

APPENDIX C. PLANETARY SCIENCE RESEARCH PROGRAM

C.1 PLANETARY SCIENCE RESEARCH PROGRAM OVERVIEW

The Planetary Science Research Program supports investigations of all classes of objects in the Solar System, except those focused on the Earth and Sun, consistent with the strategy for Solar System Exploration embodied in the *Solar System Roadmap 2006* (available at <http://solarsystem.nasa.gov/multimedia/downloads.cfm>). A proposal submitted to any of the following programs in this section must present, within its Scientific/Technical/Management section, a clear description of a specific scientific problem, a description of how the attack on this problem will be carried out, and a discussion of the relevance of the proposed research to NASA's current and/or future programs. Proposals whose intent or purpose is to extend or directly supplement investigations already selected for approved space flight missions are *not* appropriate for this NRA. Investigators who are members of science teams of ongoing missions must delineate clearly between their mission responsibilities and any research efforts proposed through this NRA. Furthermore, proposals that include analysis of data from planetary division space flight missions *must use publicly available data* released through the Planetary Data System (PDS) at <http://pds.jpl.nasa.gov/>. Proposals that utilize any data from planetary division space flight missions, in any amount, that is not yet publicly available on the PDS will *not* be considered.

The features of note regarding the Planetary Science Research Program this year are summarized below:

1. The previous specific technology programs have been replaced by the low TRL PICASSO and medium TRL MatISSE programs (C.16 and C.19, respectively).
2. As a result of the synthesis of technology programs the total number of calls has diminished and the Moon and Mars Analog Mission Activities and Planetary Major Equipment programs have been renumbered (they are now C.14 and C.15, respectively).
3. C.21 the Early Career Fellowship program has been extensively revised.
4. The Planetary Data System has defined the level of "certified data" to indicate that data products are ready for scientific use in such programs as Planetary Geology and Geophysics (C.4), Planetary Astronomy (C.5), Planetary Atmospheres (C.6), Outer Planets (C.7), Lunar Advanced Science and Exploration Research (C.8), Near Earth Object Observations (C.9), Cassini Data Analysis and Participating Scientist (C.10), Planetary Mission Data Analysis (C.11), and Mars Data Analysis (C.12) programs. The definition of certified data is available at <http://pdsmgmt.gsfc.nasa.gov/documents.html>.
5. C.6, Planetary Atmospheres has been clarified to clearly state that investigations that primarily involve making ground-based observations of extrasolar planets should be submitted to the Origins of Solar Systems program (appendix E.3).
6. C.10, the Cassini Data Analysis and Participating Scientist call continues to use a two-step submission process in which in place of an NOI the submission of a Step-1 proposal is required in order to be able to submit the Step-2 (full 15 page) proposal. Please see Section 4 of C.10 for details.

A brief description of each program element offered in the Planetary Science Research Program is given below. The intent of these summary statements is to give the prospective proposer a brief overview. A detailed description of the types of research supported by each program element can be found in the Scope of Program section of the respective program element description.

The Cosmochemistry program supports investigations of a variety of extraterrestrial materials (meteorites, cosmic dust, and lunar samples) that are aimed at understanding the geochemistry of the Solar System bodies (planets, satellites, including the Earth's Moon, and small Solar System bodies). (Appendix C.2)

The goal of the Laboratory Analysis of Returned Samples (LARS) program is to maximize the scientific return from extraterrestrial samples from NASA missions and to develop laboratory instrumentation and advanced analytical techniques. (Appendix C.3)

The Planetary Geology and Geophysics (PGG) program supports scientific investigations of the planetary surfaces and interiors, satellites (including the Moon), satellite and ring systems, and smaller Solar System bodies, such as asteroids and comets. (Appendix C.4)

The NASA Planetary Astronomy (PAST) program will continue to support both ground-based astronomical observations and suborbital investigations involving sounding rockets, balloons or reusable suborbital vehicles. Proposals are solicited for observations over the entire range of wavelengths from the ultraviolet to radio that contribute to the understanding of the general properties and evolution of the Solar System, its planets, their satellites, and of asteroids and comets. (Appendix C.5)

The Planetary Atmospheres (PATM) program supports scientific investigations that contribute to the understanding of the origins and evolution of the atmospheres of planets and their satellites and of comets. Its broad objectives include the determination of compositions, dynamics, energetics, and chemical behaviors of planetary atmospheres. (Appendix C.6)

The Outer Planets Research (OPR) program supports diverse scientific investigations that contribute to the understanding of the giant planets in the outer Solar System, as well as the smaller solid bodies including comets, asteroids, and the Kuiper Belt. This includes science data obtained by the New Horizons spacecraft, as well as the Voyager, Galileo, and Cassini spacecraft. (Appendix C.7)

The goal of the Lunar Advanced Science and Exploration Research (LASER) program is to support and enhance lunar basic science and lunar exploration science. (Appendix C.8)

The Near Earth Object Observation (NEOO) program supports investigations whose primary objectives are to inventory and characterize the population of NEOs, which may represent a hazard for impacting the Earth with the potential to significantly affect its climate and biosphere. (Appendix C.9)

The objective of the Cassini Data Analysis and Participating Scientist (CDAPS) Program is to enhance the scientific return of the Cassini mission by broadening the scientific participation in the analysis and interpretation of the data returned by the mission. Proposals to this program will be taken via a two-step proposal process. This means that the Notice of Intent is replaced by a required Step-1 proposal and the Title and Team are binding. The very brief Step-1 proposal will be used as a required NOI to facilitate the assembly of the peer review free of conflict of interest.. See Section 4.1 for details. (Appendix C.10)

The objective of the Planetary Mission Data Analysis Program (PMDAP) is to enhance the scientific return of completed Planetary Science Division missions by broadening the scientific participation in the analysis of data and samples collected by those missions. The PMDAP is intended to complement and not to overlap other active data analysis programs, e.g., Mars Data Analysis program (MDAP), CDAP, and OPR. (Appendix C.11)

The objective of the Mars Data Analysis Program (MDAP) is to enhance the scientific return from the Mars Pathfinder, Mars Global Surveyor, Mars Odyssey, Mars Exploration Rovers, Mars Express, Mars Reconnaissance Orbiter, and Phoenix missions by broadening scientific participation in the analysis of their respective data sets and to fund high-priority areas of research that support planning for future Mars missions. (Appendix C.12)

The Mars Fundamental Research Program (MFRP) seeks to sponsor the best and most innovative scientific research concerning atmospheric, climatological, and geologic processes on Mars and offers opportunities for Mars research beyond that available from analysis of spacecraft data alone. (Appendix C.13)

The Moon and Mars Analog Missions Activities (MMAMA) program addresses the need for integrated interdisciplinary field experiments as an integral part of preparation for planned human and robotic missions to the Moon and Mars. The focus will be on providing high-fidelity scientific investigations, scientific input, and science operations constraints in the context of planetary field campaigns. Funding provided in this program element is intended to enable researchers to conduct scientific investigations and integrate their instruments, projects, and/or protocols into field activities designed to help NASA plan for future exploration of the Moon, Mars, and other planetary bodies with both robots and humans. (Appendix C.14)

The Planetary Major Equipment (PME) program allows proposals for upgrading the analytical, computational, telescopic, and other instrumentation required by investigations sponsored by the following Planetary Science Division's science research programs offered in this solicitation:

- Cosmochemistry (Appendix C.2);
- Laboratory Analysis of Returned Samples (Appendix C.3);
- Planetary Geology and Geophysics (Appendix C.4);
- Planetary Astronomy (Appendix C.5);
- Planetary Atmospheres (Appendix C.6);
- Outer Planets Research (Appendix C.7);
- Lunar Advanced Science and Exploration Research (Appendix C.8);
- Near Earth Object Observations (Appendix C.9);

- Mars Fundamental Research (Appendix C.13);
- Astrobiology: Exobiology and Evolutionary Biology (Appendix C.17);
- Planetary Protection Research (Appendix C.18);
- Astrobiology Science and Technology for Exploring Planets (Appendix C.20); and
- Origins of Solar Systems (Appendix E.3).

New instrumentation may also be proposed. Planetary Major Equipment proposals may be submitted *only* in conjunction with new science research proposals to this solicitation *or* as an augmentation to planetary science multiple year awards. (Appendix C.15).

The Planetary Instrument Concepts for the Advancement of Solar System Observations (PICASSO) Program supports the development of spacecraft-based instrument systems that show promise for use in future planetary missions. The goal of the program is to conduct planetary and astrobiology science instrument feasibility studies, concept formation, proof of concept instruments, and advanced component technology development to the point where they may be proposed in response to the Maturation of Instruments for Solar System Exploration (MatISSE) Program, Appendix C.19 of ROSES. (Appendix C.16)

The goal of NASA's Astrobiology: Exobiology and Evolutionary Biology program is to understand the origin, evolution, distribution, and future of life in the Universe. Research is centered on the origin and early evolution of life, the potential of life to adapt to different environments, and the implications for life elsewhere. (Appendix C.17)

Planetary Protection Research (PPR) is aimed at the numerous areas of research in exobiology that have implications for the prevention of contamination of extraterrestrial environments by terrestrial organisms carried by spacecraft launched from Earth and, conversely, for understanding the potential hazards associated with possible extraterrestrial organisms that could be brought to Earth by sample-return missions. Research is required to allow NASA to understand the potential for both forward and backward contamination, as well as to set standards in these areas for spacecraft preparation and operating procedures and for returned-sample analysis. (Appendix C.18)

The Maturation of Instruments for Solar System Exploration (MatISSE) Program supports the advanced development of spacecraft-based instruments that show promise for use in future planetary missions. The goal of the program is to develop and demonstrate planetary and astrobiology science instruments to the point where they may be proposed in response to future announcements of flight opportunity without additional extensive technology development (approximately TRL 6). The proposed instrument must address specific scientific objectives of likely future planetary science missions. (Appendix C.19)

The Astrobiology Science and Technology for Exploring Planets (ASTEP) program solicits proposals for investigations to explore the Earth's extreme environments in order to develop a sound technical and scientific basis to search for life on other planets. (Appendix C.20)

The Fellowships for Early Career Researchers have been established to facilitate the integration of new Planetary Science Division researchers into the established research funding programs

and to provide tools and experience useful when searching for a more advanced (*i.e.*, tenure-track, civil servant, or equivalent) position. (Appendix C.21) Participation is limited to proposers to the following Planetary Science Division science research programs offered in this solicitation:

- Cosmochemistry (Appendix C.2);
- Planetary Geology and Geophysics (Appendix C.4);
- Planetary Astronomy (Appendix C.5);
- Planetary Atmospheres (Appendix C.6);
- Outer Planets Research (Appendix C.7);
- Lunar Advanced Science and Exploration Research (Appendix C.8);
- Near Earth Object Observations (Appendix C.9)
- Cassini Data Analysis and Participating Scientists (Appendix C.10)
- Planetary Mission Data Analysis (Appendix C.11);
- Mars Data Analysis (Appendix C.12);
- Mars Fundamental Research (Appendix C.13);
- Astrobiology: Exobiology and Evolutionary Biology (Appendix C.17)
- Maturation of Instruments for Solar System Exploration (MaTISSE) (Appendix C.19);
- Astrobiology Science and Technology for Exploring Planets (Appendix C.20); and
- Origins of Solar System (Appendix E.3).

The Origins of Solar Systems program solicits basic research proposals to conduct scientific investigations related to understanding the formation and early evolution of planetary systems and to provide the fundamental research and analysis necessary to detect and characterize other planetary systems. These investigations may involve analytical and numerical modeling, laboratory research, and observational studies in the following areas: star formation and the relationship to planetary system formation, solar nebula processes, accumulation and dynamical evolution, analysis of primitive materials, and the detection and characterization of other planetary systems. This program is shared with the Astrophysics Division, which takes responsibility for proposals involving the detection of extra solar planets. (Appendix E.3)
