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The Multimission Archive at the Space Telescope Science Institute

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Abstract. We describe the expansion of the Hubble Data Archive into the Multimission Archive at the Space Telescope Science Institute (MAST), which provides access also to non-HST data. MAST includes the following: International Ultraviolet Explorer (IUE), Extreme Ultraviolet Explorer (EUVE), Copernicus, ORFEUS IMAPS and BEFS, ASTRO HUT, WUPPE, and UIT data, and VLA FIRST data. MAST is also the active archive site for the Far Ultraviolet Spectroscopic Explorer (FUSE), launched in June 1999, and provides access to the Digitized Sky Survey. MAST data are stored on two 480-platter Plasmon CD-ROM jukeboxes. Data retrievals, plans for expansion, and features of the World Wide Web interface are also presented. The MAST homepage is at `http://archive.stsci.edu/mast.html`.

1. Introduction to MAST

The Space Telescope Science Institute (STScI) holds the Hubble Data Archive (HDA), which includes all Hubble Space Telescope (HST) observations. The HDA, as of November 1999, contains over 7 TB of science and engineering data, for a total of $\sim 200,000$ science exposures. In the past year the volume of archived data has reached average rates of about 4 GB/day, with ~ 15 GB/day retrieved by archive users.

Based on the success of the HDA, and taking advantage of its existing archive infrastructure, the STScI archive has taken on responsibilities as NASA's UV/optical/near-IR archive center and has recently expanded by providing access to non-HST data. The Multimission Archive at the Space Telescope Science Institute (MAST) includes extreme ultraviolet, ultraviolet, and selected radio archives, all of which may be accessed at the MAST homepage[2].

[1] Affiliated to the Astrophysics Division, Space Science Department, European Space Agency

[2] `http://archive.stsci.edu/mast.html`

2. The MAST Holdings

MAST includes the following missions:

IUE International Ultraviolet Explorer (1200 – 3350 Å), which contains over 104,000 spectral images of $\sim 10,000$ individual astronomical sources.

Copernicus (OAO-3) far- (900 – 1560 Å) and near- (1650 – 3150 Å) ultraviolet spectra of 551 objects.

EUVE Extreme Ultraviolet Explorer (70 – 760 Å) spectroscopic observations of ~ 350 sources, mostly galactic.

ASTRO three UV missions from ASTRO 1 and 2 Shuttle flights:

- Hopkins Ultraviolet Telescope (HUT) (825 – 1850 Å), which includes about 500 ultraviolet spectra of more than 300 targets;
- Wisconsin Ultraviolet Photo-polarimeter Experiment (WUPPE) (1400 – 3200 Å), designed to obtain simultaneous ultraviolet spectra and polarization measurements. It includes 400 observations of roughly 200 targets;
- Ultraviolet Imaging Telescope (UIT) (1200 – 3300 Å), which contains about 1,600 images of more than 200 targets.

ORFEUS Orbiting Retrievable Far and Extreme Ultraviolet Spectrometers, two UV missions from ORFEUS 1 and 2 Shuttle flights:

- Interstellar Medium Absorption Profile Spectrograph (IMAPS) (950 – 1150 Å), designed to obtained high resolution ($R = 75,000$ for IMAPS-1) objective-grating echelle spectra. The IMAPS archive currently contains roughly 600 spectra of 10 hot stars from the first Shuttle flight. The archive will soon include an additional 3,900 spectra of 29 stars;
- Berkeley Extreme and Far-UV Spectrometer (BEFS) (400 – 1200 Å), which returned high-resolution ($R = 5,000$) far UV spectra of 75 astrophysical objects from the first Shuttle flight. The archive will soon include 100 more spectra from the second Shuttle flight. Extreme UV spectra (400 – 900 Å) were obtained for a subset of the targets.

FIRST Faint Images of the Radio Sky at Twenty-centimeters, a radio survey at 20 cm (1.4 GHz) of over 10,000 square degrees down to a flux of 1 mJy. Access to the radio images and the source catalog, currently $\sim 550,000$ entries, is provided.

DSS Digitized Sky Survey, digitized photographic plates from the Palomar and UK Schmidt telescopes.

FUSE MAST is the active archive site for the Far Ultraviolet Spectroscopic Explorer, a NASA-supported mission successfully launched on June 24 1999, which is exploring the Universe with high resolution spectroscopy in the far UV (905 – 1190 Å) spectral region. FUSE is part of NASA's Origins Program under the auspices of NASA's Office of Space Science. MAST will provide access to both proprietary and public FUSE data.

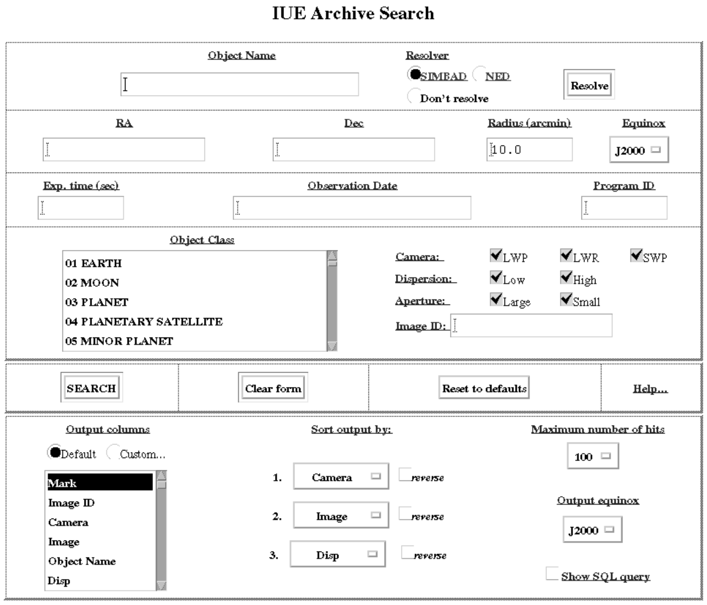

Figure 1. The IUE World Wide Web Interface.

ROSAT As a service to the optical/UV community, MAST provides also access to ROSAT (ROentgen SATellite) X-ray data. The ROSAT Master observations log (ROSMASTER) at the High Energy Astrophysics Science Archive Research Center (HEASARC) is in fact accessible via an interface which is very similar to the other MAST interfaces.

3. The MAST Interface

The MAST holdings are available via simple World Wide Web (WWW) interfaces. A sample search page for IUE data is shown in Figure 1. Similar interfaces are available for all MAST data.

Archival data may be searched by name (resolved by SIMBAD or NED), position, object category, and observation specifics (date, instrument, filters, exposure time, etc.). Previews are available for most MAST missions, to allow the user to have a "quick look" at the data before retrieving them.

3.1. MAST Cross-Correlations with Astronomical Catalogs

The potential use of the MAST archive is greatly increased by allowing users to search more than one mission at a time and cross-correlate the archive holdings with astronomical catalogs. Cross-correlations can be performed using the Hipparcos stellar catalog, an active galactic nuclei catalog, the Abell Galaxy Cluster catalog, and any user-supplied list of positions. MAST users can select a sample of astronomical sources based on a range of properties (e.g., redshift, magnitude, radio flux for active nuclei) and then look for the relevant entries in MAST. Work is in progress to expand this facility by using NASA's Astronomical Data Center (ADC) interface. This will allow cross-correlations to be made between MAST and any of the ADC catalogs and tables, opening up new possibilities for the exploitation of MAST data.

4. Data Storage, Access, and Organization

Most MAST data are now stored at STScI. (See Abney & Richon (2000) for a discussion of the HDA migration to magneto-optical media.) The MAST data network consists of a SUN Enterprise 450 server, a large staging disk area, and two Plasmon 480 platter CD-ROM jukeboxes. The migration of IUE data to STScI is now completed and only EUVE data are not stored on-site (they currently reside at HEASARC but are easily accessible through MAST).

Having most MAST data stored on-site allows direct data retrievals: selected data are retrieved simply by clicking on the data set name. No username or password is required. Data sets may be downloaded as .tar, .tar.gz, .tar.Z, or .zip files. MAST has made every attempt to include sufficient documentation and background information to make its data products as useful as possible. Each mission generally includes a project description, details of the data processing, data description (documentation, known problems, etc.), and information on available software for data reduction. MAST also is the prime software provider for many missions.

5. The Future of MAST

MAST will incorporate additional ultraviolet and optical archives in the future, particularly those connected with NASA's missions. MAST will further enhance the scientific value of its data holdings by seeking to archive data from ground-based CCD mosaic imagers. Work is in progress to link HST datasets with the publications which resulted from them. This will allow archival researchers to have easy access to all HST-based papers from the HST WWW interface. To fully exploit the multiwavelength parameter space which is being made available also by the many large surveys completed and under way, MAST will establish closer ties and coordination with other archive centers. Within this framework, MAST will work towards providing the community with "science-ready" products. For example, data characterization and catalogs of selected HST data would enable the identification of faint optical counterparts of deep surveys at various wavelengths.

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References

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