The Multimission Archive at STScI Newsletter

March 2011 Space Telescope Science Institute

The Multimission Archive at STScI (MAST) Newsletter disseminates information to users of the HST, GALEX, Kepler, FUSE, IUE, Copernicus, EUVE, HUT, UIT, WUPPE, HPOL, IMAPS, BEFS, TUES, VLA-FIRST, and XMM-OM data archives supported by MAST. Inquiries should be sent to archive@stsci.edu.

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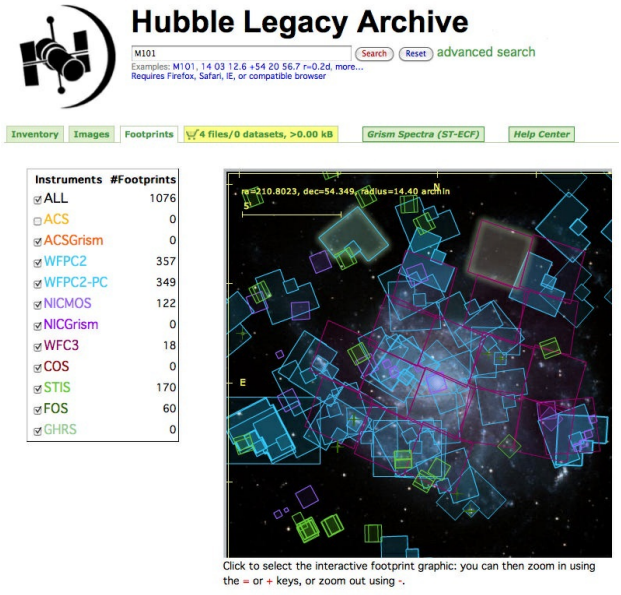
Hubble Legacy Archive -- Data Release 5



Click to select the interactive footprint graphic: you can then zoom in using the = or + keys, or zoom out using -.

MAST is pleased to announce the immediate availability of the Hubble Legacy Archive (HLA) Data Release 5 (DR5). The Hubble Legacy Archive (HLA) provides enhanced HST data products in a form suitable for direct use by a broad variety of science projects, as well as an advanced browser-based interface with powerful search, display, and retrieval capabilities. With DR5, the HLA offers a new, interactive interface to the footprint data, which outline the region of the sky covered by any HST dataset. With this new interface, users can easily zoom and pan in the footprint view, select datasets of interest, and transfer those selections to other views to facilitate the display and retrieval of selected data. Another improvement of note is the ability to view the properties of individual sources from the Interactive Display, where source positions are overlaid on the actual HST image; this ability applies to both HST-derived sources and those from external catalogs.

New data available in this release include the completion of WFPC2 processing, including those data that were still proprietary at the time of the last release, and the addition of multi-wavelength source lists for ACS and WFPC2 data. New sets of High-Level Science Products, including the Early-Release Science WFC3 observations and the first images from the Multi-Cycle Treasury program CANDELS, have also become available. Starting with DR5, the HLA is transitioning to an incremental data release process, and new data - including processed WFC3 and COS products - are expected to become available over the next few months.

Data Release 4, released in March 2010, included visit-level combined data for all science observations with imaging instruments – Advanced Camera for Surveys (ACS), Wide Field Planetary Camera 2 (WFPC2), and Near Infrared Camera and Multi-Object Spectrometer (NICMOS) – that were publicly available through February 2010.

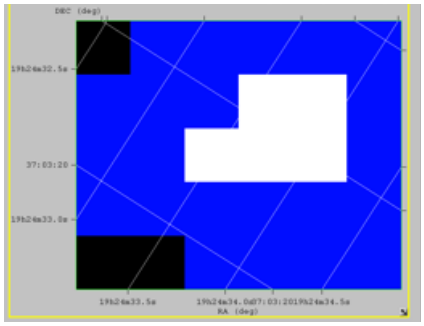
Generally, HLA includes two categories of advanced data products: mosaics and High-Level Science Products (HLSPs). Mosaics increase depth and widen sky coverage (http://hla.stsci.edu/hla_faq.html - mosaics). Hubble HLSPs are based on fully processed—reduced, co-added, cosmic-ray cleaned, etc.—Hubble images and spectra, and all are ready for scientific analysis. These HLSPs represent the best that can currently be done with Hubble data. HLA also provides visit-level combined images. A detailed description of advanced and visit-level data products for the HLA can be found on the “Getting Started” page at http://hla.stsci.edu/hla_help.html. Several movie tutorials are also available (http://hla.stsci.edu/hla_movie.html) to help new users understand the capabilities of the HLA interface.

Kepler News

Kepler was launched into an Earth-trailing heliocentric orbit on March 6, 2009, and will stare at a 105 square degree region of the sky in the constellations of Cygnus and Lyra. The goal of the mission is to obtain precise long-term light curves of up to 170,000 cool stars and to search for periodic transits of planets as small as the Earth. A secondary objective is to study rapid oscillations of the target stars in order to determine their ages, radii, and chemical compositions. A general overview of the mission and more details about the scientific objectives can be found at the Kepler Mission website (http://kepler.nasa.gov/). Kepler has now monitored the same field in the sky for about half of its nominal 3.5 year lifetime.

MAST is the Kepler archive holding not only the data but also important documentation such as the Kepler Data Release Notes The MAST/Kepler website can be found at http://archive.stsci.edu/kepler/. Kepler data may be retrieved through the standard MAST/Kepler search and retrieval interface. Public data can also be retrieved via your browser or via ftp as single light curves or bundled as large tar files. For more information on these alternative retrieval methods see http://archive.stsci.edu/kepler/publiclightcurves.html.

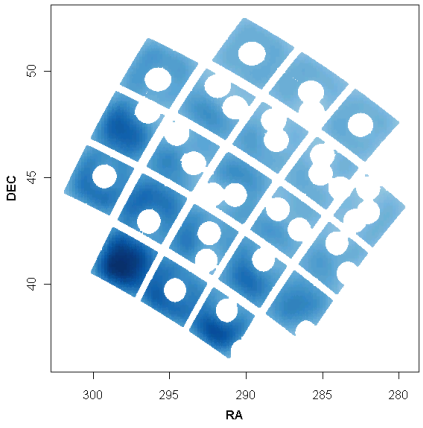
A new product is available for Kepler data users. Called a target pixel file (tpf), the product contains the pixel values, both as read down from the spacecraft and as contained in the calibrated data, in an FITS binary table. There is a table entry for each read out, which has an image of the pixels. Also in the table are a cosmic ray image, a background flux image and a quality flag. In addition, the tpf has an Aperture extension, which contains an image of the aperture used on the spacecraft to capture the pixels from the focal plane. The image is composed of bit flags, which indicate if a given pixel was in the target aperture and if it was used to calculate the flux. Target pixel files may be downloaded via the same standard MAST/Kepler interface as used for light curve retrieval. http://archive.stsci.edu/kepler/data_search/search.php.



The New Kepler-to-GALEX Cross-Match Tool

Coinciding with Kepler's Cycle 3 guest-observer (GO) season, MAST is happy to announce the availability of a cross-match tool between GALEX sources and the Kepler initial catalog. Its purpose is to extend the wavelength baseline from the optical magnitudes of Kepler ground support (Sloan-like g, r, i, and z filters) to near- and far-ultraviolet bandpasses. This extension is especially important for selecting hot star targets when only photometric data are available.

Kepler FOV Minus GALEX Field of View Plot created using CasJobs output



The cross-match tool is available two ways: by an interface form (http://archive.stsci.edu/kepler/kgmatch/search.php) and by Structured Query Language (SQL) queries in the CasJobs tool environment at (http://mastweb.stsci.edu/kplrcasjobs/).

The form has the classic look and feel of other MAST mission-data retrieval forms. It works for simple queries that yield a relatively small list of results (<15,000 rows). As with other standard MAST interfaces, this interface can be access programmatically as a web service.
An example would be:
http://archive.stsci.edu/kepler/kgmatch/search.php?action=Search&search_table=kggoldstandard&nuvg_color=0.0..0.5
.
For a list of available parameters see: http:/archive.stsci.edu/search_fields.php?mission=kgmatch. There is no restriction on the number of rows that can be returned from the service. More general information about MAST Servicesis available.

The SQL interface in CasJobs (originally developed by the Department of Physics & Astronomy at the Johns Hopkins University) is better suited for large, batch queries. CasJobs remains the recommended way to access the Kepler database for users interested in storing the result of their queries on MAST databases, and for group collaborations.

The cross-match tool allows easy access to objects observed by both Kepler and GALEX. The data represent one-to-one matches within a search radius of 2.5 arcsec of the position of a Kepler object. A list of possible GALEX matches within a search radius of 5 arcsecs is also included. Generally, automated cross-match algorithms, such as the one used by MAST, cannot always unambiguously select the correct match between objects observed by different missions. MAST therefore provides CasJobs users with a comprehensive list of objects ranked by distance from the match. Both the classic Seach Form and CasJobs support uploads of target lists.

GALEX General Release 6 All Sky Survey Data

All data for the General Release 6 (GR6) of the GALEX All-Sky Imaging Survey (AIS) has been delivered to MAST, completing the GR6 imaging release. The data are available on the MAST/GALEX web site. A description of the most notable changes between GR6 and the old GR4/5 can be found at http://galex.stsci.edu/doc/gr6_cs.txt. A delivery of GR6 grism data products, expected in 2011, will complete the GR6 data delivery. The grism data will be available on the News corner and on the table of survey tiles, both located on the MAST/GALEX home page.

The first table below shows the number of tiles available for each GALEX survey in each release. The second table

below shows the exposure time (Ksec) of each survey for each data release.

Number of Tiles						
	AIS	CAI	DIS	GII	MIS	NGS
GR 6	28889	51	338	1314	3479	480
GR 4/5	28269	38	292	788	2161	458
GR 2/3[1]	15721	20	165	288	1017	296
GR 1[1]	3074	-	14	-	112	52

Exposure time (Ksec)												
	AIS		CAI		DIS		GII		MIS		NGS	
	NUV	FUV	NUV	FUV	NUV	FUV	NUV	FUV	NUV	FUV	NUV	FUV
GR6	5633	4780	302	187	7968	4781	5702	4113	7062	5085	2547	1673
GR4/5	5135	4380	149	117	6400	4535	3616	2391	4345	3856	1929	1385
GR2/3[1]	1753	1752	44	23	4355	2819	943	658	2038	1803	763	645
GR1[1]	327	318	-	-	225	225	-	-	205	203	103	101

[1]*Data for GALEX Releases 1 and 2/3 are no longer available at MAST*.

The operations phase of the GALEX mission has been planned to end on September 30, 2012. In the intervening time, GALEX began to observe sky regions of high science value that have not yet been well observed – or in some cases not observed at all. The GALEX project plans to deliver the data to MAST in monthly installments which will be made publicly available immediately upon ingest. These deliveries are "secondary MIS" datasets (Medium Imaging Survey), and can be found within the MIS survey area of the MAST/GALEX web site. First notice of availability will appear on the News corner of the GALEX home page. This notice will contain a link to a list of secondary MIS tiles, which will grow over the duration of this observing program.

The timeline for the operations phase of the GALEX mission is at this time somewhat uncertain. The President's FY12 budget contains only 100K for GALEX closeout. The MAST and GALEX teams have accelerated their efforts to identify remaining data, catalogs and documentation to be archived at MAST.

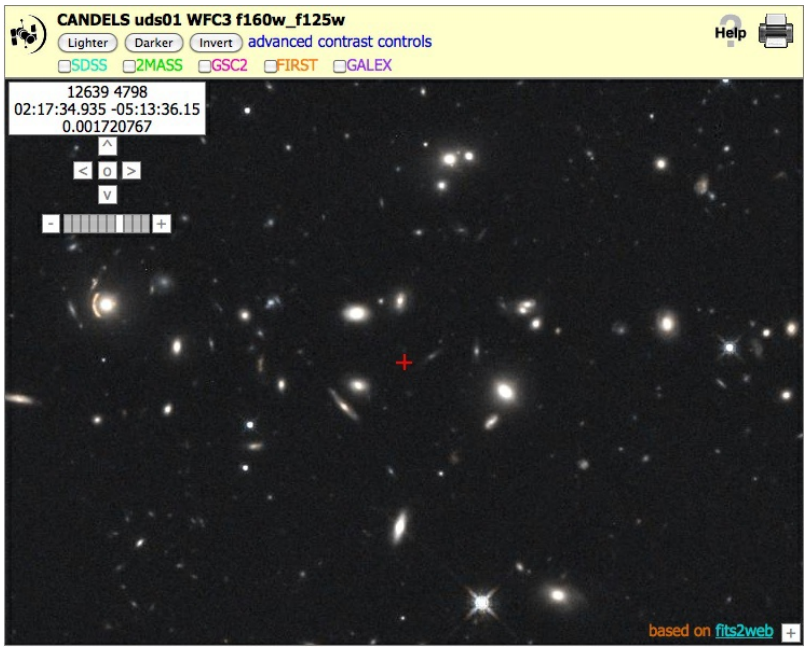
MAST has cross-matched all GALEX sources in this catalog with the with the Sloan Digital Sky Survey DR7 catalog. The cross-match is available in CasJobs. There is a tutorial for this linked from the CasJobs site. In the future cross-matches between GALEX catalog and Guide Star Catalog 2 and the Two Micron All Sky Survey wil become available. As always watch the News corner of the GALEX home page for the announcement.

Hubble Multi-Cycle Treasury Program Data

Hubble Treasury and Multi-Cycle Treasury programs provide an opportunity for the community to address high-impact scientific questions requiring observing time on a scale not easily accommodated by the standard time allocation process. Multi-Cycle Treasury programs have no proprietary period, and the three programs launched with Cycle 18 are being released as HLSPs to the community via the HLSP page in MAST.

- **The Cosmic Assembly Near-IR Deep Extragalactic Legacy Survey (CANDELS)** is an observing program designed to document the first third of galactic evolution, from z = 8 to z = 1.5. It will obtain deep images of more than 250,000 galaxies with two Hubble instruments, the Advanced Camera for Surveys (ACS) and the near-infrared channel of the Wide Field Camera 3 (WFC3). It will also discover and characterize Type Ia supernovae (SNe) beyond z = 1.5 in order to establish their accuracy as standard candles for cosmology. The survey explores five premier sky regions, each well documented by existing multi-wavelength data from Spitzer and other facilities, and by extensive spectroscopy of the brighter galaxies.

  The first and second set of High-Level Science Products (HLSP) from The Cosmic Assembly Near-IR Deep Extragalactic Legacy Survey (CANDELS) team are now available at the CANDELS website at MAST. Below is a screen shot of the WFC3 UDS field as displayed in the HLA viewer.



- **Cluster Lensing and Supernova Survey with Hubble (CLASH)** uses panchromatic imaging from the new Wide Field Camera 3 (WFC3) and the restored Advanced Camera for Surveys (ACS). The goal is to harness the power of strong gravitational lensing to test models of the formation of cosmic structure with unprecedented precision. When combined with existing wide-field optical and X-ray imagery, CLASH observations will be a giant advance in the quality and quantity of information from strong lensing. The strong lenses in the CLASH sample – massive, intermediate redshift galaxy clusters – will allow us to identify hundreds of multiply imaged sources, which in turn, will allow us to challenge theoretical scenarios for the distribution of DM in clusters with ~10% precision. The CLASH images will also yield a tenfold advantage for identifying galaxies with $z > 7$, compared with any field survey of comparable area. The high magnification provided by the cluster lenses presents a unique opportunity to obtain spectra for very young galaxies that would otherwise be beyond the reach of large ground-based telescopes. In parallel with the lensing survey, CLASH will use both ACS and the WFC3 infrared (IR) channel to detect type-Ia supernovae (SNe Ia) in the redshift range $1 < z < 2.5$, which is uniquely accessible from space. Because the SNe Ia will be detected when these cameras are operating in parallel, they will be located far from the cluster core, where the effects of lensing are small (and correctable). Therefore, any SNe that are detected can be used to improve the limits on the redshift variation of the DE equation of state. The CLASH team website is at http://www.stsci.edu/~postman/Home.html. The first data will be released as a High-Level Science Product in 2011.

- **The Panchromatic Hubble Andromeda Treasury (PHAT)** will conduct a wide-area imaging survey of the stellar populations of Andromeda (M31). The goal is to establish a new foundation for interpreting observations of stellar populations across the universe and back through cosmic time. The PHAT survey covers roughly 1/3 of M31's area, from the bulge to just beyond the end of the star-forming disk. M31 provides the best match to the metallicity, morphology, and luminosity of the massive galaxies that dominate redshift surveys, making a wide-area systematic survey of its populations compelling. M31 shows true spiral structure, contains populations that extend to super-solar metallicity, and hosts a traditional spheroidal component. Across the universe, fully 84% of stars lie in spiral disks (58%) or bulges (26%), and more than 3/4 of all stars today have metallicities within a factor of 2 of solar. The data cover wavelengths from the ultraviolet (UV) through the near infrared (NIR) with sufficient coverage to both isolate key features of the color-magnitude diagram and to disentangle stellar parameters and extinction for individual stars. The imaging reaches the maximum depth possible with Hubble's resolution in most filters, and is accompanied by extensive spectroscopy for thousands of stars. The PHAT team website is at http://www.astro.washington.edu/groups/phat/Home.html. The first data will be released as a High-Level Science Product in 2011.

For a more detailed description of each of the three Cycle 18 Multi-Cycle Treasury programs, please look for the winter issue of the STScI newsletter.

Community Contributed High-Level Science Products

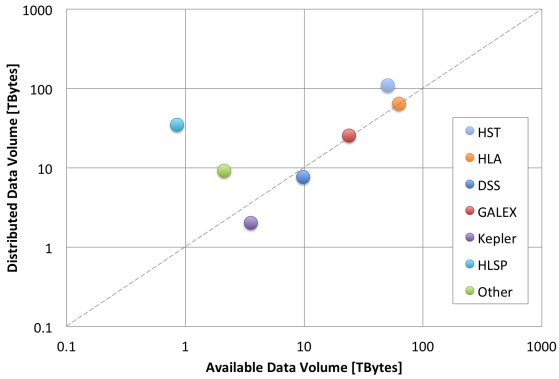
MAST currently holds a rich variety of High Level Science Products(HLSP) from Hubble and other missions, including surveys, deep fields, and atlases (http://archive.stsci.edu/hlsp/). The community contributes HLSPs as fully processed images and spectra ready for scientific analysis.

We encourage both individuals and teams to archive their science-ready products at MAST. Not only does MAST offer a permanent home for both data and catalogs associated with all HLSPs, but it provides a permanent URL to facilitate references in publications. HLSPs are among the most downloaded products in MAST, second only to Hubble and GALEX data. In fact, our bibliographical statistics show that, of the 25 programs with the most associated papers, 72% are also associated with archived

Plot showing Data Volume as of January 2011 vs Volume of Data Distributed 2008-2010

HLSPs, and more than half of the top 50 programs are associated with HLSPs.

MAST is pleased to announce the recent availability of the following HLSPs.

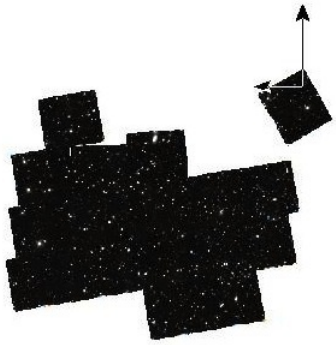


The Cosmic Assembly Near-IR Deep Extragalactic Legacy Survey (CANDELS)

The Cosmic Assembly Near-IR Deep Extragalactic Legacy Survey (CANDELS) is designed to document the first third of galactic evolution from z = 8 to 1.5 via deep imaging of more than 250,000 galaxies with WFC3/IR and ACS. It will also discover and characterize Type Ia SNe beyond z > 1.5 and establish their accuracy as standard candles for cosmology. The CANDELS team has released version 0.5 of the first epoch of GOODS South and the UDS fields.

Version V0.5 represents the team's best-effort calibration at that time, including bias-stripe and CTE corrections for ACS, but no corrections for WFC3/IR persistence. V1.0 will use more mature instrument calibration files, improved astrometry where necessary, and persistence corrections for WFC3/IR where applicable.

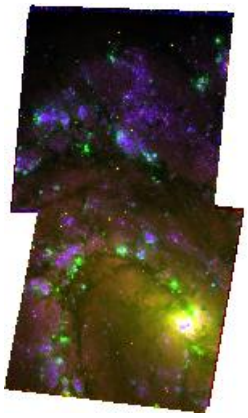
Interactive Display For the WFC3 UDS mosaic



Interactive Display for the WFC3 GOODS-S

Wide Field Camera 3 Early Release Science Program

The STScI director allocated ~210 orbits of Director's Discretionary time to the WFC3 Science Oversight Committee (SOC) for challenging science programs designed to test key capabilities of both the UVIS and IR channels. The combined dataset from these programs is referred to as the 'WFC3 Early Release Science (ERS) Program'. The first set of ERS High Level Science Products of M83 are now available through MAST. See the http://archive.stsci.edu/prepds/wfc3ers/ for information about the data and instructions for download.



Interactive Display of M83 WFC3 F438W F336W F225W

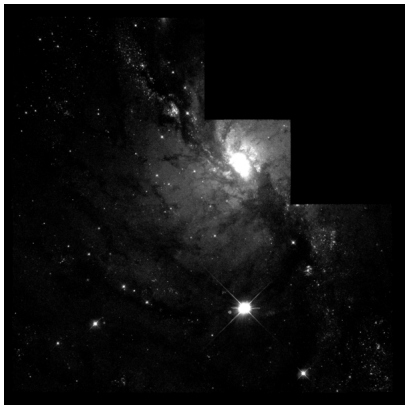
ACS H-Alpha Survey of the Carina Nebula

In 2005, 43 orbits of Hubble observing time were spent studying the Carina Nebula in the light of the Balmer-alpha line of hydrogen. Although these observations cover only a small, central part of the entire nebula, they produced one of the largest sets of contiguous ACS images ever collected. Most of the observations are part of a large mosaic, centered on the star clusters Trumpler 14 and Trumpler 16. M. Mutchler and his team have processed the data and created the mosaic images (http://archive.stsci.edu/prepds/carina/).

Carina Nebula Mosaic WFC3 F658N

Archive of Nearby Galaxies: Reduce, Reuse, Recycle (ANGRRR)

A team headed by J. Dalcanton, K. Gilbert, and B. Williams are producing an archive of stellar photometry for non-Local Group galaxies within 5 Mpc of the Milky Way, based on primary and parallel, wide-filter, ultraviolet, and optical observations obtained by ACS and WFPC2. The first release of ANGRRR provides the results for galaxies within 3.5 Mpc (http://archive.stsci.edu/prepds/angrrr/. The associated reference images and binary fits tables of the raw photometry are also included.



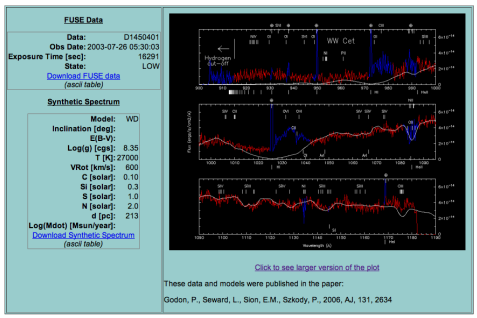
WFPC2 image of IC 342

Dusty Interacting Galaxy GADGET-SUNRISE Simulations (DIGGSS)

DIGGSS is a database of simulated galaxy merger images and associated data products. These simulations were created and analyzed with the support of HST Theory Programs 9515, 10678 (PI Joel Primack), 10958, and 11759 (PI Patrik Jonsson). The N-body/SPH code GADGET produced the simulations, which were processed through the Monte-Carlo radiative transfer code SUNRISE to produce mock SDSS–g–band images at 11 different viewing angles. The effects of dust and new star-formation are included (http://archive.stsci.edu/prepds/diggss/).

Catalog of Cataclysmic Variables and Related Objects (CVARO-UVSCAT)

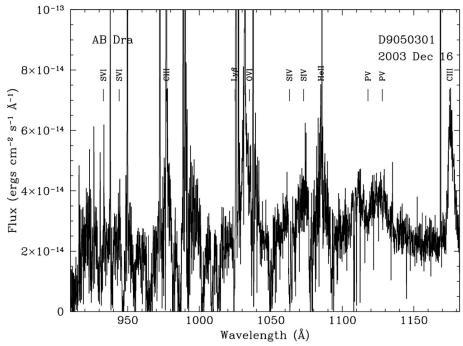
P. Godon and collaborators have created a catalog of FUSE spectra of cataclysmic variables (CVs) and related objects. The catalog includes all CV types and sub-types, such as dwarf novae (U Gem, Z Cam, SS Cyg, WZ Sge, SU UMa sub-types), nova-like objects (VY Scl/anti-DN, UX UMa, SW Sex sub-types), and magnetic systems (IPs, Polars, DQ Her, AM Her sub-types). For each object, the catalog has at least one FUSE spectrum, basic data about the system including figures and tables, and possibly a fitted theoretical spectrum – in cases where the continuum can be modeled successfully. The catalog also includes various objects related to CVs, such as novae of all types, symbiotic stars, and some pre-CVs (http://archive.stsci.edu/prepds/cvaro).



Spectra of MU Cam from the CVARO-UVSCAT

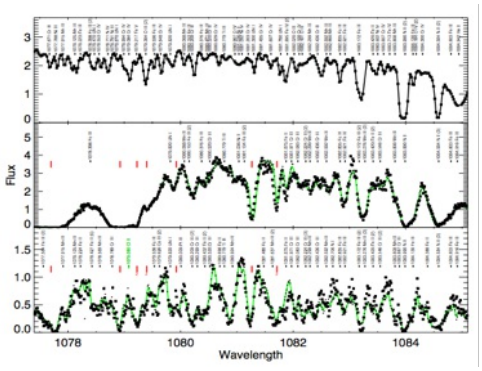
FUSE Survey of Cataclysmic Variables

C. Froning has provided the FUSE Survey of Cataclysmic Variables, which contains 178 FUSE observations of 99 CVs (http://archive.stsci.edu/prepds/fuse_cv/).



The Far-UV Spectral Atlas of B Stars

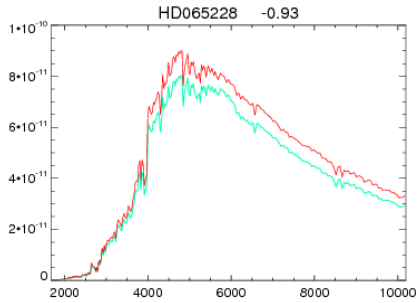
M. Smith has published a far-ultraviolet spectral atlas of ten sharp-lined B0–B9 stars near the main sequence. The atlas is based primarily on reprocessed FUSE data, but includes data from Copernicus, IUE, and Hubble. The atlas provides tables of all recognizable photospheric and interstellar-medium lines in the spectra of the B0, B2, and B8 stars – some 2000 lines in each case. These tables should enable astronomers to synthesize B-star spectra (http://archive.stsci.edu/prepds/fuvbstars/).



7.5 Å, 3-panel plots (1077.5 - 1085 Å)

Next Generation Spectral Library (NGSL Version 2)

S. Heap and D. Lindler have delivered STIS spectra of 374 stars. Each includes segments from gratings G230LB, G430L, and G750L merged into a single spectrum covering ~2000 – 10,000 Å (http://archive.stsci.edu/prepds/stisngsl/).



The plot compares the Version-2 spectrum with the Version-1 spectrum of HD065228.

ACS Treasury Survey of the Coma cluster

A deep, two-passband imaging survey of the Coma cluster (Abell 1656) of galaxies. The survey team released version 2 of the image data and version 2.1 of the associated catalogs. (http://archive.stsci.edu/prepds/coma/).

The recent DR2.2 release contains one data product: a Catalog of structural parameters of 8814 galaxies.

High-Level Science Products that are coming soon:

- Additional data from the CANDELS (Faber/Ferguson) Multi-Cycle Treasury Team
- First release of HLSP from the CLASH (Postman) Multi-Cycle Treasury Team
- First release of HLSP from the PHAT (Dalcanton) Multi-Cycle Treasury Team
- USNO-Kepler Catalog (Kinemuchi)
- Catalogs of GALEX UV unique sources, and of UV-optical matched sources (Bianchi)
- Photometry and images from the *An ACS Survey of Galactic Globular Clusters* (Sarajedini) HST Treasury program
- Data from *A Legacy Archive PSF Library And Circumstellar Environments {LAPLACE} Investigation* (Schneider) HST Archival Legacy Program
- *Hubble Infrared Pure Parallel Imaging Extragalactic Survey" (HIPPIES)* – Hao-Jing Yan

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The Space Telescope-European Coordinating Facility Now Closed

The Space Telescope European Co-ordinating Facility, a unique collaboration between the European Space Agency (ESA) and the European Southern Observatory, was officially closed on 31 December 2010 after 26 years of operations. The full text of the announcement can be found on the ESA website . MAST and STScI will miss the close and productive collaboration and partnership we have had with our European colleagues for the past 26 years and we salute the contributions they have made to the HST project.

ESA is maintaining the European copy of the archive, keeping the current archive in place for a few months. ESA plans to transition support to the European Space Astronomy Centre (ESAC) during 2011.

MAST User Survey and Users Group Meeting

MAST requests user feedback on a regular basis. We ask our users for input on current and future features, on improvements they would like to see, or on enhancements that would make their experience more helpful when visiting the large collection of MAST sites.

In June 2010 MAST conducted a User Survey. We want to thank all of those who participated for their feedback. The results of the survey can be viewed a PDF file and MAST responses to some of the comments and questions that we received are available at http://archive.stsci.edu/surveyresults/2010/response2010.html.

On July 16, 2010, the MAST User Group (MUG) held its annual meeting at the Institute. The MUG provides an essential user perspective on archive operations and development, including assessments of the priorities for short- and long-term operational and scientific enhancements to MAST. The 2010 MUG report and the presentations made at the meeting by MAST staff members are available at the MAST MUG page.

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