GALAXY EVOLUTION EXPLORER (GALEX)

GUEST INVESTIGATOR PROGRAM - Cycle 6

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GALEX GUEST INVESTIGATOR PROGRAM - Cycle 6

1 Guest Investigator (GI) Program Description

1.1 Overview

This program element (D.5) of the 2009 ROSES solicits proposals for the acquisition and analysis of new scientific data from the Galaxy Evolution Explorer (GALEX). GALEX operates in two broad bands, Far-UV (FUV, 1350-1800 Å) and Near-UV (NUV, 1800-2800 Å), providing wide-field (1.2 degree) imaging and low resolution (R = 150-300) grism spectroscopy, with sufficient sensitivity to study a wide variety of objects within and outside of our Galaxy. GALEX was launched on April 28, 2003.

This solicitation is for Cycle 6 of the GALEX Guest Investigator (GI) Program, to be carried out beginning on January 1, 2010, and lasting approximately 12 months. Section 2 contains instructions for proposal preparation. A brief description of the GALEX mission is in Section 3; a more detailed description can be found at http://www.caltech.edu/researcher/techdocs.html/.

Proposals will be accepted for both new observations and for archival research. Proposed scientific investigations should not duplicate GALEX primary science investigations, or already accepted GI Programs (see http://galexgi.gsfc.nasa.gov/science/index.html). Guest Investigations may be proposed for fields already observed by the GALEX science team, as long as the science investigation is clearly different. Many projects may be best addressed as archival investigations, using the data already collected for the primary mission; all publicly available GALEX data in the Multimission Archive at Space Telescope (MAST) will be available for archival investigations. Potential proposers are strongly encouraged to examine the descriptions of the GALEX primary science investigations before proposing. Examples of GALEX science may be found in the list of publications (http://www.galex.caltech.edu/researcher/data.html). Planned and completed GALEX observations are summarized in the GALEX Target Observation and Archive Research Tool (TOAST).

1.2 Program Types

Proposals submitted in response to this program may be for new observations with GALEX, or for analysis of existing GALEX data. Approximately 1500 ksec (1/3 of the available observing time) is expected to be available to the community for new observations in Cycle 6. There are four proposal categories: 1) Standard, 2) Legacy, and 3) Snap proposals are for new observations; while 4) Archival proposals are for investigations using the rich GALEX archival data set. Mixed proposals may be submitted that include some new observations and some archival work; these should be submitted as the relevant type of observing

proposal. More information on the different proposal types may be found in the following sections.

For the first three categories, proposals submitted in response to this NRA constitute the first phase of the GALEX GI proposal process. The following information is required: a scientific justification, a description of the proposed observations, a discussion of the technical feasibility, astronomical target data, exposure time estimates, and any special operational requirements (e.g., orientation constraints, timing considerations, etc.). Section 1.3 describes how GI programs will be evaluated and implemented in Cycle 6. After selection by NASA, successful GI observing programs will undergo a detailed Phase 2 review, for safety checks, feasibility assessment, and observation scheduling. No Phase 2 review will be required for successful archival proposals.

Two types of unscheduled observing timet can be made available with the approval of the GALEX Mission Scientist. The first deals with major Targets of Opportunity (ToO), such as supernovae, novae, and comets. The second type, called Discretionary Observing Time (DOT), is intended for observations of an urgent nature requiring a small amount of observing time and of sufficiently high scientific priority that they should not be delayed to the next observing cycle (See Section 1.2.3 for more details). No funding will be provided for accepted DOT proposals.

1.2.1 New Observations: Program Categories and Time Allocation

Observing Program Categories - Each GALEX observing proposal must be designated in one of three proposal categories at the time of submission - Standard, Legacy, or Snap - and this category must apply to all targets in the proposal. Approximately 1/3 of the available observing time during Cycle 6 (~ 1500ksec) is expected to be available to the community for new observations. GALEX observing time is allocated in orbital nights (orbits of ~1.5 ksec). Proposals should request only the time needed for scientific exposures.

1. **Standard proposals** provide the opportunity to observe targets specified by the proposer. These may include shallow or deep imaging, shallow or deep grism observations, repeated visits to observe time-variable phenomena, mapping of regions of the sky not observed by the GALEX primary science surveys, or Target-of-Opportunity (ToO) observations. NASA intends to execute all observations associated with accepted Standard proposals. These programs *typically* request less than 100 ksec.observing time (but may be larger).

2. **Legacy proposals** provide the opportunity for large coherent projects of general and lasting importance to a wide astrophysical audience. These proposals typically request a minimum of 100 orbits (but they may be smaller). Legacy programs should use GALEX to enhance significantly the overall scientific return of the mission. They are expected to provide value-added data products, to offer immediate data access, to make available ancillary data, or otherwise enhance the resulting dataset. NASA intends to execute all observations associated with the allocated observing time for accepted Legacy proposals. Legacy proposals should explain what lasting value they offer the community, and what "value-added" provisions are planned. NASA anticipates that at least 25% of the GI observing time in Cycle 6 will be allocated to Legacy proposals.

3. **Snap proposals** are intended to maximize the science return of GALEX and to provide scheduling flexibility by providing a large pool of targets to the mission schedulers; they will receive lower priority in target scheduling. Snap programs provide the opportunity for observations of a class of objects to be undertaken without the requiring that any specific object in the class be observed. It is unlikely that all targets in an accepted Snap program will be observed. Although there is no assurance that any specific target in a Snap program will be observed, NASA expects that data will be obtained for many targets in this category.

Following the evaluation of submitted proposals, some proposals submitted but not accepted by NASA under the

Standard category may be recommended for inclusion in the Snap category. It will be the proposer's option to accept or reject such reprogramming of a submitted Standard proposal.

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Observing Program Constraints – Standard and Snap proposals may only request observations using GALEX standard observing modes. These are described briefly in Section 3.3.1 and in more detail in the http://www.galex.caltech.edu/researcher/techdocs.html. Legacy proposals may use non-standard GALEX observing or data-processing modes, ***IF*** the GI proposal team includes one or more GALEX team experts to be responsible for the non-standard operations as part of the proposed investigation (this should be explained in the feasibility section of the proposal).

Program Execution and Carryover - NASA intends that all observations for non-ToO Standard and Legacy observing programs will be performed. If necessary, observations not executed during the current cycle will be carried over into the following cycle. GIs do not need to re-propose for these observations, and any such observations will be given priority in the next cycle. ToO programs will ***not*** be carried over into the next Cycle. ToO programs that are not activated and executed within the nominal one-year observing cycle must be re-proposed in order to be considered in the next observing year. Unobserved targets in Snap programs must also be re-proposed each Cycle.

1.2.2 Archival Investigations

Archival Proposals will be accepted for scientific investigations based on any data in the GALEX public archive at MAST (http://galex.stsci.edu). Search tools and lists of completed and planned non-AIS GALEX observations may be found at http://galexgi.gsfc.nasa.gov/MissionStatus/gistatus.csv . Although Archival proposals may be based on any data released in the GALEX data releases, they should not duplicate the science goals of type 1 PI science team investigations or already accepted GI programs.

1.2.3 Unscheduled Observing Time

Targets of Opportunity -- The GALEX mission is poorly suited for Targets of Opportunity (ToO). However, because of the potential scientific impact of ToO observations (for targets such as supernovae, novae, cataclysmic variables in outburst, comets, etc.), limited ToO observations will be supported in Cycle 6. Scientists wishing to observe such targets should prepare and submit proposals according to the same procedures used for a Standard program (i.e., as described in Section 2. Target of Opportunity status should be noted in the Special Requirements section of the proposal. ToO proposals will be reviewed in the regular review cycle, and successful proposals will be approved and will be allocated specific amounts of provisional observing time. (Review panels may recommend a maximum amount of observing time that should be allocated to a given ToO program.) Up to four ToO programs requiring a response time between one week and one month will be approved for Cycle 6. Observers with fast-response ToO programs might do better to propose to SWIFT.

The lack of a real-time observing capability constrains the speed with which a ToO observation can be implemented. The GALEX ToO response time is expected to be *no less than* 7 days during Cycle 6. ToO proposals must clearly state the required response time. The PI of an accepted ToO proposal will need to negotiate an agreement on what will constitute a “trigger” for the ToO with the CalTech GALEX Science Operations Center and the GALEX Mission Scientist. It will be the GI's responsibility to notify the GALEX Mission Scientist and the GALEX Science Operations Center at CalTech when any approved opportunity has occurred. The Mission

Scientist will consult with the GALEX PI and other members of the GALEX operations team to determine the feasibility of observing the particular event and the impact of disrupting ongoing observations, before deciding whether or not to activate the ToO program and approve the observation.

Discretionary Observing Time -- Discretionary Observing Time (DOT) is intended for observations of an urgent nature for which no approved observing program exists, and that are of sufficiently high scientific merit and priority that they should not be delayed to the next observing cycle. The total amount of DOT available during Cycle 6 is extremely limited. The GALEX Mission Scientist may approve DOT in those cases where the scientific timeliness of the project is such that it should be done quickly, *the need for the observation could not have been foreseen*, and the observation does not duplicate or infringe on PI or approved GI programs. A proposal for DOT may be submitted to the Mission Scientist in the form of a letter (printed or electronic) and should describe the scientific objectives, reason(s) for requiring GALEX, the proposed observations and their feasibility, and should explain why DOT should be granted in lieu of consideration during the next proposal cycle. All requests for DOT will be reviewed for scientific merit and technical feasibility.

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1.3 Mission Capabilities and Constraints During Cycle 6

This section summarizes GALEX capabilities that should be considered by all GALEX proposers. Complete information on the GALEX instrument and other topics is available from the GALEX Mission homepage http://www.galex.caltech.edu/researcher/techdocs.html.

Sensitivity Limits – There are *fundamental detector performance limitations* which preclude observations of individual bright targets, of target fields containing bright stars, and of bright or crowded fields (section 3.3.2). Proposers should pay particular attention to this issue in the "Feasibility" section of their proposal. Further information on brightness limits may be found in and at the GALEX Mission homepage, http://www.galex.caltech.edu/researcher/techdocs.html and a field brightness checker tool may be found at http://sherpa.caltech.edu/gips/tools.

Please note: Brightness limits preclude Magellanic cloud observations within 3.75 degrees of the LMC center, or 2.0 degrees of the SMC center. Proposals for such observations will not be reviewed.

Observing Modes - GALEX has two observing modes, broad-band imaging and grism spectroscopy. The exposure time alone defines the achievable signal-to-noise ratio for a given image or spectrum. Imaging observations are typically done either "normal" mode (observe one field for one orbital night), or in "petal pattern mode" (observe several mostly-overlapping fields centered on the proposed field center – in this mode full exposure depth will be obtained for a region 1 degree in diameter, used for fields with containing stars very near the brightness limits). Grism spectroscopy is done in multiple orbits, with a different grism orientation used for each orbital night. Observations are generally obtained in both FUV and NUV bands simultaneously. Further information on observing modes may be found in Section 3.3.1 and at http://galexgi.gsfc.nasa.gov/documents/MissionOverview.html.

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1.4 General Guidelines and Policies

1.4.1 Proposal Process

Proposals should provide a strong scientific justification and careful feasibility analysis, and an overview of planned observations and targets. Proposals that are awarded observing time based on the evaluation process described in Section 1.7 subsequently will undergo a more detailed technical safety review before final acceptance (Phase 2). Successful U.S. proposers and U.S. Co-Is of successful non-US proposers will be invited to submit a budget based on funding guidelines provided by NASA (section 1.8) when the proposal is accepted. Proposal submission steps are summarized in Section 2.4. The most up-to-date proposal submission checklist may be found at http://galexgi.gsfc.nasa.gov/propforms/ProposalChecklist.html; **PLEASE NOTE:** this list may be updated during the proposal period.

1.4.2 Who May Propose

Participation in the GALEX GI Program is open to individuals associated with all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, and other Government agencies. Each GALEX GI proposal must identify a single Principal Investigator (PI) who assumes full responsibility for the conduct of the scientific investigation. Proposal Co-Investigators must have well-defined roles in the investigation, which will be evaluated as part of the proposal review process. Following selection by NASA, the various participants in the GALEX GI program (GALEX GI Center at GSFC, the GALEX SOC at CIT, and the Multimission Archive at Space Telescope (MAST) at (http://galex.stsci.edu/) will communicate formally only with the PI (or her/his designee) of each proposal. It is this person's responsibility to provide the GALEX project with the necessary data that defines each observation in a timely manner and to respond promptly to any questions concerning observational constraints or configurations.

1.4.3 Late Proposals

Consistent with NASA policy, a late proposal may be considered only if it is judged to be in the best interests of the Government. However, a proposal submitted after the published deadline is unlikely to be considered of uniquely greater value to NASA than proposals submitted on time. A proposal is considered “on time” *only* if all necessary components, (Cover page, Target forms and Scientific Justification .pdf file) are submitted by the proposal deadline. Finally, please note that processing delays due to (but not limited only to) network failures, denial-of-service attacks, hard disk crashes, power outages, Internet delays, or hungry dogs, do not excuse late submission of a proposal.

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1.5 Data Rights and Distribution

GIs will be notified electronically when their data are available from the archive. Data rights for GALEX GI observations (Legacy, Standard and Snap programs) reside solely with each observing program's Principal Investigator for a period of *six months* following availability of the processed data at the GALEX data archive in MAST-GR5 After this period, the data become available for public access through MAST. Investigators, particularly for Legacy Proposals, are encouraged to consider waiving the proprietary period for their data.

Observations of calibration fields generally have no proprietary period and will be released through the GALEX archive as soon as the processed data products are available. The GALEX Project reserves the right to use any

GALEX observation to assist in assessing the performance of the instrument, but the confidentiality of data obtained for scientific programs will be maintained.

During QA checking, UV Variable objects are noted and shared with the community through an alerts page. If this occurs in a GI observation, the position of the variable object and its light curve is published but all other aspects of the data remain confidential for the 6 month proprietary time.

1.6 Targets for Observation

The Cycle 6 observing opportunity primarily seeks to identify new targets for observation with the GALEX satellite or to obtain significantly deeper exposures of already-observed targets. Search tools and lists of all targets observed or planned for observation (excluding AIS fields, including previous cycle GI targets) may be found at http://galexgi.gsfc.nasa.gov/MissionStatus/gistatus.csv. Each target's name and celestial coordinates (right ascension and declination, epoch J2000) will be considered when judging any potential target duplications.

Target Duplication – By design, the GALEX prime mission will obtain moderate exposures of a large fraction of the sky in the All-Sky Imaging Survey (AIS). Many GI projects may be well suited to archival investigations using the data collected for the primary mission. Any target duplication between Cycle 6 GI observing programs and those observed by the GALEX primary mission, or by previous cycle GIs, must be strongly justified in the proposal (e.g., expected variability, need for deeper exposures, etc.). Review panels will receive a summary of any perceived duplications between pending and existing observations and those proposed for Cycle 6. The panels will also receive a summary of target duplications between different Cycle 6 proposals. In general, a given pointing center will be allocated to only one observing program. Failure to provide accurate target data in the proposal may result in disallowing a target if a conflict with another program is discovered after proposal acceptance and the target conflict was missed as a result of the inaccurate target data.

Target List Modifications - After selection of Cycle 6 programs, small changes to a program's target list may be permitted only with the approval of the GALEX Mission Scientist. Any new target must be consistent with the program's scientific objectives and must not already be allocated to another program. Large-scale target list changes will not be accepted.

Calibration Targets - Astronomical targets are used for photometric and wavelength calibration. Most of the calibration objects (Appendix, In-Flight Calibration Guide) will be observed for calibration purposes. GI's are allowed to include calibration targets as scientific targets in their programs. The GALEX Project may continue to use these objects for calibration, even if the target is allocated to a GI program.

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1.7 Proposal Evaluation and Selection Process

Proposals submitted to NASA in response to this opportunity will be evaluated in a competitive peer review conducted by NASA Headquarters, using review panels organized by scientific research area. Upon completion of the review by the individual panels, a final cross-discipline panel review chaired by a NASA representative will synthesize the results of the individual panels. Legacy proposals will be reviewed with other GALEX proposals in the same scientific discipline as well as in other disciplines (e.g., stellar evolution, ISM, large scale structure, etc). Each scientific panel will have the option to forward a small number of Legacy proposals for final evaluation by the chairs of the GALEX peer panels; this panel of chairs will formulate the final recommendations to NASA for the

Cycle 6 observing program. Based on these results, the GALEX Program Scientist will then develop a recommendation for the total program to be submitted to the Selection Official. The final proposal selection will be made by the director of the Astrophysics Division of NASA's Science Mission Directorate. The following factors, listed in descending order of importance, will be used in evaluating proposals for their scientific merit and technical feasibility for the GALEX Guest Investigator Program:

1. The overall scientific merit of the proposed investigation;

2. The suitability and feasibility of using the GALEX observatory or GALEX data for the proposed investigation;

3. The likelihood of accomplishing the objectives of the investigation;

4. The degree to which the investigation uses the unique capabilities of GALEX;

5. The feasibility and scope of the data analysis plans;

6. The relevance to NASA's goals.

Legacy proposals will also be evaluated on:

7. Provisions to provide legacy data to the community in a timely fashion (possibly waiving the proprietary period) and/or plans to provide enhanced data products to the community.

Scientific review panels will be given an assessment of the technical feasibility of each proposal, determined by the GALEX science operations team. After acceptance of an observing program by NASA, successful proposers must work with the Caltech SOC to prepare detailed (Phase 2) evaluation & observing plans. Should there be any question regarding the safety or feasibility of individual observations, the GALEX PI, in consultation with the GALEX Mission Scientist, will make the final decision as to whether or not to attempt or postpone a particular observation, based on the latest information available regarding the satellite's on-orbit performance. NASA reserves the right to select only a portion of a proposed investigation, in which case the investigator will be given the opportunity to accept or decline such partial selection.

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1.8 Funding for U.S. Investigators

Limited funds for awards under this NRA are expected to be available to investigators at U.S. institutions, subject to the annual NASA budget cycle. Approximately $2M is expected to be available, and is expected to support approximately 25 investigations. Successful proposers at U.S. institutions (including U.S. Co-Investigators on successful non-U.S. proposals), will be eligible for funding. Funding will be available for both new observations and for archival investigations. Budgets should *not* be submitted with research proposals in response to this NRA. Selected investigators will receive a funding guideline from NASA based on the scope of the approved observing program and the available budget for the GALEX GI program. The primary guideline for funding new observations will be a program's total time allocation. Secondary factors include proposal ranking, scope of data analysis plans, the number of targets/observations, and expected difficulty of data analysis. The primary guideline for funding archival proposals will be scope and feasibility of data analysis. A budget summary and narrative description of how these funds will be used must be submitted *after* receipt of the guideline.Budgets will be

submitted through the NSPIRES proposal system at NASA Headquarters and will require institutional approval. US co-investigators on proposals by non-US GIs may receive funding; the GI will need to appoint a US "administrative PI" who will submit the budget through NSPIRES and be responsible for managing funding to US investigators.

1.9 Education and Public Outreach

The policy of NASA's Science Mission Directorate (SMD) continues to encourage the participation by the space science community in education and public outreach activities, with the goal of enhancing the Nation's formal education system and contributing to the broad public understanding of science, mathematics, and technology. A significant national program in space science education and outreach is now underway, and SMD's demonstrated contributions to education and outreach have now become an important part of the broader justification for the public support of space science (for further details see the SMD's "Education and Public Outreach" page (http://science.hq.nasa.gov/research/epo.htm). Guest Investigators selected for GALEX Cycle 6 will have an opportunity to submit a supplemental E/PO element to their research proposal in conjunction with the budget phase of the proposal process. E/PO proposals will be due 60 days after the date of the selection letter for the Cycle 6 science proposal. Information about and instructions for preparing and submitting E/PO proposals is available in Section (b) of the ROSES-2009 NRA Summary of Solicitation.

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2. General Information on NASA Proposals

2.1 Proposal Preparation

General information on the preparation and submission of research proposals to NASA may be found in the 2009 NASA HQ NRA Proposers Guidebook

http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2009.pdf OR

http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2009.doc

If you have questions about the general nature of NASA NRAs, or questions or problems with submitting NOIs or Phase 2 Budget proposals, please consult the NASA HQ Proposal Submission FAQ page, or send technical support questions to proposals@hq.nasa.gov.

Questions about the GALEX Guest Investigator Program, or about the GALEX Cycle 6 GI proposal submission process should be directed to the GALEX GI help desk (send email to galexhelp@galexgi.gsfc.nasa.gov).

2.2 Notice of Intent

NOI-s are not required.

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2.3 Proposal Submission

GALEX Cycle 6 proposal submission is all-electronic, and uses the Remote Proposal Submission (ARK/RPS) system of the HEASARC. Proposers will need to establish an account with the Astrophysics Research Knowledgebase (ARK/RPS) to submit proposals. Already established ARK/RPS accounts/passwords from previous submissions are still active. A proposal submission checklist can be found at http://galexgi.gsfc.nasa.gov/propforms/ProposalChecklist.html, with links to more detailed instructions. A complete proposal submission consists of the following steps:

1. **Fill out** the ARK/RPS cover sheet information and target form(s).

2. **Verify** the ARK/RPS form, using the "Verify" button.

3. **Submit** the ARK/RPS form (the "Submit" button will not appear until the form has passed verification. (An acknowledgment of receipt will be sent to the proposal submitter by return e-mail if requested in your ARK/RPS account setup.)

4. **Upload** the .pdf file of your Scientific Justification.

You may re-submit and re-upload as often as needed. All steps must be completed by

16:30 pm EDT on 19 June, 2009

in order to be included in the proposal review for this cycle of the GALEX Guest Investigator program.

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2.4 Cover Pages and Target Information.

Cover pages and Target information are submitted directly into ARK/RPS (Remote Proposal System) of the HEASARC, see **Section 2.3**).

Cover page information includes Title, PI information, Co-I's and affiliations, and basic information about the proposal (type, science area, time requested etc.)

In all cases, including Archival Proposals, a target list must be submitted. More information on target submission can be found in the help file for the GALEX RPS forms.

2.5 Science Justification - Format and Content

Proposals must be written concisely, in English. The length of each section of the proposal should not exceed the page limits indicated below. Proposals must be printed with a font size no smaller than 11 points (about 6 characters per cm) throughout (References and figure captions may be 10pt). Margins should be 1 inch (2.54cm). Proposals should be single spaced on 8.5x11 or A4 paper. Reviewers will be instructed to base their review only on the portion of each proposal that complies with the page limits given below in this NRA; excess pages will be rejected before being sent to the reviewers. Illustrations contained in the printed proposal may be in black and white or color. Proposals will be sent to reviewers as .pdf files, and may be printed out on the reviewer's printer, so

proposers would be prudent to verify that any color entries are also legible in black and white.

A GALEX proposal Science Justification requires the following sections, which should be included in the order indicated. Page limits for each section are indicated below. **Total page limits are: 8 pages for Standard or Snap observing proposals, 10 pages for Legacy proposals, and 6 pages for Archival proposals** (including figures, tables and references).

1. Scientific Justification (not to exceed 3 pages for Standard, Survey or Archival proposals, or 5 pages for Legacy proposals): Fully describe the scientific objectives of the proposed investigation, clearly stating its goals, its significance to astronomy, why GALEX data are essential to the investigation, and the relevance to NASA goals. The page limit includes all text, figures, tables, and references for this Section. The proposed scientific investigation should not duplicate GALEX primary science investigations or accepted GI programs (http://galexgi.gsfc.nasa.gov/science); any cases where overlap might be perceived should be clearly justified. GI investigations may be proposed for targets or fields observed by the GALEX science team or by other GI programs, as long as the science goals of the investigation are clearly different.

2. Description of Observations (no more than 1 page, not required for archival proposals): Describe the desired observations. All observing constraints (e.g., Time-Critical (coordinated observations, phase coverage, contiguous orbits, specific cadence, etc.), Target of Opportunity, Low Zodiacal Light, Moving Target), and/or Special Requirements (non-standard data products, FUV-only observations, brightness waivers, specified grism orientation, etc.) must be explained and justified. Triggering events for Targets of Opportunity should be defined clearly. Actual ephemeris data for Solar System targets are not required for this phase of the proposal process, but a discussion of when and where should be provided (Proposers wishing to observe moving targets should be aware that they will need to request receive time-tagged photon data and will need to reconstruct these into images themselves). Requests for special co-adds should be explained here.

3. Feasibility and Safety (not to exceed 1 page, not required for archival proposals): The proposal should justify the requested exposure time for each target, noting the required signal-to-noise ratio (S/N) and spectral resolution, expected flux, and any other information relevant to the observation (e.g., wavelength, region of interest, spectral flux distribution, emission line intensities). This section forms the basis for technical assessment of the feasibility of the proposed observations. Proposers are advised to verify that their targets can be safely observed and to explain any questionable cases in the Feasibility discussion. Proposers requesting time-critical observations are advised to verify that their targets are visible to the GALEX spacecraft at the desired times. Safety concerns, target visibility through the year, zodiacal light background, etc. may be checked using several tools available at http://sherpa.caltech.edu/gips/tools/; an exposure simulation available at the same site.

4. Additional Information (up to 2 pages for Archival proposals, up to 1 page for others): *A data analysis plan is required for Archival proposals or for mixed new/archival proposals and should be included here.* This Section should provide any relevant information concerning data analysis plans, modeling capabilities, corollary data from other telescopes, etc.

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2.6 Templates, Examples, and Instructions

GALEX proposal Scientific Justifications must be submitted as .pdf files, which are uploaded by ARK (after cover sheet and target information are entered). A LaTeX proposal form and style file, a Word proposal form, more

detailed instructions for preparing the proposal, a sample filled-in latex form, and sample proposals may be found at http://galexgi.gsfc.nasa.gov/Cycle6/ . If a proposer does not wish to use the templates provided, s/he may use a text-editor of choice to provide a similarly formatted proposal (*i.e.* page limits, font sizes, required sections and summary information must be provided as shown in the sample proposals).

Submission procedures are described in Section 2.3.

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3 The GALEX Mission

3.1 Mission Overview

GALEX is a NASA Small Explorer (SMEX), developed in collaboration by Caltech in Pasadena , California , the Laboratoire d'Astrophysique Spatiale (LAS) in Marseilles , France , the University of California at Berkeley , the Johns Hopkins University in Baltimore Maryland , and the Yonsei University, South Korea. The GALEX Principal Investigator, Dr. Christopher Martin of Caltech, is responsible to NASA for the mission design, development, and operations. The GALEX Science Operations Center is located on the Caltech campus in Pasadena, California. The GALEX mission homepage is at http://www.galex.caltech.edu/.

The GALEX PI is responsible for achieving the scientific objectives of the primary mission. GALEX's primary objectives are to map the global history and probe the causes of star formation over the redshift range $0 < z < 2$. This time span traces 80% of the life of the universe, the period over which galaxies have evolved dramatically, and the time that most stars, elements, and galaxy disks had their origins. GALEX uses the space ultraviolet ($l < 3000$ Å) to simultaneously measure redshift (using emission lines and the Lyman Break), extinction (using the UV spectral slope), and star formation rate (using the UV luminosity, which is proportional to the instantaneous star formation rate). Other scientific objectives supporting this overarching goal are: 1) Determining the UV properties of local galaxies and how their rest-UV properties, measured at high redshift by other missions, relate to star formation rate, extinction, metallicity, and burst history; 2) Measuring the star formation and metal production history of galaxies over the redshift range $0 < z < 2$; 3) Determining the time and location of the origins of the stars and elements we see today, and connecting this to the evolution between $0 < z < 2$; and 4) Identifying the global (galaxy-wide) factors that drive star formation and evolution in galaxies. Goals of the GALEX extended mission expand on the primary mission goals.

The GALEX prime mission addresses these objectives by performing complementary imaging and spectroscopic surveys, with approximately 2000 orbits devoted to each survey in the baseline version. Details of the GALEX primary mission science plan, and how itl uses these surveys, can be found at http://galexgi/gsfc/nasa/gov/Documents. Approximately70% of the primary mission survey data will be available for GI archival proposals in Cycle 6.

Imaging surveys: These use two bands (FUV (1350-1800 Å) and NUV (1800-2800 Å)) to image the sky with ~5 arcsec\ resolution, a 1.2 degree field-of-view, and <1 arcsec astrometric accuracy. These surveys will detect millions of galaxies in the local universe and many thousands in the more distant universe over the redshift range $0.5 < z < 2$. More detailed information may be found in Table 1, or at http://www.galex.caltech.edu/researcher/data.html

- **AIS -** All-sky Imaging Survey: ~80% of the sky, 26,000 deg^2, largely avoids Galactic plane, typical exposure time

100 sec. (photon-limited)

- **MIS** – Medium-Deep Imaging Survey: SDSS and 2df overlap, 1500 deg^2, typical exposure 1500sec. (background limited, barely)
- **DIS** - Deep Imaging Survey: Overlaps other deep surveys (List of DIS fields is here), total of 80 deg^2, typical exposure 30 ksec
- **UDIS** - Ultra Deep Imaging Survey: 4 degrees 2, includes e.g., CDFS, Groth, NOAO Deep-Wide, others
- **NGS** - Nearby Galaxy Survey. 300 nearby galaxies, with exposures of 1 or 2 orbits per galaxy (1500-3000sec) and mosaics of the nearest galaxies (LMC (outskirts), SMC (outskirts), M31).
- **MSS** - Medium-deep Spectroscopic Survey: uses a slitless grism with spectral resolution of R=150-300. Centers of DIS fields Chandra DFS, NOAO Deep-Wide Fields

The GALEX extended mission, is conducting several Legacy Surveys, which will be delivered to the scientific community as quickly as possible. These include:

- **GCS** - Galactic Cap Survey: Increase survey area at MIS depths (1500sec) by more than an order of magnitude in area over the SDSS Northern and Southern galactic caps. These fields continue to be named MIS-field name.
- **MWS** - Milky Way Survey: Obtain MIS-depth imaging (1500sec) over as much of the SEGUE survey area and Galactic Plane as possible. These fields continue to be named MIS-field name.
- **DGS** - Deep Galaxy Survey: Deep (10 orbit) images of 100 nearby galaxies in a volume-limited sample to provide an unbiased census of extended star formation and halo gas and dust; grism observations of a subset of 25 of the most extended galaxies. (List of DGS fields todate here.)
- **LDS** - Legacy Deep Survey: Deep images (~30 ksec) over 100 deg^2 of the SDSS and Pan-STARRS-1 surveys. (List of LDS fields here)
- **UDS** - Ultra-Deep Imaging Survey: Covers 7 deg^2 at 250 Ksec.

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Approximately 2/3 of the observing time during Cycle 6 will be used by the PI Team for survey observations

The wide field-of-view and spectral bandpasses provided by GALEX permits the study of many important astrophysical subjects besides galaxy evolution. These include, but are not limited to: stellar winds and outflows, post-main-sequence stellar evolution, binary/multiple star evolution, globular cluster structure and evolution, massive stars, supernova remnants, reflection nebulae, interstellar dust, structure of the ISM / IGM, the UV background, nearby galaxy populations, galaxy clusters, intergalactic material, QSO evolution, and large scale structure.

3.2 Instrument Overview

GALEX is a 50cm UV-optimized telescope that obtains images simultaneously in two bands: 1350-1800Å (far-UV, FUV) and 1800-2800Å (near-UV, NUV). The circular field of view is 1.2 degrees in diameter and the angular resolution is ~4.5 arcsec. GALEX can also obtain slitless spectroscopy (same field of view and spatial resolution) with spectral resolution of R=200-350 (FUV) and 80-150 (NUV). The telescope has one primary 50 cm mirror, which feeds light through either an imaging window or an imaging grism, to a dichroic beamsplitter, and into two sealed-tube microchannel-plate photon-counting detectors. The effective area is ~35 cm^2 for the FUV channel and ~65 cm^2 for the NUV channel. The high throughput results from an optical design utilizing a high-efficiency beam splitter, a high–efficiency CaF_2 grism, and multilayer reflective coatings optimized for wavelength coverage in the GALEX range. Further details on the GALEX instrument can be found at http://www.galex.caltech.edu/researcher/techdocs.html, Instrument Status paper , the GALEX Mission and Instrument Summary, the GALEX

Observer's Guide, and the GALEX Detector Handbook at http://www.galex.caltech.edu/researcher/techdocs.html and in the GALEX Calibration Papers at http://galexgi.gsfc.nasa.gov/docs/galex/instrument.html.

3.3 Satellite Operations and Observation Planning

GALEX is in a nearly circular orbit with a mean altitude of 690 km, an orbital inclination of 29º, and an orbital period of 98 minutes with ~2100 sec orbital nights. The plane of the orbit precesses with a period of 60 days. Typically, GALEX is in contact with the ground station for 8-12 minutes per orbit for 10 consecutive orbits, followed by five orbits with no contact. All GALEX scientific observations are conducted autonomously by the onboard instrument data system, from week-long observing plans. Science observations are made only during orbital nights, with a typical time of ~1500 sec/orbit available for science observations. Observations are scheduled in units of 1.5ksec.

3.3.1 Observation modes

All science data collection uses a spiral dither, to prevent bright-star-induced fatigue of localized regions on the detectors and to improve image flat-fielding. In "normal" (or "stare/dither") mode, only one field center is observed for the entire eclipse. In "petal pattern mode", several (typically 10-12) largely-overlapping field centers are observed during one orbital night, such that full-depth exposure is obtained for a field approximately 1 degree in diameter – this is done for fields containing stars near the brightness limits and is done to avoid damaging the detectors.

Grism observations are always done at a single grism orientation for each orbit; multiple observations are during multiple orbits made at different grism orientations. Grism images require a "pre-image" (may be an existing GALEX image if the field centers are within 15 arcmin); the pre-image is used as a "finding chart" for spectral extractions, and requires an exposure time *at least* 5% that of the proposed grism observations for proper spectral extraction. All pre-images require a full orbit, i.e., AIS fields may not be used as pre-images. All GALEX science data is sent down as time-tagged photon lists, allowing ex-post-facto aspect determination and image reconstruction.

Proposers may request time-tagged photon data, but should be aware that there is currently no data analysis or pipeline support for data reduction.

GI observations may use *only* these standard GALEX observing modes except for Legacy proposals with PI team membership. We hope in future cycles to offer a "short pre-image + long grism in a single orbit" option but this is not available in Cycle 6.

3.3.2 Brightness Limits

There are detector brightness limits that, because of the wide field of view, significantly affect flexibility of mission planning when choosing targets. *Fundamental detector safety requirements* limit observations of bright targets. Currently, point sources, with flat spectra, may not be observed (imaging or grism) that are brighter than:

BRIGHTNESS LIMITS					
FUV	**5,000cps**	**or**	**mAB = 9.5**	**or**	**Flux = 7 x 10-12 erg cm-2 s-1 Å-1**

NUV	**30,000cps**	**or**	**mAB = 8.9**	**or**	**Flux = 6 x 10-12 erg cm-2 s-1 Å-1**
Bright and / or crowded fields may not be observed if they exceed total brightness levels of:					
FUV	**15,000cps**	**or**		**or**	**Flux = 2.0 x 10-11 erg cm-2 s-1 Å-1**
NUV	**50,000cps**	**or**		**or**	**Flux = 1.6 x 10-11 erg cm-2 s-1 Å-1**

Pointing centers must be separated from bright stars by:

POINTING CENTERS					
0.75°	**for an object with**	**Flux _NUV = 1 x 10-12,**	**or**	**mAB = 10.8**	**(5,000 cps)**
0.88°	**for an object with**	**Flux _NUV = 1 x 10-11,**	**or**	**mAB = 8.3**	**(50,000 cps)**
1.00°	**for an object with**	**Flux _NUV = 4 x 10-11,**	**or**	**mAB = 6.8**	**(200,000 cps)**
1.50°	**for an object with**	**Flux _NUV = 1 x 10-10,**	**or**	**mAB = 5.8**	**(500,000 cps)**
2.00°	**for an object with**	**Flux _NUV = 2 x 10-10,**	**or**	**mAB = 5.0**	**(1,000,000 cps)**
(Fluxes and magnitudes in NUV band (~ 2300 Å),				**Flux in ergs cm-2 s-1 Å-1)**	

A quick check with the Brightness Checker Tool at **http://sherpa.caltech.edu/gips/tools/** will check for all of these, and will give more detailed information on fields that fail. Proposers are strongly encouraged to check fields of interest before proposals; fields that fail the brightness checker will be rejected.

Proposers should be aware that for observations near / at the brightness limits, the detectors will have a non-linear photometric response. This **"dead time"** is monitored by the instrument electronics and is corrected in the data pipeline; however it is not corrected in the exposure time simulator and proposers should be aware of this in planning observations of bright sources.

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3.4 Data Processing, Calibration, and Distribution

3.4.1 Pipeline Processing

Data pipeline processing is done at the GALEX SOC, including image construction from time-tagged photon lists, flat-fielding, background subtraction, photometric calibration, image rectifying, astrometric solution, and transformation into North-up FITS images. Multiple visits to the same target are stacked. In the case of imaging observations (both single visit and stacked images), the pipeline detects objects in the field, extracts object properties, and collects the objects and their properties into catalogues. In the case of grism observations, for each object in the field, a subimage of the spectrum is cut out, the subimages are rotated and stacked, and individual source spectra are extracted, wavelength calibrated, corrected for spectral response, and collected into catalogues The astrometric accuracy of the resulting images is ~0.6 arcsec RMS (slightly worse at the edge of the field). The current photometric accuracy is routinely 3% / 5% (NUV / FUV), although there are systematics of similar order. The wavelength accuracy of the spectral ranges is 1-2 Å relative, 2-4 Å absolute. More details may be found in the http://www.journals.uchicago.edu/ApJ/journal/contents/ApJL/v619n1.html and other documents at http://galexgi.gsfc.nasa.gov/Documents).

The GALEX pipeline produces a series of image and spectroscopic products in addition to the images and spectra.

These are delivered, with the images and spectra, in GALEX Data Releases (GRs). The fifth public data release (http://galex.stsci.edu/GR4/) occurred in December 2008 to April 2009; it contains approximately 96% of the data for the GALEX primary mission surveys. All data in the GALEX archive may be used in GALEX Cycle 6 archival proposals.

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3.4.2 Data Distribution

The GALEX data is permanently archived at the Multimission Archive at Space Telescope (MAST) (http://galex.stsci.edu/). Guest Investigators access their data through MAST, and MAST provides selective access to proprietary data. Access procedures for public and proprietary data are similar to those for Hubble Space Telescope data. Only the PI of each GI program (and their designees) can access that program's data during the proprietary period. GALEX data distribution is by electronic file transfer from MAST. Observations of calibration targets generally have no proprietary period. See Section 1.5 for additional information about GALEX data rights.

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4.0 Important Dates

GALEX Cycle 6 Guest Investigator Proposals	**NRA Release – 13 February, 2009**
Proposal Deadline	**4:30pm, EDT, 19 June 2009**
Cycle 6 Observations	**1 January 2010 through 31 December 2010**

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5.0 Contact Information

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