

APPENDIX B. HELIOPHYSICS RESEARCH PROGRAM

B.1 OVERVIEW

1. Overview

The Heliophysics Research Program of the Science Mission Directorate supports investigations of the Sun and planetary space environments, including the origin, evolution, and interactions of space plasmas and electromagnetic fields in the heliosphere and in connection with the galaxy. Understanding the origin and nature of solar activity and its effect on the space environment of the Earth is a particular focus. The traditional discipline interests have been:

Solar and Heliospheric Physics, which treats the Sun as a typical dwarf star and includes processes taking place throughout the solar interior and atmosphere; the evolution and cyclic activity of the Sun; and the origin and behavior of the solar wind, energetic particles, and magnetic fields in the heliosphere and their interaction with the interstellar medium; and

Geospace Science, which treats the physics of magnetospheres, including their formation and fundamental interactions with plasmas, fields, and particles (the Earth's magnetosphere is emphasized, but studies of the magnetospheres of planets, comets, and other primordial bodies are also supported); and the physics of the mesosphere, thermosphere, ionosphere, and aurorae of the Earth, including the coupling of these phenomena to the lower atmosphere and magnetosphere.

The recommended priorities of the heliophysics community are discussed in the National Research Council decadal survey for space physics, *The Sun to the Earth -- and Beyond: A Decadal Research Strategy in Solar and Space Physics* (available at <http://www.nap.edu/catalog/10477.html>), the *Science Plan for NASA's Science Mission Directorate (2007-2016)* (available at <http://nasascience.nasa.gov/about-us/science-strategy>), and the Heliophysics Roadmap for Science and Technology 2005-2035, *The New Science of the Sun-Solar System Connection*, (http://sec.gsfc.nasa.gov/Roadmap_FINALpri.pdf).

The Heliophysics Research Program supports several types of endeavors, including Supporting Research and Technology (SR&T) and Low Cost Access to Space (LCAS) programs in the various disciplines, the Heliophysics Theory Program, the Guest Investigators Program, the Living With a Star Program, and contributions to the Heliophysics data program via virtual observatories, resident archives, etc. Generic program descriptions follow immediately below, while specific information can be found in the Heliophysics program elements described in Appendices B.2 through B.8. It is the overall guiding objective of each of these programs to contribute as effectively and directly as possible to the achievement of NASA strategic goals, and priority for selection is given to those proposals that most clearly demonstrate the potential for such contributions.

2. Supporting Research and Technology

Supporting Research and Technology (SR&T) programs support individual research tasks that employ a variety of research techniques, e.g., theory, numerical simulation, and modeling; analysis and interpretation of space data; development of new instrument concepts; and laboratory measurements of relevant atomic and plasma parameters, all to the extent they have a clear application to Heliophysics program goals. The Solar and Heliospheric SR&T program is administered as part of the Solar and Heliospheric Physics program element described in Appendix B.2, while the Geospace SR&T program is one component of the Geospace Science program element, which is described in Appendix B.3.

3. Low Cost Access to Space

Low Cost Access to Space (LCAS) programs have as their objectives science investigations that may be completed through suborbital rocket or balloon flight of experimental instrumentation, as well as proof-testing new concepts in experimental techniques that may ultimately find application in free-flying Heliophysics space missions. The LCAS program for solar and heliospheric physics is treated in the Solar and Heliospheric Physics program element in Appendix B.2, and the Geospace LCAS program is treated in the Geospace Science program element in Appendix B.3.

4. Heliophysics Theory Program

The Heliophysics Theory Program (HTP) element, Appendix B.4, supports efforts to attack problems concerning phenomena relating to the Heliophysics program using relatively large "critical mass" groups of investigators that are beyond the scope of the nominally smaller SR&T tasks discussed above. This program element is not competed in ROSES-2009.

5. Guest Investigators Program

The Heliophysics Guest Investigators (GI) program is intended to maximize the return from the missions of the Heliophysics Great Observatory by providing support for research which heavily utilizes mission data. The Heliophysics GI program element is described in Appendix B.5.

6. Living With a Star

The Living With a Star (LWS) program offers a number of separate program elements that are focused on those particular aspects of Heliophysics that directly affect life and society.

The LWS Targeted Research and Technology (TR&T) program supports a range of research tasks of the connected Sun-Earth system that affect life and society. Every year

there are several focused science topics competed. Given the submission of proposals of adequate number and merit, up to eight selections will be made for each Focused Science Topic. Once selected, these investigators will form a team in order to coordinate their research programs (similar to the PIs selected for a NASA hardware mission who form a coordinated science working group). These teams will define a plan for structuring their work into an integrated research program that ideally will address the Focused Science Topic in a much more complete way than any one investigation could by itself. Current teams are listed at http://lws-trt.gsfc.nasa.gov/trt_focusteams.htm. The LWS TR&T program element is described in Appendix B.6.

A primary goal of NASA's LWS Program is the development of first-principles-based models for the coupled Sun-Earth and Sun-Solar System, similar in spirit to the first-principles models for the lower terrestrial atmosphere. Such models can act as tools for science investigations, as prototypes and test beds for prediction and specification capabilities, as frameworks for linking disparate data sets at vantage points throughout the Sun-Solar System, and as strategic planning aids for enabling exploration of outer space and testing new mission concepts. Strategic Capabilities are the development and integration of such models for all the various components of this system. The LWS Strategic Capability program element is described in Appendix B.7.

7. Heliophysics Data Environment Enhancements

The Heliophysics Data Environment Enhancements program has several opportunities to contribute to the Heliophysics data environment. In particular, this program promotes the integration of search and access to the many data services for solar, heliospheric, and geospace physics data necessary to the conduct of research in the Heliophysics field. Another part of this program permits holders of heliophysics data to propose for small grants to upgrade their data services in order to participate in one of the several virtual observatories either in existence or proposed. This program also solicits proposals to continue resident archives of data from previously operating missions. This program element is described in Appendix B.8.

8. General Guidance for Proposals to Heliophysics Programs

Proposals to any of the Heliophysics program elements are expected to present within their Scientific/Technical/Management section a clear description of a specific scientific problem, of how the attack on this problem will be carried out, and of the relevance of the proposed research to NASA's strategic objectives. The development and testing of new instrument concepts, new observing techniques, new models, and/or new data analysis techniques that are pertinent to discipline goals are also supported. However, proposals for such efforts must provide at least a brief explanation of the relationship between such proposed efforts and clearly defined Heliophysics science problems.

Proposals with the intent of duplicating or directly supplementing investigations selected for current approved space flight missions are not appropriate for this NRA. Investigators who are funded members of the science teams of ongoing missions (including mission

PIs and Co-Is) and who propose to use data from these missions in SR&T, Guest Investigator, or other Heliophysics program element's efforts proposed through this NRA must clearly delineate between their mission responsibilities and the proposed efforts.
