



**National Aeronautics
and Space Administration**

**February 16, 2001
NRA 01-OSS-02**

RESEARCH ANNOUNCEMENT

**FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER
(FUSE)**

GUEST INVESTIGATOR PROGRAM

CYCLE 3

**Notice of Intent Due:
Proposals Due:**

**MARCH 30, 2001
MAY 11, 2001**

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER
(FUSE)

GUEST INVESTIGATOR PROGRAM

Cycle 3

NASA Research Announcement
Soliciting Proposals for Basic Research

NRA 01-OSS-02

Release Date: February 16, 2001

Notices of Intent Due Date: March 30, 2001

Proposal Due Date: May 11, 2001

Office of Space Science
National Aeronautics and Space Administration
Washington, DC 20546-0001

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER (FUSE)

GUEST INVESTIGATOR PROGRAM - Cycle 3

SUMMARY OF SOLICITATION

This NASA Research Announcement (NRA) solicits basic research proposals for participation in the National Aeronautics and Space Administration (NASA) program for space science observations and subsequent analysis of the resultant data from the Far Ultraviolet Spectroscopic Explorer (FUSE) that was launched on June 24, 1999. The primary goal of the FUSE mission is the investigation of the nature and physics of interstellar and intergalactic gas through the use of high-resolution spectroscopy of the far ultraviolet (905-1187 Å) radiation of distant sources.

FUSE is a Principal Investigator (PI)-class NASA mission. The FUSE PI, Dr. Warren Moos of Johns Hopkins University (JHU), is responsible to NASA for mission design, development, and operations. The FUSE PI is also responsible for achieving the mission's primary scientific objectives and has been granted a significant fraction of the observing time for this purpose. The FUSE mission was developed in cooperation with Canada and France, whose resident personnel will share in the observing time as indicated in Appendix C, Section C.1.3.

Although FUSE is a PI-Class mission, the majority of the FUSE observing time is available to the general astronomical community. The FUSE Guest Investigator (GI) Program solicited through this NRA is intended to enhance the scientific return from the mission by drawing on the astronomical community to use FUSE to conduct independent investigations. This NRA is the third announcement for the FUSE GI Program and solicits proposals only for Cycle 3, the last year of the prime mission, which is planned for the 12-month period beginning in December 2001. Approximately 5700 kiloseconds of on-target exposure time, or about 75% of the available Cycle 3 science observing time, will be allocated to GI Programs selected through this NRA.

Participation in the FUSE GI Program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit organizations, NASA Centers, and other Government agencies. Proposals may be submitted at any time before the proposal due date. Scientists planning to propose should submit a Notice of Intent (NOI) to propose in order to facilitate the timely selection of proposal review panels. Proposals received in response to this NRA will be evaluated in a competitive scientific peer review conducted by NASA Headquarters, with a goal of announcing the selection approximately three months after the proposal due date. Proposals will be reviewed by panels organized by research area and/or topic. A schedule specifying Cycle 3 proposal deadlines is provided at the end of this Summary of Solicitation.

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. The Government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made and the receipt of proposals that the Government determines are acceptable for award under this NRA. It is anticipated that approximately \$4.5M will be available to support about 80 U.S. investigations in Cycle 3. In most cases, investigations selected for award under this NRA will be funded through the use of grants. Budgets should not be submitted with observing proposals. Only after a proposal has been awarded observing time, based on scientific peer review, will a budget and institutional signature be required (see Appendix C for detailed instructions). Funds are not currently available for awards under this NRA. The Government's obligation to

make award(s) is contingent upon the availability of appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this NRA.

Proposers whose investigations are awarded observing time will have sole use of their data for six months after the processed data are placed in the FUSE data archive. After this time the data will be available from an archive that is open to the public.

Education and the enhancement of public understanding of space science are vital and integral parts of all NASA space science missions and research programs. Therefore, NASA OSS encourages any successful U.S. proposer awarded observing time under this NRA to submit an optional Education/Public Outreach (E/PO) component with their research program. NASA expects to allocate approximately 1-2% of the FUSE GI data analysis budget for E/PO activities. Note that originality is not a criterion of such E/PO tasks; rather the important factor is that a tenable task of merit be proposed. Also, E/PO proposals are to be submitted **only** in conjunction with the budget phase of the proposal process. The guidelines and procedures for submitting E/PO proposals are currently under revision and will be posted as an amendment to this NRA by the due date for the research proposals given below. In addition, direct notification of this amendment will be sent to all persons submitting a research proposal.

Further details relevant to the FUSE GI Program are included in the Appendices as follows: Appendix A gives an overview of the mission and describes the observing opportunity. Appendix B gives the general instructions for responding to NASA Research Announcements. Appendix C, which supersedes and augments Appendix B, provides, NRA-specific information on proposal preparation, submission, evaluation, and selection. Finally, lists of the astronomical targets reserved for the FUSE PI Team in Cycle 3, FUSE calibration targets, and objects already observed or planned for observation prior to the start of Cycle 3 may be obtained from the FUSE GI Program Web site at URL <http://fusewww.gsfc.nasa.gov/fuse/>.

Technical and reference documents are available interactively from the FUSE Science Center at JHU over the World Wide Web, for download via the Web or anonymous ftp, and in hard copy by request at the address given below. Of particular value is *The FUSE Observer's Guide*, which contains an overview of the mission capabilities, a detailed instrument description, and information about proposing for FUSE observing time (e.g., instructions for assessing feasibility, instrument summary, constraint summaries, and the calculation of exposure times).

The following Summary Information applies to this NRA:

IDENTIFIER: NRA 01-OSS-02

SUBMIT NOTICE OF INTENT TO PROPOSE ELECTRONICALLY AT: <http://props.oss.hq.nasa.gov/>

NOTICE OF INTENT DUE DATE: March 30, 2001

PROPOSAL SUBMISSION REQUIREMENTS (SEE APPENDIX C) Submit *Cover Page/Proposal Summary* electronically and print out hard copy at <http://props.oss.hq.nasa.gov/> (help desk E-mail: dtripp@hq.nasa.gov);
plus
Send 12 printed copies, including printed *Cover Page/Proposal Summary* to address below;
plus
Electronically submit FUSE proposal form to fuseprop@fusewww.gsfc.nasa.gov

SUBMIT PRINTED PROPOSALS TO: FUSE Guest Investigator Program
NASA Peer Review Services
500 E St., SW - Suite 200
Washington, DC 20024-2760
USA
Telephone for commercial delivery:
202-479-9030

PROPOSAL DUE DATE: May 11, 2001

EDUCATION/PUBLIC OUTREACH PROPOSALS: See amendment to NRA to be posted by July 2001.

SELECTING OFFICIAL: Director or Deputy Director
Research Program Management Division
Office of Space Science

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RETRIEVE NRA ELECTRONICALLY:

Select "Research Opportunities" at
<http://spacescience.nasa.gov/>

FUSE GI PROGRAM WEB SITE:

<http://fusewww.gsfc.nasa.gov/fuse/>

FUSE TECHNICAL INFORMATION
WEB SITE:

<http://fuse.pha.jhu.edu/>

FUSE OBSERVER'S GUIDE WEB SITE:

<http://fuse.pha.jhu.edu/support/guide/obsguide.html>

NASA appreciates your interest and cooperation in participating in this Cycle 3 of the Far Ultraviolet Spectroscopic Explorer Guest Investigator Program.

Anne L. Kinney
Science Program Director
Astronomical Search for Origins
and Planetary Systems

APPENDICES

- A. FUSE Guest Investigator Program and Mission Description – Cycle 3
- B. Instructions for Responding to NASA Research Announcements for Solicited Basic Research Proposals
- C. Proposal Preparation, Submission, Evaluation, Selection, and Implementation

FAR ULTRAVIOLET SPECTROSCOPIC EXPLORER (FUSE) GUEST INVESTIGATOR PROGRAM AND MISSION DESCRIPTION – Cycle 3

A.1 Guest Investigator (GI) Program Description

A.1.1 Overview

The Far Ultraviolet Spectroscopic Explorer (FUSE) provides high-resolution ($R \sim 20,000$) spectroscopy at far ultraviolet (FUV) wavelengths (905-1187 Å) with sufficient sensitivity to study a wide variety of objects, including many extragalactic lines of sight. FUSE was launched on June 24, 1999. Normal science operations for the three-year prime mission began on December 1, 1999. A two-year extended mission phase is planned. A brief description of the FUSE mission is provided in Section A.2

Under this NRA, NASA seeks a scientifically meritorious FUSE GI program for Cycle 3, the last year of the prime mission. GI observing programs should exploit the unique capabilities of FUSE but the content and scope of GI programs must be consistent with the mission capabilities and the observing program policies and guidelines discussed below. Cycle 3 science observations will take place during a 12-month period beginning in December 2001.

Proposals submitted in response to this NRA constitute the first phase of the FUSE GI proposal process. Information required during this proposal phase includes the scientific justification, observation descriptions, astronomical target data, exposure times, and any special operational requirements (e.g., orientation constraints, timing considerations, etc.). After selection by NASA, successful GI's must submit detailed observing plans to the FUSE Science Center at the John Hopkins University (JHU) so that detailed planning, feasibility assessment, and observation scheduling can be performed.

FUSE observing time is made available to the international astronomical community through peer-reviewed proposals. NASA has allocated approximately half of the mission's observing time over three years to the GI program. The other half of the observing time was allocated, primarily in Cycle 1 and 2, to the FUSE PI Team to address certain high-priority scientific problems described in Section A.2.1. About 75% of the total FUSE science observing time in Cycle 3 will be allocated to GI programs (Section A.1.2).

Section A.1.3 describes some important capabilities and constraints that affect how GI programs will be evaluated and implemented in Cycle 3.

Special attention is directed to the fact that there are two types of unscheduled observing time that can be made available with the approval of the FUSE Project Scientist. The first deals with major Targets of Opportunity (ToO), such as supernovae, novae, and comets (see Section A.1.5). The second type, called Project Scientist's Discretionary Observing Time, is intended for observations of an urgent nature requiring a small amount of observing time and are of sufficiently high scientific priority that the observation should not be delayed to the next observing cycle (see Section A.1.6).

The policies concerning FUSE targets are summarized in Section A.1.8. FUSE PI Team science program abstracts and their targets reserved for Cycle 3 are available from the FUSE GI program Web site. With specific exceptions (see Sections A.1.8), there are no science investigations reserved for the PI team but there are reserved targets. The scientific goals of GI proposals may overlap with those of the FUSE PI Team as long as different targets are observed.

A.1.2 Observing Time Allocation

FUSE observing time in Cycle 3 will be allocated in on-target exposure time in units of kiloseconds (ksec). Proposals should request only the time needed for scientific exposures. After accounting for instrument calibration, target acquisition, satellite maneuvering, and operational overhead, NASA anticipates that ~5700 ksec of on-target exposure time will be allocated to GI programs in Cycle 3. In Cycles 1 and 2 the average GI observing program size was 50 ksec. About 26% of the Cycle 2 GI time was allocated to programs with more than 80 ksec.

- **Large Observing Programs** – These are an essential part of the FUSE science program, and they can provide the observing resources to address significant and/or difficult observing programs. NASA expects to allocate up to 1500 ksec across the whole FUSE GI program in Cycle 3 specifically for programs needing more than 150 ksec. Such proposals should be written according to the same guidelines and instructions as other FUSE proposals and will be reviewed with other proposals in the same research category. Recommendations for how the time for large observing programs should be allocated will then be determined when the review panel chairs meet following the reviews by the individual panels.
- **Small Observing Programs** – Due to the difficulties associated with administering many very small programs, **each Cycle 3 FUSE GI proposal must request a minimum of 10 ksec of on-target exposure time.** If the proposal has only one target, the exposure time on that object must be at least 10 ksec. A proposal having multiple targets can have exposure times of less than 10 ksec per target as long as the total exposure time for the proposal is at least 10 ksec.
- **Short Exposures** – An observing program's time allocation will be charged 4 ksec for each short exposure. If a target has an exposure time less than 4 ksec, the program will be charged 4 ksec for that observation to account for the extra overhead associated with short-duration

observations. The FUSE mission planning system was designed to support a pool of observations that requires on average of no more than three pointing maneuvers per day. Short exposures should not be arbitrarily extended to 4 ksec if the required signal-to-noise ratio (S/N) is expected to be reached in a shorter time.

- **Observing Program Duration** – Proposers may only request observations to be executed during the nominal 12-month period of Cycle 3 (i.e., multicycle proposals will not be accepted). If proposers want to continue their scientific programs over multiple cycles, they must repropose their investigations in subsequent GI cycles.

NASA intends that all approved regular (i.e., non-ToO) observing programs will be executed. If necessary, regular observing programs will be carried over into Cycle 4 if they are not executed during Cycle 3. GI's do not need to repropose for these observations, and any such programs will be given priority for execution in Cycle 4. However, ToO programs will **not** be carried over into the next Cycle. GI's must repropose any ToO programs that are not activated and executed within the nominal one-year observing cycle.

A.1.3 Mission Capabilities and Constraints During Cycle 3

Several important factors bearing on the design of Cycle 3 observing programs are summarized in this section. Complete details are available from the FUSE Observer's Guide, available online at <http://fuse.pha.jhu.edu/support/guide/obsguide.html>.

- **Satellite Orientation** – Observations are normally scheduled in the range $30^\circ < \beta < 85^\circ$ in order to maintain coalignment of the four spectroscopic channels, where β is defined as the angle between the anti-Sun direction and the telescope boresight. (The solar orientation of the satellite is restricted to β angles between 15° and 105° .) Observations may be scheduled outside the normal β angle range only with strong scientific or technical justification. For example, observations in the Large Magellanic Cloud, always at $\beta = 90^\circ$, are usually scheduled only at certain times when they are in the satellite's continuous viewing zone.
- **Channel Coalignment** – The relative alignment of the four optical channels is sensitive to changes in the satellite's thermal environment in orbit. In particular, significant changes in the orientation of FUSE with respect to the Sun can cause the channel alignments to drift relative to one another. This is particularly a concern for the SiC channels, as they are located on the side of the satellite that faces the Sun. Channel coalignment is maintained operationally by managing changes in β angle and other procedures.

Spectrograph Apertures – The default spectrograph aperture is the LWRS (see Table A-1), which should be suitable for the vast majority of observing programs. Proposals must provide specific scientific justification for the use of the MDRS and HIRS apertures.

Legitimate reasons to use these apertures include: (a) to reduce spectral contamination from terrestrial airglow, (b) to reduce spectral contamination from diffuse nebular emission near the target, (c) to eliminate spectral contamination from FUV-bright objects close to the target (e.g., crowded fields), and (d) to achieve higher spectral resolution when observing diffuse targets.

The acquisition of SiC (short wavelength) data may be more difficult than the acquisition of LiF data when using the MDRS aperture, so proposers should discuss the relative priority of the SiC and LiF data when the MDRS aperture is requested.

Use of the HIRS aperture is restricted to the LiF1 channel during Cycle 3, and the scientific justification for using this aperture must be clearly discussed in the proposal.

Table A-1. FUSE Aperture Sizes, Throughput and Spectral Resolution

Aperture	Acronym	Dimensions (arcsec)	Effective Point Source Throughput ¹	Spectral Resolution (/)
Default Aperture	LWRS	30 x 30	1.00	~20,000 (point source) 3,000 (diffuse source)
Medium Slit	MDRS	4 x 20	0.98	~20,000 (point source)
Narrow Slit	HIRS	1.25 x 20	0.55 (LiF1)	20,000 (point source)

¹ Target centered in aperture, nominal pointing jitter.

- **Instrument Performance** – The FUSE instrument routinely obtains data with a spectral resolving power of $R \sim 20,000$ and a S/N ratio of $\sim 30:1$ in a 0.05 \AA resolution element over most of the wavelength range.

Recent tests have demonstrated that higher S/N ratio spectra can be obtained with special observing techniques. **Cycle 3 proposers may request S/N up to 100 per 0.05 \AA resolution element.** See the FUSE Observers Guide for details and restrictions.

- **Exposure Times and Channel Selection** – Because the FUSE spectral resolution varies with wavelength and from channel to channel at a given wavelength, it may not always be possible to combine data from different channels and maintain the desired spectral resolution. Proposers should consider whether to define their exposure times based on achieving a desired S/N ratio in a single channel if the spectral resolution requirements exceed $R \sim 10,000$. This, in effect, reduces the effective area of the instrument but ensures that there are adequate counts to meet the resolution and S/N requirements.
- **Exposure Times And Observations Obtained During Orbital Night** – Observations of fainter objects in the LWRS aperture may be adversely affected by terrestrial air glow

emission. These effects can be significantly reduced by analyzing only the night-time portion of the obtained data set. Because FUSE cannot easily be retargeted within orbits, the scheduling of night-only observing is extremely inefficient, and there is, therefore, no "night-only" mode of observing with FUSE. If an observation requires a significant amount of night-time data, the desired night exposure time must be increased by a factor of 1.6 to obtain the proper time allocation. See the FUSE Observer's Guide for details.

- **Constrained Observations** – FUSE observations with strong scheduling constraints, such as those made in coordination with other telescopes, can be accommodated on a limited basis due to other FUSE scheduling constraints (restricted *beta* angles, ram avoidance, etc). Proposers must identify any such constrained observations in their proposals. The peer review panels will assess the criticality and potential benefits of these observations when evaluating the scientific merit of the proposal. The FUSE Project expects to be able to support ~25 constrained observations during Cycle 3 (about one every two weeks). This includes all time critical and moving target observations for both GI and PI-team programs.

Decisions on when Cycle 3 observations will be scheduled can be made only after Phase 2 data for accepted programs have been submitted and reviewed. The final scheduling decisions will be made by the FUSE PI after consulting with the FUSE NASA Project Scientist, taking into account any recommendations of the proposal review panels. Any requests for coordinated observations received after proposal acceptance by NASA, but not identified in the original proposal, will be reviewed by the FUSE Project Scientist. Approval of such late requests for constrained observations will be made on a case by case basis prior to any scheduling activity by the FUSE Project.

- **Sensitivity Limits** – There are fundamental detector performance limitations for both faint ($F < 5 \times 10^{-15} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$) and bright ($F > 3 \times 10^{-11} \text{ erg cm}^{-2} \text{ s}^{-1} \text{ \AA}^{-1}$) targets. Proposers expecting to observe objects near either extreme should consult the FUSE Observer's Guide for further information and restrictions.
- **Moving Targets** – Recent tests have demonstrated the capability of FUSE to observe moving targets. The flight software has been tested at rates up to 0.2 arcsec/sec, although actual Solar System observations to date have only been made in the Jovian and Saturnian systems (i.e., much slower rates).

Proposers should be aware that only a limited number of moving target observations can be scheduled during Cycle 3. Moving targets require special commanding and flight and ground software. They require a high degree of familiarity on the part of the user with the FUSE satellite capabilities. The FUSE Project can schedule only a limited number of Solar System observations during Cycle 3, and in general these observations compete for the same resources as other highly constrained observations (see above). Any Solar System observations attempted with FUSE during Cycle 3 must adhere to the *beta* angle constraints discussed in A.1.3.

A.1.4 Data Rights and Distribution

Data rights for FUSE GI observations will reside solely with each observing program's Principal Investigator for a period of six months following delivery of the processed data to the FUSE data archive (<http://archive.stsci.edu/fuse>). GI's will be notified electronically when their data are available from the archive. After this period, the data become available for public access through the FUSE data archive (see Section A.2.4).

Observations of calibration targets that are not also on GI or PI Team target lists will be released through the FUSE archive as soon as the processed data products are available. The calibration target list may be modified prior to the release of the NRA for future observing cycles. The FUSE Project may use any FUSE observation to assist in assessing the performance of the instrument, but the confidentiality of data obtained for scientific programs will be maintained.

A.1.5 Proposals for Targets of Opportunity

Proposals for major Targets of Opportunity (ToO), such as supernovae, novae, cataclysmic variables in outburst, comets, etc., will be supported in Cycle 3. Scientists wishing to observe such targets should prepare and submit proposals according to the same procedures used for regular program (i.e., as described in the following sections of this Appendix). Note that a proposal must not contain a mixture of ToO targets and non-ToO targets. Target of Opportunity status should be noted in the Special Requirements section of the proposal. The proposals will be reviewed in the regular review cycle, and successful proposals will be approved but will not be allocated specific amounts of observing time. (However, the 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 of one month or less will be approved for Cycle 3.

The lack of real-time observing capability constrains the speed with which a ToO observation can be implemented. The FUSE ToO response time may be as short as two days. ToO proposals must clearly state the required response time. It will be the GI's responsibility to notify the FUSE Project Scientist and the FUSE Science Center at JHU when any approved opportunity has occurred. The Project Scientist will consult with the GI, the FUSE PI, and other members of the FUSE Project 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.

A.1.6 Discretionary Observing Time

Project Scientist's Discretionary Observing Time is intended for observations of an urgent nature for which no approved observing program exists, which can be accomplished with a small amount of observing time, and which are of sufficiently high scientific merit and priority that they should not be delayed to the next observing cycle. The total amount of Discretionary Observing Time available during Cycle 3 is extremely limited. The FUSE Project Scientist may approve Discretionary Observing Time 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 proposed for in the current observing cycle, and the observation does not duplicate or infringe on approved GI or PI Team programs. A proposal for Discretionary Observing Time may be submitted to the Project Scientist in the form of a letter (printed or electronic) and should describe the observations and their feasibility and scientific objectives, and explain why Discretionary Time should be granted in lieu of consideration during the next proposal cycle. All requests for Discretionary Time will be reviewed for scientific merit and technical feasibility.

A.1.7 FUSE Observers Advisory Committee

The FUSE Observer's Advisory Committee (FOAC) was formed by the FUSE Project Scientist in the spring of 1999. Membership of the FOAC is drawn from the names of Principal Investigators of GI programs. The FOAC meets periodically to advise the Project Scientist on matters concerning the FUSE GI program. See the FUSE GI Program Web site (<http://fusewww.gsfc.nasa.gov/fuse/>) for the current FOAC membership and minutes of the FOAC meetings.

A.1.8 Targets For Observation

This NRA primarily seeks to identify new targets for observation with the FUSE satellite. The targets reserved by the FUSE PI Team for Cycle 3 are available from the FUSE GI Program Web site. Lists of previously observed targets and those planned for observation in Cycle 2 are also available. Proposers should bear in mind that the FUSE instrument has essentially only one observational mode. Aside from small differences resulting from the choice of aperture, the exposure time alone defines the achievable signal-to-noise ratio for a given spectral resolution for observations of point sources. The target's name and celestial coordinates (Right Ascension & declination in epoch J2000) will be considered when judging any potential target duplications.

D. Target Duplication – Cycle 3 GI targets may not overlap with those on the PI Team reserved target list. Any duplication of targets between Cycle 3 GI programs and those observed in previous Cycles must be strongly justified in the proposal. The review panels will receive a summary of any duplication between existing observations and those proposed for Cycle 3. The panels will also receive a summary of target duplications between different Cycle 3 proposals. In general, a given target will be allocated to only one observing program.

- **Target List Modifications** – After selection of Cycle 3 GI programs, additional GI and PI Team targets may be added with the approval of the FUSE Project Scientist. Any new target must be consistent with the program's scientific objectives and must not already be allocated to another program.
- **Solar System Targets** – Since Solar System objects are not defined uniquely by a fixed RA and DEC, a different policy applies for defining and protecting the Solar System observations. A GI may propose to observe a Solar System target, even if it has been reserved by the PI Team, if the proposed observation and scientific investigation does not infringe on that planned by the PI Team. The criteria used to differentiate the proposed GI observations from those of the PI Team are the scientific goals and other factors, including aperture size, aperture location on the target, and integration time. GI proposals for reserved Solar System targets should clearly state the differences between the proposed observation and those of the PI Team. The PI Team Solar System observations planned for Cycle 3 are those described in the target lists and abstracts available from the GI Program Web site.
- **Targets of Opportunity** – Some Targets of Opportunity may fall into the same category as Solar System objects because their identity and celestial coordinates (RA & DEC) are not known in advance. In this case, a scientific investigation defined by the PI Team would take precedence over a GI proposal with similar objectives.
- **Calibration Targets** – Astronomical targets are used for photometric, flat-field, and wavelength calibration. Most, but probably not all, of the objects listed (see the GI Program Web site) will be observed for calibration purposes. GI's are allowed to include calibration targets as scientific targets in their programs, provided those targets are not also on the PI Team target list. The FUSE Project may continue to use these objects for calibration, even if the target is allocated to a GI or PI Team program.

A.2

The FUSE Mission

A.2.1 Mission Overview

FUSE is a PI-class mission, developed in collaboration with the space agencies of Canada and France. The FUSE Principal Investigator, Dr. Warren Moos of the Johns Hopkins University (JHU) in Baltimore, Maryland, is responsible to NASA for the mission design, development, and operations. FUSE is controlled from the FUSE Satellite Control Center located on the JHU campus in Baltimore, Maryland. The FUSE PI is responsible for achieving the primary scientific objectives of the mission. These are the study of (1) the abundance of deuterium in a variety of astrophysical environments, from the local interstellar medium to distant gas clouds along the lines of sight toward quasars and active galactic nuclei, and (2) the amount, distribution, and kinematics of hot gas (as traced by the O VI ion) in the Milky Way disk and halo and in the Magellanic Clouds in order to understand the origin and dynamics of hot gas in these galaxies.

These large programs comprise a large fraction of the total time allocated to the PI Team in Cycle 3. Lists of the PI Team reserved targets and science program abstracts are available from the FUSE GI program web site.

The spectral window covered by FUSE permits the study of many astrophysically important atoms, ions, and molecules that cannot otherwise be investigated. This wavelength range is extremely rich in spectral lines arising within the interstellar gas. Proposers are encouraged to take full advantage of the capabilities of FUSE to address important problems in astrophysics. The FUV spectral range provides an opportunity for unique studies of many types of astrophysical objects, such as AGN's and quasars, massive stars, supernova remnants, nebulae, the outer atmospheres of cool stars, planets and their satellites, and comets.

A.2.2 Instrument Overview

FUSE obtains spectra in the 905-1187 Å far-UV band with high resolving power ($R \sim 20,000$) and high throughput. FUSE has four optical channels, each of which is fed by separate off-axis parabolic mirrors that serve as the primary mirrors for four co-aligned telescopes, all of which simultaneously view the same astronomical field at the same magnification. A Focal Plane Assembly (FPA) is at the focus of each mirror and consists of a flat mirror mounted on a precision two-axis micromotion stage. There are three entrance apertures built into each FPA. The combined effective area of all four channels ranges from $\sim 20 \text{ cm}^2$ to $\sim 70 \text{ cm}^2$, depending on the wavelength.

The high throughput results from the use of an efficient multichannel optical design and reflective coatings optimized for wavelength coverage in the FUSE range. The spectrograph gratings disperse and refocus the light onto two 2-dimensional delay-line microchannel plate detectors. The entire wavelength range is simultaneously covered on each detector by combining data from two optical channels. Two of the optical channels (one LiF and one SiC) feed one detector, the other LiF and SiC channels feed the other detector. The channels with SiC-coated optics cover $\sim 905\text{-}1100 \text{ Å}$, and the channels having LiF-coated optics cover $\sim 990\text{-}1185 \text{ Å}$. The resulting spectral images are highly astigmatic in the cross-dispersion direction. Spatially resolved spectral data of limited quality are available only at a few specific wavelengths where this astigmatism is minimized.

Further details on the FUSE instrument can be found the FUSE Observer's Guide, available online at <http://fuse.pha.jhu.edu/support/guide/obsguide.html>.

A.2.3 Satellite Operations and Observation Planning

FUSE is in a nearly circular orbit with a mean altitude of 768 km, an orbital inclination of 25° , and an orbital period of ~ 100 minutes. The plane of the orbit precesses with a period of ~ 60 days. Typically, FUSE is in contact with the ground station for 10-12 minutes per orbit for

about seven consecutive orbits, followed by eight orbits (~12 hours) with no contact. All FUSE scientific observations are conducted autonomously by the onboard instrument data system.

One of the main observational constraints is the restrictions in *beta* angle, defined as the angle between the anti-Sun direction and the telescope boresight, and is restricted to values between 15° and 105°. However, observations are normally scheduled in the range $30^\circ < \beta < 85^\circ$ in order to maintain coalignment of the four spectroscopic channels. Since the channel alignment is sensitive to changes in the instrument's thermal environment, the *beta* angle constitutes an important scheduling parameter. Observations outside the normal *beta* angle range are possible but must be carefully planned in advance. See Section A.1.3 and the FUSE Observer's Guide for further information.

A.2.4 Data Processing, Calibration, and Distribution

The FUSE data processing pipeline corrects the two-dimensional raw data for instrumental effects and produces one-dimensional, calibrated, extracted spectra. Each exposure produces independent SiC and LiF spectra on each of four detector segments (two segments for each FUSE detector) for a total of eight independent spectra. The data processing system is described in the FUSE Data Handbook (<http://fuse.pha.jhu.edu/archive/dhbook.html>).

Wavelength calibration maps pixel coordinates into the wavelength domain. The relative wavelength accuracy is presently $\sim 10 \text{ km s}^{-1}$, depending on the channel. Depending on the relative locations with the spectroscopic apertures of the targets used for the dispersion solution and a science target, there can also be a zero-point shift in the wavelength scale. For observations made in the LWRS aperture this offset can be as large as 50 km s^{-1} . The FUSE photometric calibration has an absolute accuracy of $\sim 10\%$ and a rms relative uncertainty of no more than 5%. However, the accuracy realized during an observation depends critically on the stability of the target within the aperture of a particular channel.

The FUSE data are archived at the Multi-Mission Archive at Space Telescope (MAST) at URL <http://archive.stsci.edu/fuse/>. Access procedures for proprietary and public 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. The distribution of FUSE data is made by electronic file transfer from the FUSE archive. Observations of calibration targets generally have no proprietary period. See Section A.1.4 for additional information about FUSE data rights.

APPENDIX B

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(JANUARY 2000)

NASA Federal Acquisition Regulations (FAR) Supplement (NFS)

Part 1852.235-72

(accessible through URL: <http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>)

(a) **General.**

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRA's contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRA's.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRA's are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRA's; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) **NRA-Specific Items.** Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRA's will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) **Transmittal Letter or Prefatory Material.**

- (i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) **Restriction on Use and Disclosure of Proposal Information.** Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice
Restriction on Use and Disclosure of Proposal Information

The information (data) contained in *[insert page numbers or other identification]* of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description.**

- (i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.
- (ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) **Facilities and Equipment.**

- (i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.
- (ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

(8) **Proposed Costs (U.S. Proposals Only).**

- (i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and

other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

- (ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.
- (iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).
- (iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) **Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) **Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) **Special Matters.**

- (i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.
- (ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) **Renewal Proposals.**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) **Joint Proposals.**

- (1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and

indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

- (2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors.**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(1) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) **Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

(End of provision)

Appendix C

PROPOSAL PREPARATION, SUBMISSION, EVALUATION, SELECTION, AND IMPLEMENTATION

The information contained in this Appendix C augments and supersedes Appendix B and applies only to this NRA.

C.1 General Guidelines and Policies

C.1.1 Proposal Process

Proposers should submit a Notice of Intent to Propose (see the NRA Summary of solicitation and Section C.4) in order to facilitate the timely selection of peer review panels. Note that Notices of Intent are not required in order to propose for the FUSE GI program. Proposals may be submitted at any time before the proposal due date.

Proposals submitted in response to this NRA should provide the scientific justification and feasibility analysis, which form the basis for selection by NASA. Proposers who are awarded observing time, based on the evaluation process described in Section C.6 will subsequently be required to submit observation specifications following guidelines provided by the FUSE Project. These data will provide the FUSE Science Center with the detailed definition of each observation to be executed for the program. In addition, U.S. proposers will be invited to submit a budget based on funding guidelines provided by NASA – see Section C.8.

Submission of proposals in response to this NRA has three components:

1. proposal summary information must be submitted through the designated NASA Web page and used to print the proposal's *Cover Page/Proposal Summary* (see Section C.2.2);
2. the specified number of printed copies of the complete proposal, including a printed copy of the *Cover Page* signed by the PI, must be submitted to the address given in the NRA Summary of Solicitation (see Section C.5); and
3. a FUSE Cycle 3 proposal template, also referred to as the Proposal Form, must be completed and submitted electronically (see Section C.2.3).

C.1.2 Who May Propose

Participation in the FUSE GI Program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, NASA Centers, and other Government agencies. Each FUSE 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 FUSE Science Center at the Johns Hopkins University (JHU) will communicate formally only with the PI (or his/her designee) of each proposal. It is this person's responsibility to provide JHU with the necessary data that defines each observation in a timely manner and to respond to any questions concerning observational constraints or configurations.

C.1.3 Canadian and French Observing Time

As part of their participation in and contribution to the FUSE mission, Canada and France each receive a minimum of 5% of the mission's observing time as defined in Letters of Agreement between NASA and their respective space agencies. This observing time will be selected competitively via the GI proposal peer review process described in this NRA. Scientists at Canadian and French institutions should follow the instructions in this Appendix for proposal preparation and submission. Note, however, that an institutional endorsement of the type described in the Section C.1.4 is not required for Canadian and French proposals submitted in response to this NRA.

C.1.4 Guidelines for other than Canadian and French Non-U.S. Participation

See Part (l) of Appendix B.

C.1.5 Late Proposals

NASA's general policy on late proposals is given in Part (g) of Appendix B and states that such a proposal may be considered only if it is judged to be in the best interests of the Government. Owing to the historically large over-subscription of proposals for this program, a proposal submitted after the published deadline is unlikely to be considered of uniquely greater value to NASA than the proposals that are submitted on time. A proposal is considered to have been submitted on time only if all necessary components, including electronic material, have been received by the published deadline. Finally, note that processing delays at the proposer's home institution, the method of shipment of the proposal, or Internet delays do not excuse the late submission of a proposal.

C.2

Proposal Preparation

C.2.1

Proposal Format and Content

Proposals must be concisely written in English. The length of each section of the proposal should not exceed the page limits indicated below, using single-spaced 8.5x11 inch or A4 format paper with 1 inch (2.5 cm) margins. Proposals must be printed with a font size no smaller than 11 points (about 6 characters per cm). Reviewers will be instructed to base their review on only

the portion of each proposal that complies with the page limits given below in this NRA. Double-sided copies are encouraged. Illustrations contained in the printed proposal may be in black and white or color.

C.2.2 Cover Page/Proposal Summary

All proposals must be prefaced by an integrated *Cover Page/Proposal Summary* that contains important, required information. This item is produced by first entering the requested information electronically through a NASA Peer Review Services (NPRS) Web site specified in this NRA's Summary of Solicitation and then printing this form by the proposer. Note that a sample of this Web form may be printed at any time for preliminary inspection. The printed copy of the electronically submitted form is then used to obtain the signature of the PI to submit with the original copy of the proposal.

The *Cover Page/Proposal Summary* includes the following information: Proposal title (both abbreviated and full length); PI name, institution, address, and telephone number; Co-I name(s) and institution(s); proposal summary (restricted to about one-half page of text); scientific category (see further below); and total requested observing time. This *Cover Page/Proposal Summary* must be signed by the PI and used as the preface of all submitted copies of the printed proposal (see Section C.5). An institutional signature is **not** required until a budget is submitted by proposers who are awarded observing time.

The last three digits of the identification number assigned to your proposal by the NASA Peer Review Services Web site must also be included in the required LaTeX proposal form. This identifier is displayed on the Web page and printed at the upper left-hand corner of the *Cover Page/Proposal Summary*. For example, in the proposal identifier "NRA-00-05-OSS-189," the ID number is the last three digits "189."

C.2.3 LaTeX Proposal Template

The FUSE proposal form uses an ASCII LaTeX file that allows the proposer to supply certain information for a set of keywords, including the proposed target list. Some keywords are required (e.g., proposal title, PI name and address, abstract, total observing time requested, etc.) and some are optional (e.g., special requirements). For proposers familiar with LaTeX, the proposal form may also be used to format the final printed proposal. Electronic submission of the LaTeX proposal form (without figures) is required of all proposers, since this file will be part of the database used to support the proposal review. Instructions for obtaining the proposal form are given in Section C.3, and submission procedures are described in Section C.5.

The FUSE LaTeX proposal form defines a number of sections, or subject areas, including the proposed target list and exposure times. These proposal sections are listed below and should be contained in the proposal in the order indicated.

Summary Information – Proposal summary information, the same as that submitted to the NASA Peer Review Services Web site for the *Cover Page/Proposal Summary*, must also be supplied in the LaTeX proposal form. In addition, the three-digit proposal identification number is required for the proposal form.

Scientific Category – Each proposal must identify one of nine primary research areas as listed below that is used to guide assignment of the proposal to the appropriate scientific review panel. These nine research areas (and some examples) are:

- **Solar System objects** (planets, satellites, comets)
- **Cool stars** (single and noninteracting binary systems)
- **Hot stars** (O, B, and Wolf-Rayet stars, white dwarfs, central stars of planetary nebulae, including hot stars in the Magellanic Clouds)
- **Interacting binary systems** (RS CVn systems, cataclysmic variables, symbiotic stars, mass-transfer binaries, novae)
- **Stellar ejecta and gaseous nebulae** (circumstellar material, H II regions, planetary nebulae, supernova remnants, supernovae)
- **Interstellar medium and galactic structure** (interstellar gas and dust, diffuse Galactic emission, Galactic halo, gas and dust in the Magellanic Clouds)
- **Galaxies and extragalactic stellar populations** (excluding the Magellanic Clouds)
- **Active Galactic Nuclei (AGN) and quasars**
- **QSO absorption lines and the intergalactic medium**

Proposal Sections – The proposal must contain the following Sections and be addressed in the order indicated for each proposed observing program. The page length limits are indicated.

- **Scientific Justification (3 pages)** – Fully describe the scientific objectives of the proposed investigation, clearly stating its goals, its significance to astronomy, and why FUSE data are essential to the investigation. The page limit includes all text, figures, tables, and references for this Section.
- **Feasibility and Safety (2 pages)** – The proposed program must justify the need for 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. Describe the basis for and accuracy of the flux estimates, including any assumptions made or extrapolations into the FUSE spectral range from other wavelengths.
- **Description of Observations (1 page)** – Describe the observations. All special requirements (e.g., usage of MDRS or HIRS apertures, Target of Opportunity, monitoring program, specific aperture orientation) must be summarized and justified. These requirements encompass any information affecting the scheduling of the target, such as

pointing constraints (e.g., observations at specific times), scheduling constraints (e.g., coordinated observations, phase coverage, contiguous observations, etc.), Targets of Opportunity, and basic moving target data. However, actual ephemeris data for Solar System targets are not required for this phase of the proposal process.

- **Additional Information (1 page)** – This Section may be used to provide any relevant information concerning data analysis plans, modeling capabilities, plans for supporting observations to be conducted using other telescopes, etc.
- **Previous FUSE Observing Programs (1 page)** – Summarize the status, results, and publications arising from FUSE observing time allocated to the PI in previous FUSE GI observing cycles. The presentation of this information for Co-I's is optional.
- **Principal Investigator and Co-Investigator Biographical and Publication Data (1 page)** – An abbreviated biographical sketch for the PI should be provided and include a list of the most recent refereed publications relevant to the scientific proposal. Additional biographical or publication data may be provided for any of the Co-I's.
- **Proposed Target List** – Each proposal must include a table of the proposed targets for observation that includes all the requested target and exposure information and parameters described in the instructions for the proposal template. Proposers are strongly encouraged to use the LaTeX proposal form to prepare this formatted table of targets and exposure times. In all cases, these data must also be submitted electronically using this template.

C.3 Obtaining the Phase 1 Proposal Form and Instructions

The FUSE LaTeX proposal form and style file may be retrieved automatically via E-mail by sending a message to URL fuseprop@fusewww.gsfc.nasa.gov with the word "help" as the subject of the message. The necessary files will automatically be sent by E-mail. These files, plus the instructions for preparing the proposal form, are also available electronically from the FUSE GI Program Web site <http://fusewww.gsfc.nasa.gov/fuse/>.

C.4 Notices of Intent to Propose

In order to expedite the proposal review process and the timely selection of scientific peer review panels, investigators intending to submit proposals for participation in this program should submit a Notice of Intent (NOI) to propose by the deadline to the Web address given in the NRA Summary of Solicitation. This NOI Web site will request the tentative title of the investigation, name and affiliation of the PI and any Co-I's, and a brief summary of the objectives of the proposed investigation.

C.5

Proposal Submission

A complete proposal submission consists of the following three steps.

1. Provide basic summary information through the NASA Peer Review Services Web site (see Letter of Solicitation) and print the *Cover Page/Proposal Summary*. Note that the proposal number in the upper left-hand corner of the *Cover Page* must be inserted in the LaTeX proposal form in the appropriate keyword.
2. Send 12 printed copies of the proposal to the address given in the Summary of Solicitation. The PI must sign the printed *Cover Page/Proposal Summary* (see Section C.2.2) and attach it as the front of the proposal. Copies of the *Cover Page/Proposal Summary* must also be attached to the other 11 copies of the proposal that are submitted (i.e., one original and 11 copies must be submitted).
3. E-mail the LaTeX proposal form to fuseprop@fusewww.gsfc.nasa.gov. An acknowledgment of receipt will be sent to the proposal submitter by return E-mail.

All printed and electronic proposal materials must arrive at the above address by the closing date given in the Summary of Solicitation to this NRA in order to be included in the proposal review for this cycle of the FUSE Guest Investigator program.

C.6

Evaluation and Selection Process

Proposals will be evaluated in a competitive peer review conducted by NASA Headquarters using review panels organized by research area (see Section C.2.3 above). The panel membership will include scientists from the U.S., Canada, and France. Upon completion of the review by the individual panels, a final cross-discipline panel review chaired by a NASA HQ representative will synthesize the results of the individual panels. Based on these results, the FUSE 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, Research Program Management Division, Office of Space Science.

The following factors, listed in descending order of importance, will be used in evaluating proposals for their scientific merit and technical feasibility for the FUSE Guest Investigator Program. The weight of the first factor is approximately the same as the combined weight of the second and third, and is approximately twice the combined weight of the fourth and fifth:

- The overall scientific merit of the proposed investigation;
- The suitability and feasibility of using the FUSE observatory for the proposed investigation;
- The feasibility of accomplishing the objectives of the investigation;
- The feasibility of the data analysis techniques;

- The competence and relevant experience of the Principal Investigator and any collaborators to carry the investigation to a successful conclusion, including timely publication of the research in peer reviewed journals.

The scientific review panels will be given an assessment of the technical feasibility of each proposal as determined by the FUSE Project. After acceptance of an observing program by NASA, successful proposers must prepare detailed observing plans for submission to JHU, which are required for scheduling purposes. These plans, referred to as “Phase 2” plans, will again be assessed for feasibility. Should there be any question regarding the safety or feasibility of individual observations, the FUSE PI, in consultation with the FUSE Project 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.

C.7

Other Conditions

NASA reserves the right to offer to select only a portion of a proposer's investigation, in which case the investigator will be given the opportunity to accept or decline such partial selection.

C.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. Successful proposers at U.S. institutions, including U.S. Co-Investigators on successful non-U.S. proposals, will be eligible for funding. However, budgets should not be submitted with research proposals submitted in response to this NRA. Instead, the selected investigators will receive a funding guideline from NASA based on the scope of the approved observing program and the available budget for the FUSE Cycle 3 GI program. A budget summary and narrative description on how these funds will be spent will need to be submitted after the receipt of the guideline. An institutional signature will be required when a budget is submitted. NASA anticipates availability of approximately \$4.5M to fund approximately 80 proposals.

Copies of the three *Certifications* currently required by U.S. Code (Note: these individual *Certifications* are included for reference only and should not be signed and returned; language is now included on the proposal *Cover Page* that confirms that these certification requirements are met once the printed copy of the *Cover Page* is signed by the Authorizing Institutional Representative and submitted with the proposal).

**Certification Regarding Debarment, Suspension, and
Other Responsibility Matters**

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160-19211).

- The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
 - Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
 - Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
 - Have not within three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.
- (2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Certification Regarding Lobbying

- No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000 for each such failure.

**Assurance of Compliance with the National Aeronautics and Space Administration
Regulations Pursuant to Nondiscrimination in Federally Assisted Programs**

The _____
(Institution or organization on whose behalf this assurance is signed, hereinafter called "Applicant.")

HEREBY AGREES THAT it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1972 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and HEREBY GIVES ASSURANCE THAT it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which it retains ownership or possession of the property. In all other cases, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

THIS ASSURANCE is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contract, property, discounts or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognizes and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.