigators Guide.

The spacecraft pointing accuracy was generally about 0.02 arc seconds during the typical single scan of spectral lines, this was good enough so that the counts are usually not noticeably affected by guidance changes. However, occasionally the spacecraft drifted, which results in a sudden and often temporary drop in the count rate during a scan. These figures show examples of apparent tracking errors, note the large variation in the net flux between scans:





Occasionally one sees sudden **increases** in the count rate during a series of scans of a single line. Such changes are generally attributable to a rise in the particle background. While observations were generally planned so as to avoid the South Atlantic Anomaly (SAA) where the particle background is large, occasionally the edges (which were not that well defined) of the SAA were crossed. There are also a few observations that were taken during a crossing of the SAA itself, such scans are characterized by a larger than usual background (listed in the TBACK column of the raw data). **Figure 6** of the Guest Investigators Guide shows the typical variation in particle background within an orbit.

---

compiled by jtl

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Coadd Data Search

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Acknowledgments

Photometric Reductions

The following section on photometric reductions was reprinted, with permission from the author, from the paper "The Copernicus Ultraviolet Spectral Atlas of Tau Scorpii" by John Rogerson and Walter Upson (Ap J Suppl. 35,37-110,1977). The corrections described for cosmic ray and charged particle background, guidance variations and scattered light however, are relevant to all Copernicus observations.

The variation of the instrument sensitivity with wavelength is not well known, and consequently no attempt has been made to normalize the observations to a constant sensitivity condition. This atlas should therefore not be used to estimate the general shape of the ultrtaviolet continuum of Tau Sco, but it is entirely suitable for investigation of the line spectrum.

The counts detected at each measurement point reflect the flux in the stellar spectrum but are also affected

1. by a background due to cosmic rays and trapped ions from the lower Van Allen belt,
2. by how well the guidance system keeps the star image centered on the spectrometer entrance slit, and
3. by scattered light within the spectrometer.

Corrections for these three effects are considered below. The counts may also be affected by the strength and direction of the magnetic field in which the photomultiplers find themselves, but the behavior of many repeated U2 counts at a fixed point in the spectrum suggests that this effect must be small. This is presumably also true for U1, which is physically identical and operated identically.

Cosmic Rays and Charged Particles

This source of background counts has been carefully studied by York and Miller (1974) using counts obtained when starlight was not entering the spectrometer. The cosmic ray flux depends mainly on the geomagnetic lattitude of the satellite, while the trapped particles are primarily concentrated in the South Atlantic Anomaly. In addition, some of the data photomultipliers have windows the fluoresce for some time following a heavy exposure to the charged particles, with the result that the background for these tubes at a particular time depends not only on the current particle flux but also on their recent exposure. Although the data for this atlas do not depend on these fluorescing tubes, the background counts for all tubes are estimated by the same procedure. Under these circumstances it is expedient to designate the position of the satellite by the longitude of the ascending node of the orbit and the time after pasage of the satellite through this node. Using this coordinate system ensures that each time the satellite reaches a certain coordinate pair, it will have had the same recent history of cosmic ray and trapped particle flux exposure. The study by York and Miller shows that the background counts are quite repeatable (within expected statistical flucuations) over time intervals that are long compared to the Tau Sco observing interval when using the above-described coordinate system. Aimed with this empirical result, a table was prepared giving the expected background count as a function of the satellite coordinates, and this table was then used in removing the background count from each measurement.

[***Note: the Copernicus raw data files include background counts for most scans (see precautionary comments though). In cases where a background was for one reason or another not included, a program is available for deriving values as described above. Also, the table of background counts as a function of coordinates, is now available in FITS format.***]

Correcting for Guidance Variations

In spite of an excellant guidance system, changing external torques operating on the satellite cause the stellar image to drift about on the entrace slit of the spectrometer. The result is that the amount of stellar flux entering the spectrometer slowly changes, giving rise to variations in the observed spectrum which have no counterpart in the star's intrinsic spectrum. These variations may be as great as 10%. This effect can be corrected with the help of the signal from U2 which, as noted before, is held fixed so that its output signal provides information on the variation of stellar flux entering the spectrometer. Each U1 count is corrected for guidance drift by dividing it by the simultaneously acquired U2 count and multiplying it by the average of all U2 measurements made with U2 held fixed in position.

While the correction procedure is straightforward in theory, there are four operations that must be performed on the U2 counts before they can be used to correct for guidance variations. First, the cosmic ray and charged particle background must be removed. This is accomplished in the same manner as described above for U1. Second, while U2 is help fixed in the spectrometer, its wavelength is not quite fixed in the stars spectrum. This is caused by the changing Doppler shift mainly due to the orbital motion of the satellite. The componenet of the satellite velocity in the direction of the star is known for each measurement, and hence the instantaneous wavelength being observed by U2 can be calculated. In order to predict the U2 count variations due to the changing wavelength, the U1 spectrum in the neighborhood of the U2 position has been numerically degraded to the U2 spectral resolution (nominally 0.2 Å). This degraded U1 spectrum gives the local spectral variation of the U2 signal and allows the U2 counts to be corrected to what they would have been in the absense of a variable Doppler shift. The correction is generally quite small since the satellite valocity range of ± 7.5 km/sec is small compared to the U2 resolution of about 50 km/sec. Nevertheless, in a few monitoring positions the U2 slit was unintentionally fixed near the edge of a strong absorption feature, and the deduced corrections are not negligble. Third, the corrected U2 signal still contains a noise component which is mainly statistical. Since the guidance variations have a slow time scale (that of the satellite orbital period), we have smoothed the high frequency noise in the U2 signal, leaving intact the low-frequency guidance-induced variations. Fourth, a possible systematic error exists in the guidance correction procedure. The average U2 values for each monitoring position do not necessarily reflect the average quality of guidance; i.e., the total stellar flux passing the entrance slit, averaged over the time interval that U2 is in one monitoring position, may differ from that at another monitoring position. In order to fit together the various spectral segments, the averaged U2 signals must be corrected for variations in average guideance quality at each fixed position.

This correction was made by forming the ratio of U2 signals (corrected as above) near spacecraft midnight for consecutive U2 positions. This ratio ia assumed to be the correct intrinsic ratio since it is measured under approximately the same orbital configuration during a time (midnight) when guidance perturbations due to scattered light are at a minimum. This ratio was then used to correct the average U2 signals to the same quality of guidance.

The corrected and smoothed U2 signal finally was used to monitor and remove the guidance variations in the U1 signal. The separate segments then formed one continuous spectrum.

[***Note: listing files are available which indicate the U1 and U2 scans for which separate monitoring scans were obtained.***]

Scattered Light

Finally, the U1 counts must be corrected for scattered light within the spectrometer. This component of the observed counts may be estimated with the help of a number of interstellar absorption features which appear to be saturated. The residual signal in the saturated core is assumed to be due only to scattered light at the wavelength of the feature. The interstellar features that have been used for the scattered light analysis of the second-order spectrum are listed in **Table 2**.

While studing interstellar absorption at Lyman Alpha, Bohlin (1975) found the U1 scattered light to be linearly proportional to the strength of the local spectrum averaged over a 24 Å band centered on the wavelength of interest. Scattered light values, predicted according to Bohlin's method, were compared with the observed values given in Table 2 and while the dependence on the local average is quite evident, the detailed agreement was of inadequate quality for the purposes of this atlas. Attempts to modify Bohlins formulation to improve the detailed agreement over the whole second-order spectrum were only partially successful, though it was found that an 18 Å average is somewhat superior to the 24 Å average. *See paper for rest of discussion on scattered light.*

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Observation Time Correction

We have duplicated (to the second!) the observation times listed in early computer printouts produced by Copernicus principal investigators by adding the first SET time to the GMT observation times listed in the raw and coadded scan data files. The feeling is that our listed observation times refer to the time the Copernicus satellite crosses the longitude of the ascending node (i.e., LAN). It is still unclear however whether this reference time refers to the orbit in which the observation was made or to the orbit in which the data was last dumped.

In any event, the actual calculations for deriving the start and end observation times (from the IDL program coptime.pro), which are based on data extracted from the Copernicus raw data files, are as follows:

```
ddate = (yr_obs-1900)*1.0D+03                ; decimal date
      + day_obs + (hr_obs/24.0D0)
      + (min_obs/(24.0*6.0D01))
      + (sec_obs/(24.0*3.6D03))
fst = (frst_set * 15.72887)/(24.0*3.6D03)  ; first SET time in days
lst = (last_set * 15.72887)/(24.0*3.6D03)  ; last SET time in days
startobs = ddate(i)+fst(i)                 ; start time
endobs = ddate(i)+lst(i)                   ; end time
```

The SET times mentioned above refer to Spacecraft Equivalent Time (SET) and represent units of 15.72887 seconds.

Data Reduction/Analysis

- Analyzing Individual Scans - Examples of analyzing raw data scans.
- Reading Copernicus Files
- Early Project Memos - The following are early Copernicus memos (HTML versions courtesy of Jim Caplinger, CSC) describing various aspects of Copernicus data. The following individual articles are included:
    1. Stray Light in PEP - 8 December 1972
    2. Stray Light in PEP, II - 15 December 1972
    3. Scattered Light in U1 - 2 March 1973
    4. Background in *Copernicus* Data Tubes - 9 December 1974
    5. U1 Instrumental Profile - 11 April 1975
    6. Corrections to the U2 Wavelength Scale Between 1026 and 1110Å - 7 January 1976
    7. Spurious Emission Line Detection - 12 January 1976
    8. Sensitivity Loss in *Copernicus* - 8 September 1982
- Background Issues - a look at the sources of background counts in scans.
- Common Data Problems - including data register overflow, changes in the particle background (South Atlantic Anomaly), tracking errors, and other glitches.
- Photometric Reductions - describes the photometric corrections used for the Copernicus Spectral Atlases by Rogerson, et al. including a discussion on correcting for guidance variations.
- Observation Time Correction - describes the algorithm used to duplicate the start and end observation times found listed in old Copernicus computer printouts.

III. Description of the Princeton Experiment

A. The spacecraft

The satellite is similar to OAO-2 (described by Code et al. 1979), with some modifications designed to improve the guidance sensitivity when the spacecraft is in daylight, and the pointing stability. The Princeton equipment is described by Rogerson (1963) and Rogerson et al. (1973).

In brief, the Princeton Experiment Package (PEP) consists of a cassegrain telescope with an 80 cm primary mirror, a 7.5 cm secondary, and a Paschen-Runge spectrometer which utilizes a concave grating to focus the spectrum on a 1 meter Rowland circle (see Figure 1). Two movable carriages, each equipped with two photomultiplier tubes, scan the spectrum. These carriages, which are programmed to operate independently of each other, cover the wavelength regions shown in Table 1. The nominal bandpasses are also indicated. For brighter stars, the important region from 1500 to 1560 Å can be scanned with U1 in the first order.

B. Spacecraft pointing

The field of view utilized by the guidance Fine Error Sensor (FES) is 8 minutes of arc in diameter. The FES acts to keep the center of light in this field on the slit; therefore the target star should have no companion less than two magnitudes fainter within 5 minutes of arc.

If this restriction is relaxed, the main image will not be centered in the slit, and the photon count will be reduced accordingly. In the case of very bright sources for magnitude differences only slightly less than two, this loss of signal may be acceptable.

When the line joining the two stars is parallel to the slit, as will happen at short intervals during the year, the main image will be correctly centered, and if the distance between the stars is less than 30 arc seconds, light from both stars will go down the slit. Although it is feasible to command small spacecraft rolls to accomplish this alignment at other times, such maneuvers are generally avoided because of possible risks to the satellite. Several close systems have been observed in this way, including Alpha Cru AB and Sirius AB.

It is possible to introduce a small bias voltage in the FES, so that the center of light of the guidance field of view is as much as 5 arc sec off of the slit. This technique has been used successfully to center one component of a binary (Rho Oph A) on the slit, in a case where the magnitude difference was less than 0.5. Other special techniques have been applied to facilitate observations of stars in crowded fields.

The Inertial Reference Unit (IRU) can be used to point the telescope-spectrometer to within roughly ±40" of a given position on the sky, if a nearby bright star is available which can be used to update the FES. Use of the IRU appears to be a feasible technique for pointing at extended sources such as nebulae. It appears, however, that high-excitation, compact planetary nebulae are the only extended sources likely to be bright enough for detection with *Copernicus*, and these in general require a pointing accuracy of ±10" or better. It is hoped that the required accuracy will be achieved as a result of upcoming efforts to refine and calibrate pointing techniques using the IRU.

The spectrometer entrance slit is 39 arc seconds long and 0.3 arc seconds wide. The width can be changed to 1.2 arc seconds on ground command, increasingly the signal by about a factor of 2 for a stellar source, but this has generally been avoided for fear of failure in the slit transfer mechanism.

C. Guidance sensitivity

Before a Guest Investigator proposal is made, one should determine as accurately as possible that the target star is bright enough for the guidance system to settle on and to maintain attitude for the duration of the observations. This is estimated by predicting the output voltage of the Automatic Gain Control (AGC) which will occur when the Fine Error Sensor (FES) has settled on the target. When the AGC value is greater than 9.6 volts, the FES automatically turns off because the star is considered too faint to observe. In general for any star whose predicted AGC is greater than 8.6 volts the ability of the spacecraft to guide on the star will be tested before any observing time is committed.

It has been found that the most accurate and convenient index for predicting the AGC value for a star is its U magnitude, in the standard UBV system. The bandpass of the U filter matches the response function of the guidance system closely enough that in general no corrections are needed for spectral type or interstellar reddening. The AGC versus U calibration for the guidance configuration which is normally in use is shown in Figure 2 (upper curve). This can be used to predict AGC values for any star of spectral type earlier than about A3. U magnitudes for a very large number of stars can be found in the Photoelectric Catalogue of Blanco et al. (1968).

If no U magnitude is available, B and V can be used as approximate AGC predictors, but allowances must be made for both spectral class and reddening. Figure 3 shows the calibration curves for both indices and indicates the dependence on spectral type. AGC values derived from the B magnitude (upper plot in Figure 3) should be corrected for reddening by the addition of 0.8 E (B-V) volts. A correction of 2.0 E (B-V) volts should be added to AGC values derived from V magnitudes (lower plot). For example, an O star which has V = 1.6 and E (B-V) = 0.20 would have a predicted AGC of 3.0 + 2.0 (0.20) = 3.4 volts.

For stars of intermediate A and later spectral types, the actual AGC will be at least 1 V less than that predicted from U magnitudes because of a red peak in the guidance sensitivity spectrum which allows late-type stars to be acquired by the FES more easily than indicated by the UBV magnitudes. For example Theta Cas, an A7 star, has U = 4.61 (implying a predicted AGC of 7.7 volts) but an actual AGC of 6.6 volts. Alpha Boo, a K2III star, has U = 2.43 (implying AGC = 4.8 volts) and an actual AGC of 3.1 volts. In cases of doubt for faint stars, guidance tests will be performed before observing time is committed.

Recent tests of a heretofore unused guidance photomultiplier tube have allowed *Copernicus* to guide successfully on stars a full magnitude fainter than previously possible; i.e. with this guidance configuration, it is possible to guide on an unreddened early B star of visual magnitude 7.5. Only very hot and largely unreddened stars of such faintness in V are bright enough in the ultraviolet to produce a detectable signal in the *Copernicus* spectrometer, but even so, use of this configuration adds substantially to the number of feasible target stars which are available for study through use of long integration times. It is anticipated that the new guidance configuration will be used only periodically, so that degradation of its sensitivity can be minimized. The U magnitude vs. AGC calibration for this guidance channel is shown in Figure 2 (lower curve).

D. Experiment efficiency

In order to estimate the expected spectrometer count rate for a proposed target star, the efficiency curves shown in Figure 4 should be used. These curves, which give the 14 sec count rate as a percentage of the photon flux incident on the unocculted 2914 cm² of the primary mirror, are based on calibrated rocket data compiled by R.C. Bohlin (private communication) for the star Eta UMa. Shortward of 1200 Å, the efficiencies are based on model atmospheres calculations, there being no calibrated data available at present. The curves of Figure 4 take into account degradation which has occurred since launch, primarily shortward of 1100 Å. The degradation is wavelength dependent (greater at the shorter wavelengths), but the time dependence is not known in detail. Detectable changes in sensitivity over a 6 month interval should be expected.

Several calibration techniques are being applied by Guest Investigators and should soon be in the literature. In addition, the degradation of the optical system as a function of wavelength is monitored on a semi annual basis.

In view of the uncertainty in model absolute photon fluxes in the far ultraviolet, it is advisable to avoid total reliance on theoretical models in estimating predicted *Copernicus* count rates. If no rocket or other far UV observations are available, the typical count rates shown in Tables 2-5 for stars of a variety of spectral types may be useful. Corrections for distance, absolute magnitude, and interstellar extinction differences must of course be made. The UV extinction curve derived by a previous OAO experiment (Bless and Savage, 1972) is reproduced in Figure 5. Although there is substantial variation between different stars in the shape of the UV extinction curve, Figure 5 and the results of York et al. (1973) are helpful in estimation *Copernicus* count rates from Tables 2-5.

E. Photometric accuracy

Characteristics of the photometry are described by Rogerson et al. (1973), and will not be repeated here in any detail. Briefly, tubes U1 and U2 are normally photon noise limited over the time required to scan an interstellar line.

The count rate due to background particles is very large for V1 and V2, significantly reducing the photometric accuracy and usefulness of these phototubes, except for very bright stars. The dark count in U1 and U2 caused by these particles is generally insignificant except when the spacecraft is in the South Atlantic Anomaly, where observations are not normally made.

The chief contributor to the large fluctuations of dark count in the near-UV tubes is the presence of bursts of photoelectrons, produced by cosmic rays, which strike the photocells several times per second. It has recently been found that, if cumulative photon counts are stored every 1/8 second instead of once each 14 sec, this random noise can be greatly reduced by rejecting those 1/8-sec time frames which contain high counts due to cosmic rays.

In this way it is possible to reduce the rms fluctuation of dark count in tubes V1 and V2 from about 400 in 14 seconds to roughly N, where N is the total 14-second count (which contains a contribution of typically 3500 counts in 14 seconds, probably caused by phosphorescence following passage through the South Atlantic Anomaly). Because data storage in this mode occurs every 1/8 sec rather than every 14 sec, spacecraft memory becomes filled in 4 minutes, and less time per orbit can be used for observing than in the normal mode. This special observing technique is mainly for use with V1, the high-resolution near-UV tube. Proposals are invited for use of this mode for particularly important problems requiring accurate V1 measures over a narrow wavelength range. Scientific programming and final data presentation will be essentially the same as for the standard operating mode.

Particle background counts for standard 14-second integration are routinely predicted as a function of latitude and longitude at the time of observation. Figure 6 shows an example of the range in counts which may be encountered within a given orbit. A detailed description of the algorithms used is available on request. In addition, dark counts are taken about once every four orbits, and these can be used to provide time correction factors to the routinely predicted background counts. The predictions are based on data taken during the first eight months of operation, and may be systematically in error, due for instance to changes in solar activity.

For cases where particle background limits the usefulness of V1 or V2 data, observations can be restricted to particular orbits which provide minimum background counts (at a substantial reduction in observing efficiency), or the high time resolution mode described above may be used. For stars fainter than third magnitude routinely scheduled V1 and V2 observations are of minimal use.

The spacecraft pointing accuracy, which is generally about 0.02 seconds of arc during a period of a few minutes, is good enough so that photon counts during single scans of spectrum lines are usually not noticeably affected by guidance changes. Over a period of several hours, changes in spacecraft pointing can cause changes of 5 to 10% in the photon counts. To achieve the highest accuracy in scanning lines with U1, carriage 2 can be held motionless during each scan and the data from U2 can be used to smooth out fluctuations in U1 which are due to spacecraft pointing changes.

A more serious problem is stray light which enters photomultioliers U1 and U2 through vent holes in the phototube mounts. The stray light problems have been discussed by Rogerson, Spitzer, et al. (1973) and York et al. (1973). Details of the correction of U2 data for the stray light problem are available on request. The correction algorithm has been developed by Dr. Ralph Bohlin (GSFC) and is described by him (Bohlin, 1975). The U2 spectrum can be corrected to an accuracy of about sqrt[$(.03)^2+a^2$], where a is the fractional uncertainty introduced by guidance drifts, (generally, a < 0.1) providing about 60 Å of spectrum is available longward of the longest wavelength of interest for a particular program, and providing a continuing U2 scan is available over the region of interest. Hence, this additional region should be included in observations planned by a Guest Investigator. For cases where complete U2 spectra are available, the corrections can be made at Princeton, upon request.

The stray light on tube U1 can be eliminated by judiciously positioning the carriage 2 dipping mirror in front of the stray light hole for tube U1, as described in Section IV.C.6, below. For O and B stars, scattered light from the optical surfaces amounts to about 10% of the local continuum for 1000 Å < lambda < 1400 Å and <5% of the continuum for 1800 Å < lambda < 3200 Å. For the remaining accessible regions of the spectrum, the scattered light from other parts of the spectrum may be equal to or greater than the observed intensity of the stellar spectrum due to the low optical efficiency in these wavelength regions. For cooler stars, the scattered light becomes significant at somewhat longer wavelengths.

In most cases, the scattered light must be determined by noting the residual intensity at the bottom of saturated stellar or interstellar lines.

Copernicus Instrument Description

Mission Overview

The third Orbiting Astronomical Observatory (OAO-3, OAO3, or OAO-C) named Copernicus, was launched from Cape Kennedy on the 21 August 1972. The Copernicus satellite contained two co-aligned astronomical instruments, the "Princeton Experiment Package" (PEP), a telescope-spectrometer designed for high-resolution studies of absorption lines in the interstellar medium, and a cosmic X-ray experiment provided by UCL/MSSL (further information on the X-ray experiments can be obtained from HEASARC). The Copernicus satellite was when launched the heaviest unmanned space observatory, and was placed in a nearly circular 745 km altitude orbit inclined 35 degrees to the equatorial plane. The telescope-spectrometer was a 32-inch diameter reflecting telescope and ultraviolet spectrometer system designed, built, and operated by the Princeton University Observatory (Principal investigator Lyman Spitzer, Jr.), and was designed to obtain ultraviolet spectra especially in the rich 900-1200 A wavelength region. Between August 1972 and February 1982 a total of 549 different objects were observed (plus measurements of air-glow and geocoronal Lyman-alpha emission), and 687,960 separate scans were obtained.

Instrument Description

The Copernicus telescope-spectrometer (described in Rogerson et al. 1973a, and the Guest Investigator's Guide available on-line) used a cassegrain telescope with a f/3.4 primary of fused silica with a clear aperture of 80 cm and a fused silica secondary with a clear aperture of 7.5 cm. The optical surfaces were Al over-coated with LiF. The equivalent focal length at the spectrometer entrance slit (the cassegrain f/20 focus) was 1589 cm, with the spectrometer placed in front of the primary mirror (blocking approximately 42% of the primary aperture); the following is a diagram showing the "Princeton Experiment Package":

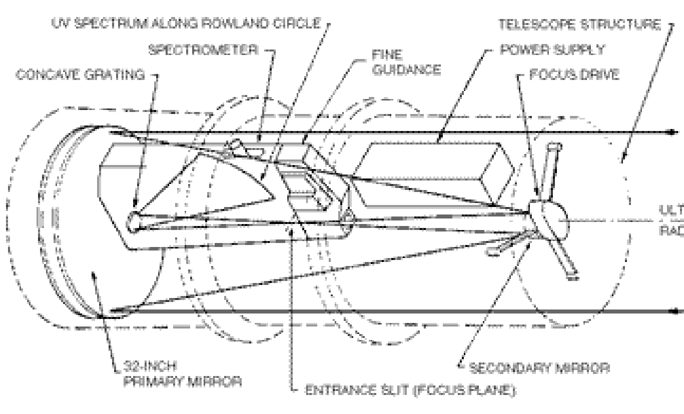


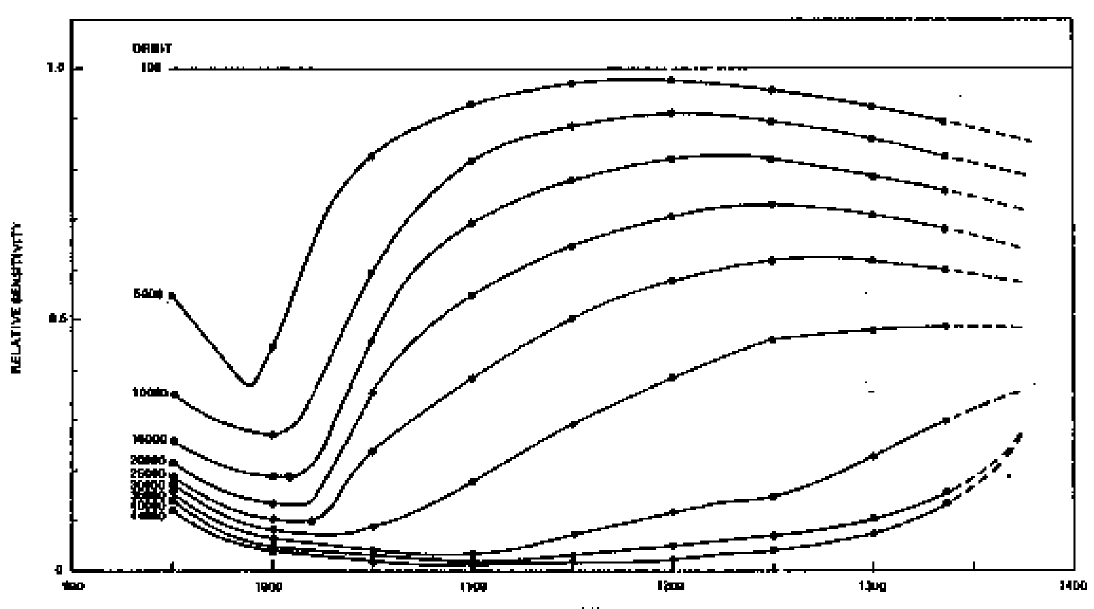
Figure 1. The Princeton telescope-spectrometer on Copernicus. Dashed lines: telescope structural wall and supporting rings. Solid lines: telescope and instrumentation.

The spectrometer was of the Paschen-Runge type with a concave grating focusing the spectrum on a 1-meter Rowland circle with a dispersion in first order of 4.2 Å per millimeter (a general discussion of such spectrographs is provided, for example, in Kitchin's book Astrophysical Techniques, chapters 4.1-4.2, in particular see Figure 4.1.12). The entrance slit (3 mm by 24.2 micron) corresponded to 39.0" x 0.314" on the sky. Two movable carriages each carrying two photomultiplier tubes were used to scan the spectrum, the U tubes were generally sensitive only in the second order, while the V tubes were restricted to the near-ultraviolet (V1 by a fused silica filter and V2 by a sapphire prism). The nominal instrumental widths (FWHM) are 0.10 Å in first order (V1 and occasionally U1) and 0.05 Å in second order (most U1 scans); for U2 and V2 the widths are about 4 times larger. There was a diagonal mirror in front of carriage 2 (holding the U2 and V2 tubes) to prevent physical interference. Another tube (U3/V3) was fixed at 3430 Å and used to monitor photometric errors due to image motion in the narrow entrance slit. The U1 and U2 tubes were generally restricted to wavelengths greater than the Lyman-limit (912 Å), although the carriages allowed observations to wavelengths as short as 710 Å. The U1 carriage could also be used in 1st order on bright stars to obtain spectra at wavelengths longer than 1500 Å, but even for the brightest stars this was generally limited to wavelengths between 1500 and 1560 Å.

Phototube	Carriage Number	Order	Nominal FWHM (Å)	Nominal Wavelength Coverage (Å)
U1	1	2	0.05	912-1500
		1	0.10	1500-1560
V1	1	1	0.10	1640-3185
U2	2	2	0.20	912-1645
V2	2	1	0.40	1480-3275

The electronics system provided for pulse counting of the signals from the data tubes during a nominal 14-second integration period (the actual time was 13.76 seconds) while the carriages were motionless, the carriages were then moved to the next position and a new integration started. The U tubes had a slowly varying dark count rate approximately equal to the flux of cosmic rays through the front of these tubes, while the V tubes had a large rapidly fluctuating dark count rate that seriously limited the photometric precision obtainable with the V1 and V2 tubes (although this could be largely removed by using a special scan mode, see for example Barker et al. 1984). Stray light from the target reached the U1 and U2 tubes through vent (outgassing) holes in the spectrograph, but this could be eliminated for the U1 tube by positioning carriage-2 to block light just longward of the U1 exit slit (see Rogerson et al. 1973b; York et al. 1973). A residual background of about 10 percent of the continuum was present for observations using the U1 tube longward of 1000 Å, presumably due to scattering from the optics. At the shortest wavelengths the scattered light could be greater than the observed intensity from the star due to the reduced efficiency at short wavelengths. The wavelength dependence of the scattered light is similar for the V1 tube). In most cases the scattered light correction must be derived from the residual counts in the bottom of saturated stellar or interstellar lines (see Rogerson et al. 1973b; Morton 1975; Bohlin et al. 1983). The correction of U2 data for stray light is described by Bohlin (1975). During the short time required to record a single scan the telescope typically oscillated by an amplitude of about 0.02 arcsecond, which was good enough so that the counts were usually not noticeably affected by guidance changes (Rogerson et al. 1973a; Bohlin et al. 1983). To achieve the highest photometric accuracy with U1, carriage 2 could be held motionless during each scan and the data from U2 used to smooth out fluctuations in U1 which are due to spacecraft pointing changes (this technique was used primarily for observations of the Lyman lines of Hydrogen and Deuterium).

There was a wavelength dependent decrease in the sensitivity of Copernicus over the duration of the mission (Polidan 1981; Bohlin et al. 1983). Over the first 5 years (27,000 orbits) the U1 and U2 tubes declined in sensitivity as expected as surfaces were contaminated, electronics decayed, and similar effects took their toll; however, there was a rapid and unexpected decrease in efficiency (particularly near 1100 Å) during the sixth year of operations. Tests of the high voltage units and the instrument focus suggested that the most likely cause of the decay was contamination of optical surfaces (Polidan 1981). It appears that material, either from outgassing or from a lubricant leak, had coated the optical surfaces and then had polymerized when it came in contact with Oxygen. The period of rapid decline corresponded to Solar maximum, when the Earth's atmosphere is expanded and there is additional Oxygen at the height of the Copernicus orbit. Similar behavior was also observed in the TIROS and Nimbus spacecraft during the same time interval due to polymerized outgassed material. The decline in sensitivity of the U1 tube is shown in the following graph from Polidan (1981):



For the V1 and V2 tubes the decline was less severe, the V tubes retained 60% of their pre-launch sensitivity (Polidan 1981).

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Above material compiled by jtl

Copernicus Instrument Performance

The following sections have been extracted from the *Final OAO-C Copernicus Operations Report* prepared by Princeton University in September 1981. They concern the optical performance and instrument characteristics throughout the duration of the mission

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Section 1: Summary of Instrument Performance

Guidance

While the Princeton Experiment Package (PEP) was gathering stellar data, the pointing was maintained by centering the stellar image on the slit jaws of the experiment using the Fine Error Sensor (FES). To ensure that the guidance characteristics were similar over the range of stellar brightnesses observed, the high voltage of the FES was determined by an automatic gain control (AGC) that depended on stellar magnitude. During the mission, stars between -1.5 and 7.0 visual magnitude were regularly observed.

[...]

Spectrometer Telescope

Throughout the mission of the PEP, both spectrometer carriages performed at nominal design specification. No mechanical anomalies were ever noted. Before the OAO-C launch, carriage 2 was discovered to have a low-rate leak in its sealed lead-screw bellows assembly. This was considered, however, to have little consequence over the anticipated 1-year lifetime of the PEP, and a decision was made to continue with launch preparations.

The commanded carriage motion was extremely predictable, and all deviations from expected behavior were traced to electronic glitches, operational programming errors, or a lack of understanding of the nonstandard operation of the carriage motion control subsystem (special programs, configurations, *etc.*).

The static position indicators for both carriages possessed a known inherent ambiguity that occasionally resulted in a scientific data loss because of incorrect interpretation of the carriage position status by operations personnel. On several occasions, the carriages were also inadvertently commanded to positions beyond their normal ranges of travel, but in each instance, the electrical limit switches were activated, and the motion of the carriages was halted be fore any physical stop was met.

The obscuration pattern of carriage 1 sensors by the carriage 2 collection mirror was determined early in the mission, and this effect was included, when necessary, in the observing programs. Stray light entering the vent ports of the far-UV sensors was also recognized as a problem. This effect was much reduced by judicious operations programs and data reduction correction procedures.

[...]

Optical Performance

The overall performance of the "optical" system (mirrors, phototubes, and associated electronics) was within expected limits for the first 5 years of the mission. Shortly after launch, telemetry indicated that the secondary mirror had not positioned itself properly. A check of the image size and shape in orbits 168-170 showed the image to be in focus. It was concluded that the secondary mirror was positioned correctly and that the telemetry was bad. A second check of the image size was performed in orbits 35250-35260 and showed no significant change in the image. A third set of image data obtained during the last month of the mission was lost. It is believed, however, that the image size and shape were maintained throughout the mission.

The only major change in performance occurred in the experiment far-UV sensitivity. During the first 5 years of the mission, the decline in instrument sensitivity was similar to that predicted before launch: the largest decline occurred the first year with the shortest wavelengths being the most affected. Beginning near orbits 25000-30000, the decline in sensitivity accelerated, dropping by a factor of 5 in 1 year, with the largest decline occurring at the middle, rather than shortest, wavelengths. This decline continued throughout the remaining 3 years of the mission. Investigation of the cause for this decline is still underway. The best explanation at this time is that the decline is due to contamination of the optical surfaces in the spectrograph by an unknown material. The onset of the rapid sensitivity degradation in 1977 corresponds to the onset of solar maximum, suggesting that a process similar to that found in the Television Infrared Observation Satellite (Tiros) is working (Reference: *Tiros Project Memo* of October 12, 1979). Details of the decline in sensitivity can be found in Section 2.

No failure of any component in the optical system was recorded during the mission. All six phototubes and their associated electronics were functioning at termination.

[...]

Section 2: Malfunctions and Resultant Impact

Mechanical Failures

The few failures that occurred within the PEP did not compromise or severely limit its basic scientific mission. These failures are itemized as follows:

a. Secondary Mirror/Focus Mechanism

> During the immediate post launch checkout of the PEP, status data indicated incomplete uncaging of the telescope's secondary mirror/focus mechanism assembly. Subsequent data analyses suggested failure of the telemetry monitor circuits and not of the uncaging operation.
>
> An attempt to change the telescope focus in orbit was also unsuccessful. Position status data of the secondary mirror implied that no motion was produced by commanding. Because the final focus adjustment prior to launch was calculated to include the effects of the launch environment, the telescope was believed to be near best focus. Image shape tests confirmed this status. End-of-mission attempts were made to move the secondary mirror, but again, no motion was observed.

b. Calibration Lamps

> Postlaunch checkout of the calibration lamps confirmed launch survival and no significant changes in the spectrometer wavelength calibration. The lamps were infrequently used thereafter. During a special series of observations about one third into mission lifetime, however, both lamps failed to operate. End-of-mission attempts to ignite calibration lamp A were unsuccessful.

[...]

Sensitivity Degradation and Effects

The principal malfunction in the PEP was the rapid decline in the far-UV sensitivity. The decision to terminate the spacecraft was based partly on the loss of far-UV sensitivity. Figure 2-1 shows the relative sensitivity of the high-resolution far-UV phototube U1 from orbits 100 to 44000. In the first 25000 orbits (5 years), the decline was close to that predicted be fore launch. A rapid (approximately 50 percent) decline at shorter wavelengths was experienced during the first year followed by smaller declines in subsequent years. At longer wavelengths, the decline was more gradual and reasonably constant (approximately 10 to 15 percent per year) through the first 25000 orbits.

After orbit 25000, the character of the decline was significantly different. At the shortest wavelengths (<1000 Å), a slow decline continued until termination. At the middle wavelengths (1000 to 1300 Å), a dramatic decline occurred. Between orbits 30000 and 35000, the sensitivity of the U1 tube decreased by a factor of 2.25 at 1100 Å. By orbit 40000, another factor of 5 was lost. Thus, in 10000 orbits, more than a factor of 10 was lost. At longer wavelengths (>1300 Å), the decline was not as rapid (a factor of 4 in 10000 orbits), but it was larger than that observed before orbit 25000.

The low-resolution far-UV phototube U2 exhibited a behavior similar to that of U1. The only significant difference was that during the period of rapid decline (orbits 25000-44000), it showed a greater decline than U1. The U2 wavelength dependence was similar to that of U1.

The near-UV phototubes, V1 and V2, did not exhibit the rapid decline seen in the far-UV phototube. They displayed an initial rapid decline followed by a much slower decline until the end of the mission. At orbit 25000, both V1 and V2 were at approximately 70 percent of their launch sensitivity. By orbit 44000, they still retained 60 percent of their sensitivity at launch.

Clearly, something occurred between orbits 25000 and 30000 that greatly affected the sensitivity of the far-UV phototubes. This is also the period in which glitches began to occur in abundance (Section 2) [not included here]. This suggests that the two malfunctions may have the same cause or that the sensitivity decline was somehow caused by the effects of the glitches.

[...]

The initial decline in sensitivity, orbits 0-25000, is similar to that seen in other devices. The cause is thought to be primarily due to the decay of the photocathodes. The rapid decline occurring after orbit 25000 is, however, quite anomalous. Investigations conducted shortly after the onset of the rapid decline absolved the power supplies and other control units as the cause of the sensitivity loss. This left only contamination of the optical surfaces and/or photocathodes as the cause of the decline. This suspicion is further supported by the fact that U2 showed a greater decline than U1 (U2 undergoes one more reflection than U1).

At the same time that *Copernicus* was experiencing this rapid decline in sensitivity, Earth sensors on Tiros-N, NOAA-A, and 5D/1 were also noted to display significant sensitivity losses. Analysis revealed that their sensitivity loss was due to contaminants on the optical surfaces. The contaminants came from outgassed material reacting with atmospheric oxygen to produce polymers. The increased solar activity in 1977 raised the mean density of oxygen in the upper atmosphere and caused the polymer production to increase dramatically (see report from Tiros Project for details).

Analysis of the data suggests that a similar reaction may have occurred in the PEP. The most likely location for the contaminant is in the spectrograph. Ample materials exist for outgassing, and the spectrograph is open to space so that atmospheric oxygen can enter (direct observation of oxygen atoms confirms their increased abundance at the altitude of the spacecraft in 1978 through 1981). U1 and U2 show greater declines because of the peculiar absorbing properties of the contaminant. The peak absorption appears to occur between 1050 Å and 1150 Å. U2 shows more loss because the incoming light undergoes an extra reflection to enter the phototube. Further analysis is continuing. A final report on the decline and possible causes will be issued when the analysis is complete.

The impact on *Copernicus* operations caused by the loss of sensitivity was to lengthen all observations. Programs were run several times to get the data quality obtained with a single run before 1977.

Impact of V Tube Fluorescence and Short Frame

As explained in Section 1 [not included here], the background levels in the near-ultraviolet tubes (V1, V2, V3) were much larger than expected. It has been determined that passage of energetic particles (cosmic rays, particles, *etc.*) through the windows covering the tubes causes a short-term fluorescence and a long-term phosphorescence. The sum of these two components results in a background count rate of approximately 7000 counts/14 seconds in V2 and approximately 10,000 counts/14 seconds in V1. Therefore, V1 and V2 were useful only for fairly bright stars, where the stellar signal was much larger than the background. With the advent of the short frame program in 1975, the V1 tube began returning higher quality data. However, short frame observations required the use of the OBP [On-Board Processor] (except for the technique implemented in 1980, whereby the spacecraft was commanded from the ground). From 1975 to 1980, the OBP had numerous minor failures and three major failures. The major failures resulted in the OBP being inoperable from April 8 to August 7, 1977; August 30, 1978 to June 26, 1979; and June 28 to October 3, 1980, a total of 17 months.

A Guide for Guest Investigators Using the Princeton Telescope on the Satellite Copernicus

Prepared by T. P. Snow
Second Edition

April 1975

Following is an electronic version of the *Copernicus* Guest Investigator's Guide published by the Princeton University Observatory, Princeton, NJ. The guide is presented essentially unaltered, with the exception of some minor formatting changes and correction of some obvious typographical errors. jrc

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Instrumentation/Operations

- Spacecraft Description - Section III of the Guest Observers guide describing the Princeton Experiment.
- Instrument Description - Description of Copernicus spectrometer.
- Instrument Performance - Excerpts from the final Copernicus Operations Report.
- Guest Observer's Guide - Second edition prepared in April,1975 by Ted Snow.

Title:	The Ultraviolet Imaging Telescope - Design and performance
Authors:	Stecher, Theodore P.; Baker, Gerald R.; Bartoe, Donna D.; Bauer, Frank H.; Blum, Albert; Bohlin, Ralph C.; Butcher, Harvey R.; Chen, Peter C.; Collins, Nicholas R.; Cornett, Robert H.; Deily, John J.; Greason, Michael R.; Hennessy, Gregory S.; Hill, Jesse K.; Hill, Robert S.; Hintzen, Paul M.; Isensee, Joan E.; Kenny, Peter J.; Landsman, Wayne B.; Linard, David L.; Maran, Stephen P.; Neff, Susan G.; Nichols, Granville R.; Novello, Joseph; O'Connell, Robert W.; Offenberg, Joel D.; Parise, Ronald A.; Pfarr, Barbara B.; Plummer, Thomas B.; Richardson, Foy F.; Roberts, Morton S.; Sitko, Susan D.; Smith, Andrew M.; Stober, Alfred K.; Stolarik, John D.; Tebay, Jack C.
Affiliation:	AB(NASA, Goddard Space Flight Center, Greenbelt, MD) AC(NASA, Washington) AE(NASA, Goddard Space Flight Center, Greenbelt, MD) AF(Space Telescope Science Inst., Baltimore, MD) AG(Kapetyn Observatory, Netherlands) AH(Computer Sciences Corp., Greenbelt, MD) AJ(Hughes STX Corp., Greenbelt, MD)
Journal:	Astrophysical Journal, Part 2 - Letters (ISSN 0004-637X), vol. 395, no. 1, p. L1-L4. (ApJ Homepage)
Publication Date:	08/1992
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NASA/STI Keywords:	DESIGN ANALYSIS, IMAGE PROCESSING, PERFORMANCE PREDICTION, SPACEBORNE ASTRONOMY, ULTRAVIOLET TELESCOPES, ASTRONOMICAL OBSERVATORIES, CALIBRATING, IMAGE MOTION COMPENSATION, RADIATION DETECTORS
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Abstract

The instrumental configuration, calibration, and operations during the first flight of the Ultraviolet Imaging Telescope on the Astro-1 mission, December 2-10, 1990, are described. The UV images of a wide variety of astronomical objects were recorded with a 40-arcmin diameter field of view. Images of targets as faint as magnitude 21 (UV) were secured with a resolution of about 3 arcsec. The optics, light baffling, and image motion compensation system are summarized, and detectors and electronic subsystems are described.

Title:	Correcting the distortion of images taken with the ultraviolet imaging telescope
Authors:	Greason, M. R.; Offenberg, Joel D.; Cornett, Robert H.; Hill, R. S.; Stecher, Theodore P.
Affiliation:	AANASA. Goddard Space Flight Center, Greenbelt, MD, US ABNASA. Goddard Space Flight Center, Greenbelt, MD, US ACNASA. Goddard Space Flight Center, Greenbelt, MD, US ADNASA. Goddard Space Flight Center, Greenbelt, MD, US AENASA. Goddard Space Flight Center, Greenbelt, MD, US
Journal:	Astronomical Society of the Pacific, Publications (ISSN 0004-6280), vol. 106, no. 705, p. 1151-1156 (PASP Homepage)
Publication Date:	11/1994
Category:	Astronomy
Origin:	STI
NASA/STI Keywords:	COMPUTER AIDED MAPPING, DISTORTION, GEOMETRIC RECTIFICATION (IMAGERY), IMAGE ANALYSIS, ULTRAVIOLET PHOTOMETRY, ULTRAVIOLET TELESCOPES, ASTRO MISSIONS (STS), GEOMETRIC ACCURACY, MATHEMATICAL MODELS, SPACEBORNE TELESCOPES
Bibliographic Code:	1994PASP..106.1151G

Abstract

The Ultraviolet Imaging Telescope (UIT) cameras include two-stage magnetically focused image intensifiers that introduce small but significant geometrical distortions into the data. These distortions, which create positional offsets as large as 25 arcsec at the field edges, are corrected by the procedure described here to 2-3 arcsec, approximately the resolution of the images. The distortion is measured by comparing and correcting UIT images to digitized Guidestar survey plates of the same fields. Two-dimensional third-order polynomials are used to model the distortion. The models assume that the distortion is an instrumental effect, independent of mission elapsed time and target, and that the effect of distortion is an instrumental effect, independent of mission elapsed time and target, and that the effect of distortion in the center of each field is minimal. The models are used to improve computed astrometric plate solutions and to remove the geometric distortion while transforming the image to a standard north-up, ease-left orientation.

Title:	The Ultraviolet Imaging Telescope: Instrument and Data Characteristics
Authors:	Stecher, T. P.; Cornett, R. H.; Greason, M. R.; Landsman, W. B.; Hill, J. K.; Hill, R. S.; Bohlin, R. C.; Chen, P. C.; Collins, N. R.; Fanelli, M. N.; Hollis, J. I.; Neff, S. G.; O'Connell, R. W.; Offenberg, J. D.; Parise, R. A.; Parker, J.; Roberts, M. S.; Smith, A. M.; Waller, W. H.
Journal:	Publications of the Astronomical Society of the Pacific, v.109, p.584-599 (PASP Homepage)
Publication Date:	05/1997
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Abstract Copyright:	(c) 1997: Astronomical Society of the Pacific
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Abstract

The Ultraviolet Imaging Telescope (\UIT) was flown as part of the \AstroMiss\ observatory on the Space Shuttle Columbia in December 1990 and again on the Space Shuttle Endeavor in March 1995. Ultraviolet (1200-3300\AA) images of a variety of astronomical objects, with a 40\arcmin\ field of view and a resolution of about 3\arcsec, were recorded on photographic film. The data recorded during the first flight is available to the astronomical community through the National Space Science Data Center (NSSDC); the data recorded during the second flight will soon be available as well. This paper discusses in detail the design, operation, data reduction, and calibration of \UIT, providing the user of the data with information for understanding and using the data. It also provides guidelines for analyzing other astronomical imagery made with image intensifiers and photographic film. (SECTION: Astronomical Instrumentation)

NASA ADS Astronomy Abstract Service

Title:	Ultraviolet Imaging Telescope Near-Ultraviolet Bright Object Catalog
Authors:	Smith, Eric P.; Pica, Andrew J.; Bohlin, Ralph C.; Cornett, Robert H.; Fanelli, Michael N.; Landsman, Wayne B.; O'Connell, Robert W.; Roberts, Morton S.; Smith, Andrew M.; Stecher, Theodore P.
Journal:	Astrophysical Journal Supplement v.104, p.287 (ApJS Homepage)
Publication Date:	06/1996
Origin:	APJ; NED
ApJ Keywords:	CATALOGS, GALAXIES: PHOTOMETRY, ULTRAVIOLET: STARS
Bibliographic Code:	1996ApJS..104..287S

Abstract

We present a photometric catalog of 2244 objects detected by the Ultraviolet Imaging Telescope in the near-ultraviolet (NUV; 1650A < {lambda} < 2900 A) during the Astro Space Shuttle mission. Sources in the catalog are as faint as m_nuv_ ~ 18.8, or f_nuv_ ~ 1.1 x 10^16^ ergs s^-1^ cm^-2^ A^-1^, but the survey is not complete to this level. Optical catalogs were used to cross identify sources and derive NUV - V colors. A majority of the objects (88%) do indeed have proposed optical identifications from catalogs, and most are stars. Our purpose in creating the catalog is to form a database useful for identifying very blue objects and performing Galactic UV stellar population studies.

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Project Publications

Instrument and Data Descriptions

"The Ultraviolet Imaging Telescope: Design and Performance," T.P. Stecher, G.R. Baker, D.D. Bartoe, F.H. Bauer, A. Blum, R.C. Bohlin, H.R. Butcher, P.C. Chen, N.R. Collins, R.H. Cornett, J.J. Deily, M.R. Greason, G.S. Hennessy, J.K. Hill, R.S. Hill, P.M.N. Hintzen, J.E. Isensee, P.J. Kenny, W.B. Landsman, D.L. Linard, S.P. Maran, S.G. Neff, G.R. Nichols, J. Novello, R.W. O'Connell, J.D. Offenberg, R.A. Parise, B.B. Pfarr, T.B. Plummer, F.F. Richardson, M.S. Roberts, S.D. Sitko, A.M. Smith, A.K. Stober, J.D. Stolarik, and J.C. Tebay. 1992,ApJ,395,L1

"Correcting the Distortion of Images Taken With the Ultraviolet Imaging Telescope," M.R. Greason, J.D. Offenberg, R.H.Cornett R.S. Hill, and T.P. Stecher. 1994,PASP,106,1151

"The Ultraviolet Imaging Telescope: Instrument and Data Characteristics," Stecher, T.P. Cornett, R.H., Greason, M.R., Landsman, W.B., Hill, J.K., Hill, R.S., Bohlin, R.C., Chen, P.C., Collins, N.R., Fanelli, M.N., Hollis, J.I., Neff, S.G., O'Connell, R.W., Offenberg, J.D., Parise, R.A., Parker,J., Roberts, M.S., Smith, A.M., and Waller, W.H. 1997,PASP,109,584.

Catalogs

"UIT Near Ultraviolet Bright Objects Catalog," E.P. Smith, A.J. Pica, R.C. Bohlin, R.H. Cornett, M.N. Fanelli, W.B. Landsman, R.W. O'Connell, M.S. Roberts, A.M. Smith, and T.P. Stecher. 1996,ApJS,104,287

Lists of Scientific Publications

UIT Papers from the ASTRO Missions, compiled by UIT project, covers 1992 - 1998.