

## A.5 ASTRONOMY AND PHYSICS RESEARCH AND ANALYSIS

### 1. Scope of Program

#### 1.1 Overview

The Astronomy and Physics Research and Analysis (APRA) program solicits basic research proposals for investigations that are relevant to NASA's programs in astronomy and astrophysics. This includes the entire electromagnetic spectrum, from radio to gamma rays, plus particle astrophysics. **Note that proposals related to gravitational physics and the fundamental laws of physics, which were previously supported under APRA, are now being solicited under the Beyond Einstein Foundation Science (BEFS) program in Section A.6 of this NRA.**

While excellence of the proposed research is the primary selection criterion, relevance to the goals of the Astronomy and Physics Division, including flight missions and overall science objectives, is a necessary criterion and must be explicitly described in the proposal. To enable the NASA Office of Space Science to evaluate properly the relevance of proposals submitted to its programs, as well as to track its progress towards achieving its goals as mandated by the Government Performance Review Act (GPRA), all research supported by NASA's programs must demonstrate its relationship to NASA Goals and Research Focus Areas (RFAs) as stated in the latest version of Space Science Enterprise Strategic Plan (follow links from the Web site <http://spacescience.nasa.gov/>); see also the discussion in Section I of the *Summary of Solicitation* of this NRA. Therefore, all proposers to this program element are asked to describe the relevance of their proposals to the Goals, Science Objectives, and RFAs given in Table 1 of the *Summary of Solicitation*. In particular, this program element is designed to help fulfill any of the RFAs for all of the Science Objectives for Goal II of both the science theme "Astronomical Search for Origins" and "Structure and Evolution of the Universe." The appropriate place for this statement of relevancy is in the introduction to the proposal's "Scientific/Technical/Management" section (see Section 2.3.5 in the *NASA Guidebook for Proposers*). The index numbers in this table may be used to identify a specific RFA, for example, "Goal I, Sun-Earth Connection Theme, RFA 1(c)" or "Goal II, Astronomical Search for Origins, RFA 3(b)."

#### 1.2 Categories of Proposals

This APRA Program Element seeks to perform the best possible (i) state-of-the-art detector technology development for instruments that may be proposed as candidate experiments for future space flight opportunities; (ii) science and/or technology investigations that can be carried out with instruments flown on suborbital sounding rockets or stratospheric balloons; and (iii) supporting technology, laboratory research, and/or (with restrictions) ground-based observations that are directly applicable to space astrophysics missions. To meet these goals, proposals are solicited in the following five broad categories:

- Detector Development
- Suborbital Investigations
- Supporting Technology Studies
- Laboratory Astrophysics
- Ground-Based Observations

### Specific Considerations and Exclusions.

- Investigators proposing stand alone detector development should propose to the Detector Development category, whereas proposals where detector development is integrated into a suborbital program should be submitted to the Suborbital Investigations category.
- The Laboratory Astrophysics component of this program element includes theoretical investigations in the area of Atomic and Molecular Astrophysics. However, all other theoretical investigations are solicited separately under the Astrophysical Theory Program (ATP) or the Beyond Einstein Foundation Science (BEFS) program discussed, respectively, in Sections A.4 and A.6 of this NRA.
- Projects directed mainly toward the analysis of archival data are solicited under the Astrophysics Data Analysis Program discussed in Section A.2 of this NRA.
- Except for investigations in support of rapid searches for counterparts to Gamma-Ray Bursts, which may be submitted by any investigator, proposers to the Ground-Based Observations component of this program element must be ineligible by virtue of their institutional affiliation to receive direct support from the National Science Foundation for ground based astronomy. Ground-based particle observations are not supported by this program element.

#### 1.2.1 Detector Development

This APRA category solicits investigations that either advance our understanding of the fundamental operational aspects of detectors or develop new types of detectors to the point where they can be proposed in response to future announcements of flight opportunities. Either new measurement concepts or methods to improve the performance of existing detectors may be proposed, provided they would be candidates for use in space. Among the characteristics typically desirable in space-quality detection systems are low mass, low sensitivity to particle radiation (i.e., "radiation hardness"), low power consumption, compactness, operation in a vacuum (such that high voltage arcing is minimized), vibration tolerance, ease and robustness of integration with instrumentation, and ease of remote operation, including reduced transient effects and ease of calibration.

This program does not support development of detectors that are intended primarily for ground-based astronomy. However, observing with ground-based facilities may be proposed to verify new detectors or overall system performance, if adequately justified as an integral part of a detector development program.

Proposals for new detectors will be evaluated in the context of currently available space astronomy detector technologies. The emphasis of this solicitation is on technologies that address problems related to achieving the astronomy and astrophysics missions and goals in the current Space Enterprise Strategic plan. (Interested parties should check URL <http://research.hq.nasa.gov/research.cfm> for a separate Office of Aerospace Technology NRA that would support detector development appropriate for the SAFIR and Einstein Inflation Probe missions.) Proposers are encouraged to identify potential mechanisms that could facilitate transfer of these detector technologies to other users, including Homeland Security and the private sector, for possible application beyond the immediate goals for NASA's programs.

### 1.2.2 Suborbital Investigations

This APRA category supports science investigations and/or technology development utilizing payloads flown on sounding rockets or balloons, or similar-class payloads flown as flights of opportunity. Suborbital payloads may be recovered, refurbished, and reflown, in order to complete an investigation. A discussion of the plans for management and for reduction and analysis of the data should be given. Although most awards are for three years' duration, in rare cases a five year proposal may be accepted to develop a completely new, highly meritorious mission investigation through its first flight.

Budgets are expected to cover complete investigations, including payload development and construction, instrument calibration, launch, and data analysis. The number of groups that can be supported is limited and heavily dependent on the funds available to this program. NASA does not carry reserves to accommodate any cost overrun incurred by a particular investigation, including the loss of the payload owing to rocket failure. Such a situation could entail either descopeing the initially proposed investigation, delaying it, canceling a particular launch date opportunity, or canceling the investigation altogether.

**Note: Owing to the anticipated greater degree of complexity, the Science/Technical/Management section of proposals for a Suborbital investigation may be 20 pages long instead of the default 15 pages specified in the *Guidebook for Proposers*.**

### 1.2.3 Supporting Technology Studies

This APRA supports technology studies not yet ready for incorporation into new detector or space mission systems, but which offer promise of potential breakthroughs that could lead to future advances in space astronomy and astrophysics.

### 1.2.4 Laboratory Astrophysics

This APRA category supports basic science investigations that do not require the space environment for completion, but which have the potential to enable or contribute significantly to space astronomy and astrophysics goals, for example, the measurement of fundamental atomic and molecular parameters important for the analysis of NASA's space data.

### 1.2.5 Ground-Based Observations

This APRA category will consider proposals for ground-based observations only if they are in direct support of NASA space astronomy and astrophysics missions and/or goals. Note that proposers eligible for support by the National Science Foundation may not apply to this NASA program unless specifically for rapid searches for the visual counterparts to Gamma-Ray Bursts.

## 2. Programmatic Information

### 2.1 General Information

The following table shows roughly the amount of FY 2005 funding and the number of new investigations to be selected for the five APRA Categories in this Program Element.

APRA Category	Approximate Funds for New Selections [\$M]	Approximate Number of New Selections
Detector Development	3	12
Suborbital Investigations	5	5
Supporting Technology Studies	1	10
Laboratory Astrophysics	2	20
Ground-Based Observations	\$ 0.5 M	3

Investigators may propose programs of any size for funding extending up to three years under this solicitation. (Rare exceptions to this time limit may be allowed in suborbital investigations, where proposals may be for up to five years.) The actual amount of funding awarded to a particular program will be determined by the merit of the program and programmatic goals of the Office of Space Science.

The participation of graduate students in the Detector Development and Suborbital Categories is strongly encouraged, especially if the project can be concluded within the nominal tenure of graduate training. In such cases, brief details of the educational goals and training of the participants should be included in the proposal.

## 2.2 Special Instructions for Multiple-Institution Proposals for Suborbital Investigations

Proposals for suborbital investigations often involve the development of payloads that require major hardware collaborations from several organizations. In such cases, lead Principal Investigators (PIs) may propose a direct subcontracting arrangement between his/her organization and the Co-Investigator (Co-I) institution(s), in which case all the nominal instructions in the *NASA Guidebook for Proposers* (see further below) apply.

Alternatively, significant cost savings for NASA may be achieved by providing separate awards to each collaborating institution, where the lead investigator from each Co-Investigator institution serves as the "Institutional PI" for the award to his/her institution (see Section 1.4.2 in the *NASA Guidebook for Proposers*). Therefore, in order to provide for such multiple-award flexibility, the following instructions may be followed for proposals that involve major hardware contributions from multiple institutions:

- Only the "lead proposal" for the overall investigation, submitted by a single PI, will be reviewed. This primary proposal must include the PI's work statement and budget, plus appended Task Statements and budgets from all other collaborating Co-I institutions (see further below) as part of its Budget Details. The *Cover Page/Proposal Summary/Budget Summary* of the lead proposal should show only the budget requested by the lead organization. However, the Budget Details of this lead proposal must include a table that shows the costs for the lead organization plus those for each Co-I institution, which together must add to the total yearly requests for the entire, integrated investigation for its complete period of performance.
- The Task Statement(s) from collaborating Co-I institution(s) that are to be included in the lead proposal are not to exceed five pages each and must include a description of the Co-I institution's contribution to the overall investigation, the roles of that institution's Co-I(s) (if more than one, a single Co-I to serve as the "Institutional PI" must be identified), and a copy of the *Budget Summary* that is submitted with that Co-I institution's independent proposal to NASA (see below).
- Finally, each Co-I institution must also submit a formal, signed proposal to NASA that is prefaced with the *Cover Page/Proposal Summary/Budget Summary* materials indicated in the *NASA Guidebook for Proposers*. Such "Co-I proposals" must clearly cross-reference the lead proposal in the first sentence of their *Proposal Summary*,

which must also be identical to, and use the same investigation title as, that of the lead proposal. The *Scientific/Technical/Management Section* of this Co-I proposal (see the *NASA Guidebook for Proposers*) is to consist only of the five-page Task Statement noted above. However, it must include a full institutional budget that covers that Co-I's proposed activities.

#### IMPORTANT INFORMATION

- As discussed in the *Summary of Solicitation* of this NRA, the Office of Space Science (OSS) now uses a unified set of instructions for the preparation and submission of proposals given in the document entitled *NASA Guidebook for Proposers Responding to NASA Research Announcement - 2004* (or *NASA Guidebook for Proposers* for short) that may be accessed by opening <http://research.hq.nasa.gov/> and linking through "Helpful References," or by direct access at <http://www.hq.nasa.gov/office/procurement/nraguidebook/> (note that the updated 2004-edition of the *Guidebook* is used for this solicitation).
- Section IV(b) of this NRA's *Summary of Solicitation* contains the Web address relevant to the electronic submission of a Notice of Intent (NOI) to propose and a proposal's *Cover Page/Proposal Summary/Budget Summary*, as well as the mailing address for the submission of the hard copies of a proposal.

Questions about the APRA program may be directed to the relevant Program Officers listed below with their areas of expertise, all of whom share the same mailing address(if uncertain, contact the APRA Lead Program Officer):

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