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Based upon Martin et al. 2003, "The Galaxy Evolution Explorer," SPIE Conf. 4854, Future EUV-UV and Visible Space Astrophysics Missions and Instrumentation.

## 1. ABSTRACT

The Galaxy Evolution Explorer (GALEX) is a NASA Small Explorer Mission launched April 28, 2003. GALEX is performing the first UV-ultraviolet sky survey. Five imaging surveys in each of two bands (1344–1786 Å and 1771–2831 Å) range from an all-sky survey (limit  $m_{AB} \sim 20.1$ ) to an ultra-deep survey of 4 square degrees (limit  $m_{AB} \sim 26$ ). Three spectroscopic grism surveys (R=100-300) are underway with various depths ( $m_{AB} \sim 20-24$ ) and sky coverage (80 to 2 square degrees) over the 1344–2831 Å band. The instrument includes a 50 cm modified Ritchey-Chretien telescope, a dichroic beam splitter and astigmatism corrector, two large sealed-tube microchannel plate detectors to simultaneously cover the two bands and the 1.2 degree field of view. A rotatable optical wheel provides either imaging or grism spectroscopy with transmitting optics.

We will use the measured UV properties of local galaxies, along with corollary observations, to calibrate the UV-global star formation rate relationship in galaxies. We will apply this calibration to distant galaxies discovered in the deep imaging and spectroscopic surveys to map the history of star formation in the universe over the red shift range zero to two. The GALEX mission will include a Guest Investigator program to support data analysis of new and archival observations. This will support a wide variety of investigations made possible by the first UV sky survey.

## 2. SCIENCE OVERVIEW

With GALEX we seek to study the UV properties of galaxies in the local universe. We will measure the relationship of UV to star formation rate, extinction, starburst history, initial mass function, and metallicity. We will do this using studies of nearby, spatially resolved galaxies, and in large samples of more distant low redshift galaxies. We will combine UV images and spectra with data obtained from the Sloan Digital Sky Survey, 2dF, 2MASS, IRAS, ISO, and a suite of nearby galaxy surveys to determine the definitive relationship between global UV properties and physical properties of galaxies.

Using this local "calibration", we will study distant galaxies over the redshift range 0.3 < z < 2 to track the cosmic star formation history, the history of extinction, modes of star formation, and the starburst history of the universe, over a cosmic time of roughly 10 Gyr.

Finally, we will generate a legacy data set which will support studies of the statistical properties and evolutionary history of quasi-stellar objects, post-main sequence stars, degenerate binary stars. A large database will definitely resolve nature of the UV rising flux in early-type galaxies. High redshift QSOs visible in the observed FUV and NUV will determine the rest EUV spectral energy distribution of quasars and provide sources for IGM studies with the H&I Gunn-Peterson test.

GALEX addresses these goals with a set of imaging and spectroscopic surveys. Five imaging surveys are underway in a Far UV band (1344–1786 Å) and Near UV band (1771–2831 Å) with 4.5-6 arcsecond resolution (FWHM) and a 1 arcsec-100, and a cosmic UV background map. Three overlapping slitless grism spectroscopic surveys over the 1344-2831 Å band with  $\lambda/\Delta\lambda \sim 100$ , resulting in greater than 100,000 galaxies with redshifts (0 < z < 2), extinction, and SFR.

**Imaging:** Five imaging surveys in a Far UV band (1344–1786 Å) and Near UV band (1771–2831 Å) with 6-8 arcsecond resolution (80% encircled energy) and 1 arcsec astrometry, and a cosmic UV background map.

[AIS:] An All-sky Survey to 20-21<sup>st</sup> (AB), netting ~10,000 galaxies within 70 Mpc and 10 million galaxies overall for an unbiased local calibration of UV galaxy morphology, SFR, and extinction.

[MIS:] A Medium Imaging Survey over 1000 square degrees to 23<sup>rd</sup> (AB) to provide data on galaxies at intermediate distances and luminosities.

[DIS:] A Deep Imaging Survey over 80 square degrees to 25<sup>th</sup> (AB) to provide photometric redshifts, extinction, and SFR for faint and distant galaxies. DIS regions will overlap Spitzer Legacy SWIRE fields.

[UDIS:] An Ultra-deep Imaging Survey over 4 square degrees to 26<sup>th</sup> (AB) to provide photometric redshifts, extinction, and SFR for the faintest and most distant galaxies.

[NGS:] Nearby Galaxy Survey of 150 nearby galaxies with exposures of 1-2 orbits per galaxy.

**Spectroscopy:** Three overlapping slitless-grism spectroscopic surveys over the 1350–2800 Å band with  $\lambda/\Delta\lambda \sim 100$ , resulting in greater than 100,000 galaxies with redshifts (0 < z < 2), extinction, and SFR.

[WSS:] A Wide-field Spectroscopic Survey to 20<sup>th</sup> (AB) over 80 square degrees to calibrate the global UV/SFR/Extinction relations and find the rarest and most luminous star-forming galaxies. WSS will overlap DIS fields.

[MSS:] A Medium-deep Spectroscopic Survey to 21–23<sup>rd</sup> (AB) over 8 square degrees to find star forming galaxies of intermediate SFR and redshift.

[DSS:] A Deep Spectroscopic Survey to 22–24<sup>th</sup> (AB) over 2 square degrees to find the galaxies with the lowest SFR and highest z, overlapping the deepest ground-based surveys.

**Guest Investigator Program:** Four months of dedicated associate investigator observations will be performed in the last eight months of the nominal 28 month mission for science complementary to the primary survey goals.

**Table 1 – Survey Summary – see also Survey Summary**

Survey	Survey Parameters			Science Objective			<z>
	Area [deg <sup>2</sup> ]	Length [Month]	Expos [ksec]	Mag. Lim [m <sub>AB</sub> ]	#Gals (est.)	Volum <sup>c</sup> [Cpc <sup>3</sup> ]	
All-sky (AIS)	40,000	4	0.1	20.5	10 <sup>7</sup>	1.5	0.2
Wide Spectroscopic (WSS)	80	4	30	20	10 <sup>4.5</sup>	0.03	0.15
Nearby Galaxies (NGS)	---	0.5	1.5	27.5	100	---	---
					[img area=° <sup>2</sup> ]		
Medium Imaging (MIS)	1000	2	1.5	23	3 x 10 <sup>6</sup>	~1	0.6
Medium Spectroscopic (MSS)	8	2	300	21.5 [R=100] 23.3 [R=20]	10 <sup>4.5</sup>	0.03	0.5
Deep Spectroscopic (DSS)	2	4	1500	22.5 [R=100] 24.3 [R=20]	10 <sup>4.5</sup>	0.05	0.9
Deep Imaging (DIS)	80	4	30	25	10 <sup>7</sup>	1.0	0.85
Ultra-Deep Imaging (UDIS)	4	1	150	26	3x10 <sup>5</sup>	0.05	0.9

## 3. MISSION

GALEX is performing with a wide-field (1.2 degree) UV-optimized instrument consisting of a 50 cm modified Ritchey-Chretien telescope, a selectable imaging window or grism, a dichroic beam splitter and corrector, a far ultraviolet and near ultraviolet sealed tube microchannel plate detectors, and support electronics. The instrument is coupled to a Orbital Sciences Corporation spacecraft that is three-axis stabilized, with fixed GaAs solar panels, a NiH battery, an X-band transmitter and S-band transmitter and receivers. The satellite mass is 277 kg, and orbit average power is 275W. The satellite is shown during integration in Figure 1, with solar panels in the deployed position.

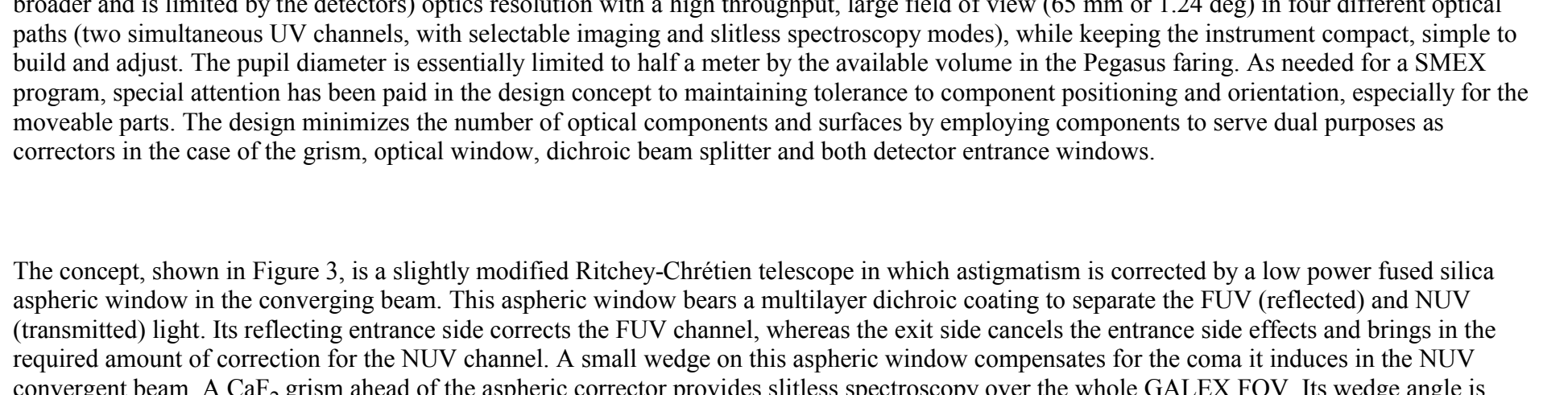


Figure 1 – GALEX satellite.

The attitude will be dithered in a 1 arcminute spiral for deep targets, while the AIS will be obtained by scanning at 200 arcseconds/sec. Dithering and scanning is performed to average over detector non-uniformities and to prevent microchannel plate detector gain fatigue by UV bright stars. During science data collection, individual photon events are collected by the far ultraviolet and near ultraviolet detectors and front-end electronics (FEE), formatted by the instrument Digital Processing Unit (DPU), and stored on the spacecraft solid-state tape recorder (SSR) along with housekeeping data. At the end of orbital night, detector high voltages are ramped to idle levels to protect them from damage and the spacecraft returns to solar array pointed attitude. Up to four times per 24 hour day the SSR is dumped via the X-band transmitter to ground stations in Hawaii or Perth, Australia, operated by Universal Space Operations (USO). Real-time satellite health and ground monitoring is performed by the Mission Operations Center (MOC) at Orbital Sciences Corporation in Dulles, Virginia, during the ground pass. Science telemetry is shipped by ground network to the Science Operations Center at Caltech, with a latency of 4 hours for housekeeping and 48 hours for photon data. Science data will be processed at Caltech to produce images, object catalogs, and extracted spectra. Catalogs and spectra will be delivered to the Space Telescope Science Institute to be archived in a database developed by Johns Hopkins University for the Sloan Digital Sky Survey (SDSS).

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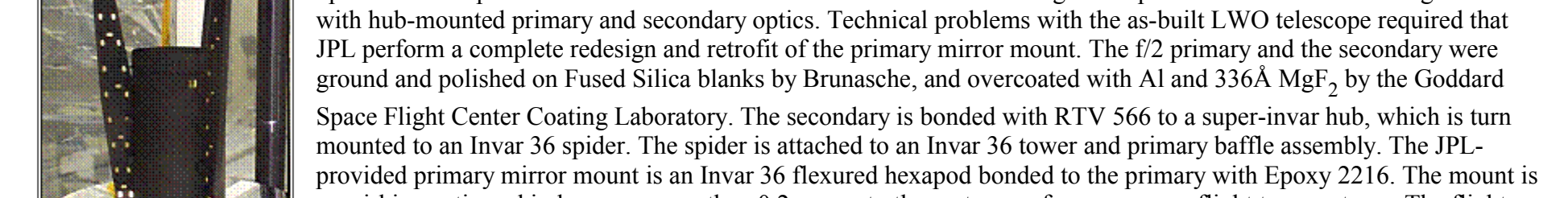


Figure 2 – GALEX Orbit sequence.

## 4. INSTRUMENT

The adopted design meets the challenging requirements of providing ~2.3 arcsec 80% encircled energy (80% EE). NB the system resolution is broader and is limited by the detectors) optics selection with a high throughput, large field of view (65 mm or 1.24 deg) in four different optical paths (two simultaneous UV channels, with selectable imaging and slits spectroscopy modes), while keeping the instrument compact, simple to build and adjust. The pupil diameter is essentially limited to half a meter by the available volume in the Pegasus faring. As needed for a SMAX program, special attention has been paid in the design concept to maintaining tolerance to component positioning and orientation, especially for the correctors. The design minimizes the number of optical components and surfaces by employing components to serve dual purposes as mounters in the case of the grism, optical window, dichroic beam splitter and both detector entrance windows.

The concept, shown in Figure 3, is a slightly modified Ritchey-Chretien telescope in which astigmatism is corrected by a low power fused silica aspheric window in the converging beam. This aspheric window bears a multilayer dielectric coating to separate the FUV (reflected) and NUV (transmitted) light. Its reflecting entrance side corrects the FUV channel, whereas the exit side cancels the entrance side effects and brings in the required amount of correction for the NUV channel. A small wedge on this aspheric window compensates for the coma it induces in the NUV convergent beam. CaF<sub>2</sub> grism ahead of the aspheric corrector provides slitless spectroscopy over the whole GALEX FOV. Its wedge angle is adjusted to correct for the coma it induces in the converging beam, primarily advantageously for orders 2 and 1 spectra of the FUV and NUV channels respectively. It turns out that the resulting deviation is low, a 2<sup>nd</sup> order advantage for switching between imaging and slitless spectroscopy. This switching is performed by exchanging the grism with a low power plano-convex CaF<sub>2</sub> imaging window. These two components are mounted on a rotatable wheel that also provides an opaque position. The grism and the imaging window positional tolerances are loose (0.5 mm) because they are curvilinear components with only a power in the detector windows, and the detectors are tilted to the best plane. A remarkable feature is that a single blaze angle on the grism facets is found to provide a well-centered efficiency for both FUV and NUV channels, owing to the CaF<sub>2</sub> dispersion with wavelength.

The design yields a field-averaged spot size of 1.6 arcsec (80%EE) for the FUV imagery and 2.5 arcsec (80%EE) for the FUV spectroscopy at 1600Å. NUV performance is similar. There is no in-flight resolve capability.

## 4.1. Optical Design

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## 4.2. Telescope

The telescope, shown in Figure 4, is a 50 cm, f/6, modified Ritchey-Chretien design optimized for the required 1.2 degree wide field of view. The telescope and light spare (used as cone collimator for optical testing) were originally designed and provided by Light Works Optical Corporation (LWO). The design requirements were comparatively modest, driven by overall mass, stiffness, and maintenance of the required 30 micron 80%EE spot size over flight operational temperatures with no active thermal control. The LWO design incorporates a Meinel strut arrangement with hub-mounted primary and secondary optics. Technical problems with the as-built LWO telescope required that JPL perform a complete redesign and retrofit of the primary mirror mount. The f/2 primary and the secondary were ground and polished on Fused Silica blanks by Brunasche, and overcoated with Al and 336Å MgF<sub>2</sub> by the Goddard Space Flight Center Coating Laboratory. The secondary is bonded with RTV 566 to a super-invar hub, which is turn mounted to an Invar 36 spider. The spider is attached to an Invar 36 tower and primary baffle assembly. The JPL provided primary mirror mount is an Invar 36 flexured hexapod bonded to the primary with Epoxy 2216. The mount is quasi-kinematic and induces no more than 0.2 arcsec to the system performance over flight temperatures. The flight telescope was assembled and aligned at JPL, and was subjected to vibration and thermal vacuum testing beyond expected environmental conditions. A small amount of focus shift is present over temperature, roughly 5 microns/degree C, and due mostly to the secondary mirror mount. The primary and secondary mirrors are temperature controlled. A small amount of astigmatism (approximately 1 wave, and induced by the secondary mount) was discovered during end-to-end optical tests, but remained stable. In spite of these deficiencies, the telescope contribution to the system angular resolution budget remains within specification.

## 4.3. Window and Grism

The dispersive component for the spectroscopy mode is a 75 grooves/mm CaF<sub>2</sub> grism that can be inserted with loose tolerances into the convergent beam to produce slitless spectra. Both the grism and the imaging window that comes in phase of the grism have been polished by STIGA from a 180 mm diameter, high quality UV-grade monocrystalline CaF<sub>2</sub> ingot screened for low phosphorescence, provided by SOREIM. Both the grism and imaging window have a low curvature entrance face and require a tight control of the differential thickness ( $\pm 30\mu\text{m}$ ) to keep in focus while switching between imaging and spectroscopy. Nevertheless the most difficult part was by far the grism ruling; although grisms are widely used in visible and near infrared ground-based astronomy, the UV cutoff of the resins involved in their manufacturing process prevents their use in the vacuum UV range. LAS and John-Yvon developed a proprietary process to imprint the blazed profile into the CaF<sub>2</sub> grism. Figure 5 shows the grism, the efficiency ratio of the flight grism to that of the imaging window, and a polarization image. The absolute efficiency measurements reach 82% in the FUV and 61% in the NUV. Electromagnetic computations have shown the grism is negligible. The GALEX grism was the first ever built for the FUV<sup>3</sup>. The grism is mounted in a mechanism that can rotate the spectra to 872 position angles on the detectors and sky.

Slitless spectroscopy produces numerous overlapping object spectra and multiple orders. For this reason, all spectroscopic surveys are obtained using a different position angle for each orbit integration. The confusion problem becomes worse as the survey deepens. At the same time the number of position angles increases, compensating. The deep spectroscopic survey will utilize all 872 distinct positions. Simulations have shown that this also method yields a confusion limit comparable to that of the imaging surveys when more than 100 angles are utilized. Satellite roll, which may also be used to control spectral position angle, is often otherwise constrained.

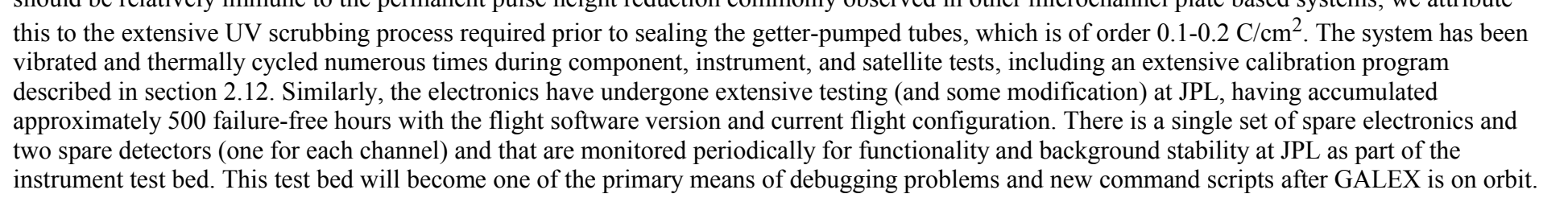


Figure 5 – LEFT: Grism. CENTER: Ratio of Grism to Imaging Window efficiency. RIGHT: Grism calibration image.

## 4.4. Dichroic Beam Splitter

The 110 mm diameter UV-grade fused silica aspheric corrector window (AS) is only 4 mm thick. Using its entrance face as a mirror sets tight manufacturing tolerances that already were challenging, but the polishing it flat on both faces, at the first manufacturing step. The AS is tilted at 22° to the beam to accommodate the FUV detector position, but the aspherization has been performed asymmetrically to simplify manufacturing, with only marginal impact on the image quality. The required aspherization was 4.7µm for the first side and 11.4µm for the second. The two aspherizations were achieved at IOTA (University of Paris) by broad-beam ion milling with a carbon mask, a technique that combines a very good shape precision, conservation of the optical smoothness comparable to that allowed by the classical flat polishing, and absence of any stress in the material thus preserving the shape of the side not being processed<sup>4</sup>. The FUV side has been eroded first, after the polishing of a mask iteratively adjusted from calibration erosion on test blanks. A significant part of the FUV residual departure from flatness after the basis of a mask corrected for by adjusting the erosion time. For the NUV side, the erosion has been performed in two steps, the second (~10% of the exposure time) being adjusted as at high voltage. We encountered no surprises and there was no damage to the instrument.

The mechanical mount developed for the aspheric corrector window was used to hold the crystalline grism and imaging window with minimal strain in the thermal, vibration and shocks environment of Pegasus launchers. The three components were bonded to the heads of three titanium flexure bipods. The bipod leg angle was set to equally share the maximal stress in the thinned parts for the X, Y and Z directions of vibration. An o-ring linking the bipod legs to a suitably flexible telescope interface has proved very efficient in damping the sharp natural resonance during environmental testing.

## 4.5. Filters

Three of the GALEX back focal assembly optics are coated with multilayer filters designed to enhance the in-band throughput and off-band rejection of the GALEX instrument. The dichroic coating applied to the entrance face of the fused-silica aspheric corrector plate separates the FUV (reflection) and NUV (transmission) optical paths. This all-dielectric dichroic coating provides a significant improvement over conventional 40%-40% UV beam splitter coatings, with a mean reflectance of 61% over the 1400-1700Å band and a mean transmittance of 83% over the 1800-2750Å band. A transmissive blue-edge filter coated on MgF<sub>2</sub> provides 10% rejection of the OI 1304 argon line for the FUV channel. A reflective broad-band red-blocking filter on the M3 folding mirror has an edge at 2800Å. This edge yields an additional factor of 10-20 rejection for the NUV zodiacal light background above and beyond the natural Cs<sub>2</sub>Te detector photoconductor cut-off.

The detector resolution tests could only be performed during end-to-end optical tests, because of the presence of the thick, curved entrance windows. The detector resolution varies significantly with position and pulse amplitude. Based on 50 aperture tests and 200 microchannel plate (MCP) contributions to the detector resolution, the median resolution is 75 microns for the FUV and 107 microns for the NUV detectors (80% encircled energy diameter), which corresponds to 50 microns and 70 microns FWHM, respectively. The NUV detector is somewhat wavelength dependent and depends because of photoelectron gain spread transiting the proximity-focused gap. Post-tube processing QE is 10% at 1500Å (FUV) and 8% at 2300Å (NUV).

## 4.7. Instrument Ground Calibration and Performance

From April 20 through May 13, 2002 the GALEX JPL instrument ground calibration and MAESTRO science teams performed a thermal-vacuum ground calibration campaign in Dulles, Virginia. We operated around the clock in three overlapping, equivalent shifts per day. We made measurements continuously at cold, nominal, and hot operational thermal plateaus, and during transitions between them. We successfully obtained required data and did not have any failures that required us to break vacuum. We collected 100 GByte of data during ~500 hr when at least one detector was at high voltage. We encountered no surprises and there was no damage to the instrument.

The primary purpose of the calibration thermal vacuum test was to make detailed measurements of GALEX instrument performance characteristics. The flight data-analysis pipeline requires these as inputs. The second purpose was to look for anomalies while and through exercising the instrument over a range of targets, light levels, count rates, temperatures, bus voltage, and detector high voltage. The third purpose was to verify performance of parameters including proper focus and optical alignment, point spread function (PSF), detector spatial nonlinearity, and thermal stability, as required by our requirements matrix. The fourth purpose was to test a modification of a survival heater thermostat and to perform two thermal vacuum cycles (of four days) at the instrument level to demonstrate thermal robustness and to look for workmanship problems. The fifth purpose was to exercise the science operations and data analysis team, the instrument team, and the data analysis team. The sixth purpose was to select table values for operating the detector front end electronics (FEE).

Among calibration parameters, we gave priority primarily to those that were more difficult to measure in flight. We adhered to the principle "test it like we fly it" to the extent practical. We commanded the instrument and downloaded data using the Orbital Sciences Corp MAESTRO command and telemetry software that we use in flight. The MAESTRO system communicated with a spacecraft simulator, which communicated with the instrument via a 1553 bus, and included a solid-state recorder simulator, which read science data through an RS-422 bus. We implemented the instrument with a light aperture beam produced by a light-spare telescope with a target wheel at its focus. A Roper Scientific Acton Research VM-502 0.2-m vacuum monochromator with a deuterium lamp provided UV illumination.

Our top priority calibration items were relative sensitivity versus wavelength, flat field, imaging-to-spectroscopic differential sensitivity versus wavelength, and spatial nonlinearity. The middle priority were absolute sensitivity (3 pencil beam locations in the aperture), grism dispersion function compared to imaging, high count rate tests (local and global), and a sky-simulation target. The lowest priority were PSF characterization, near-angle star light, detector spectrum (monochromator at zero order), and detector background. At daily status/scheduling meetings, we adjusted the time allocation between tests based on their priority, on considerations of granularity and signal-to-noise, on the need to repeat certain tests at different environmental or detector temperatures, and on the relative efficiency of particular tests. Of the tests listed above, the local high count rate and near-angle stray light tests were reduced in scope because of operational difficulties. All other tests were performed satisfactorily. Much of the data has been analyzed and all critical parameters are adequately known and acceptable. Key performance results are summarized in Table 2.

**Table 2 – Instrument Design & Performance Summary (based on Ground Calibration)**

Telescope Aperture	50 cm
Optical Design	Modified Ritchey-Chretien with 4 channels: FUV & NUV Imaging, FUV & NUV Spectroscopy. FUV & NUV obtained simultaneously using dichroic beam splitter also acting as a field aberration corrector.
Field of View	1.2 degrees, circular
Focal Length	3 m
Telescope coatings	Al+MgF <sub>2</sub>
Imaging/Grism Modes	(1) CaF <sub>2</sub> Imaging window, (2) CaF <sub>2</sub> transmission grism; (3) Opaque position.
Grism Rotation	Grism position angle may be selected with a resolution of 0.3 degrees, independent of SC roll
Dichroic/Corrector	Aspheric astigmatism corrector Ion-etched fused silica (aspheric surfaces on both sides)
	Dichroic beam splitter with dielectric multilayer coating on input side
Band	FUV 1350-1750 Å NUV 1750-2800 Å
Beam path	Reflected from dichroic Transmitted through dichroic
Filters	Blue edge filter Red block filter/Fold mirror
Detectors	(blocks OI, Ly-α - transmission) (blocks red Zodiacal light)
Detector Window	Sealed tube Z-stack microchannel plate with crossed delay-line anodes MgF <sub>2</sub> Fused Silica
Detector Photocathode	Cs <sub>2</sub> Te, semitransparent
Detector peak QE	12% 8%
Detector maximum local count rate w/o temporary saturation within PSF	~100 e/s ~1000 e/s
System angular resolution	6.0 arcsec (80% EE diam) 8.0 arcsec (80% EE diam)
Spectral Resolution	4.0 arcsec (FWHM) 5.6 arcsec (FWHM)
Imaging Effective Area	250-300 40-150
Photometric Zero Point [1 ct/s] m <sub>AB</sub>	18.1 20.1
Spectroscopy Effective Area	20 cm <sup>2</sup> 39 cm <sup>2</sup>

## 5. MISSION AND SCIENCE OPERATIONS AND DATA ANALYSIS

Mission Operations will be performed at Orbital Science Corporation's Mission Operations Center (MOC) in Dulles, VA. Ground contacts will occur four times per day over the Universal Space Networks (USN) Perth and Hawaii stations. Satellite and instrument housekeeping will be monitored during ground contacts. Real time commanding will be used through In-Orbit Checkout (IOC) and during infrequent critical command sequences-including anomaly recovery.

GALEX is in a low-earth orbit (690 km altitude, 29 deg inclination, 99 minute orbital period). Low-background requirements limit science observations to orbital night. During a typical orbit, the GALEX detectors are ramped to their nominal high voltage at night entry and ramped down to a safe low state prior to night exit. GALEX detectors are also ramped to safe levels during South Atlantic Anomaly passages and during scans over bright stars during the All-sky Survey. Bright objects such as the sun, moon, earth limb, and bright planets are avoided during observation intervals.

Science observations for the GALEX mission are planned at the Science Operations Center at Caltech in Pasadena, CA. Once per week, an observation description file containing a time-ordered sequence of pointing and instrument setting commands is sent to the Mission Operations Center. GALEX science mission planning software is designed to schedule the science surveys as efficiently as possible while ensuring that no adjacent quantum cycles (of four days) are violated. During each observation, the GALEX instrument stores time-tagged photon positions for each detector on the spacecraft solid-state recorder. The ~5 GB of science data collected each day will require four 25 Mbps X-band downlink contacts to transmit to the ground for processing.

The GALEX data analysis pipeline operated at the Science Operations Center receives the time-tagged photon lists, instrument/spacecraft housekeeping, and satellite aspect information within two days of the ground contact. From these data sets, the pipeline reconstructs the aspect vs. time and generates images, spectra, and source catalogs. The first pipeline module corrects the photon positions for detector and optical distortions and uses a maximum-entropy algorithm to calculate an optimal aspect solution based on the time-tagged photon data. A photometric module accumulates the photons into count and intensity maps and extracts sources from images. A spectroscopy module uses image source catalog inputs to extract spectra of these sources from the multiple slitless grism observations. Realistic processing simulations indicate that eight installed 1-2 GHz dual processor servers running under the Linux operating system will process the complete set of data from a 24 hour period in considerably less than the 12-hour maximum requirement.

Final GALEX images and catalogs are to be released to the public at the Multimission Archive at Space Telescope (MAST) using a queryable database schema. The GALEX archive is based on the Sloan Digital Sky Survey (SDSS) SkyServer architecture. This is a natural match, both because the GALEX science depends on SDSS corollary data and since the structure and the format of the data has remarkable similarities to the SDSS (multiwavelength, combination of imaging and spectroscopy, etc.). The Archive will be implemented using Microsoft SQL Server, and much of the front end will be web-based, probably implemented using SOAP and .NET, and adhering to the National Virtual Observatory standards.

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Figure 6 – Measured effective area for imaging and grism modes, and background levels.

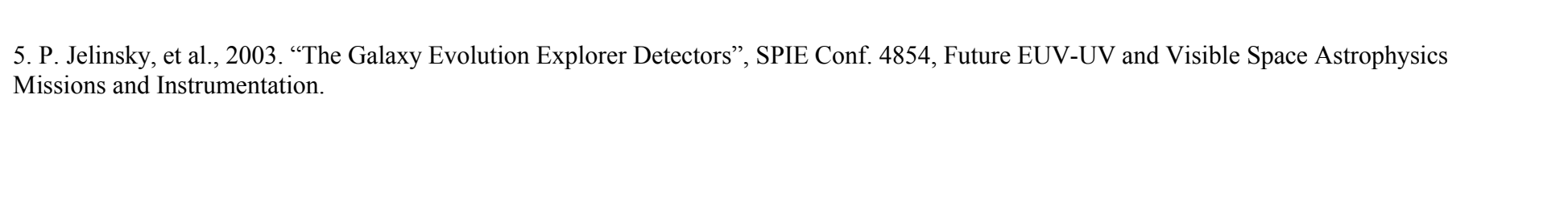


Figure 7 – Flight NUV Detector.