APPENDIX B. Heliophysics Research Program

B.1 Heliophysics Research Program Overview ROSES-2024

1. Overview

The overarching goal of NASA’s Heliophysics Division is to understand the Sun and its interactions with the Earth and the Solar System, including space weather. In this framework, the Heliophysics Research Program is guided by *Science 2019-2024: A Vision for Scientific Excellence* and any more up to date versions of the Science Plan (available at [https://science.nasa.gov/about-us/science-strategy](https://science.nasa.gov/about-us/science-strategy)) and by the 2013 National Research Council Decadal Strategy for Solar and Space Physics report, *Solar and Space Physics: A Science for a Technological Society* ([www.nap.edu/catalog.php?record_id=13060](http://www.nap.edu/catalog.php?record_id=13060)). Heliophysics research addresses these recommendations by implementing a program to achieve all of the goals and objectives in the Science Plan and Decadal Strategy report, summarized by these combined objectives:

- Explore and characterize the physical processes in the space environment from the Sun to the heliopause and throughout the Universe
- Advance our understanding of the Sun’s activity, and the connections between solar variability and Earth and planetary space environments, the outer reaches of our Solar System, and the interstellar medium
- Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.

The Heliophysics Research Program supports investigations in all research regimes of Heliophysics. The program supports investigations of the Sun, including processes taking place throughout the solar interior and its atmosphere, as well as the evolution and cyclic activity of the Sun. It supports investigations of the origin and behavior of the solar wind, transient structures, energetic particles, and magnetic fields in the heliosphere and their interaction with the Earth and other planets, as well as with the interstellar medium. The program supports investigations of the physics of magnetospheres, including fundamental interactions of plasma wave-particle interactions and particles with guide fields, as well as coupling to the solar wind and ionospheres. It supports investigations of the physics of the terrestrial mesosphere, thermosphere, and ionosphere, neutral and ionized, and coupling of these phenomena to the lower atmosphere and magnetosphere. It supports investigations focused on processes that create space weather events, and investigations to enable a capability for predicting future space weather events.

The Heliophysics Research Program also supports investigations that span the regimes and address a systems approach – emphasizing the understanding of fundamental processes and interconnections across the traditional science disciplines, on a broad range of spatial and temporal scales. In concert with the other NASA science divisions (Planetary Science, Astrophysics, Earth Science, and Biological and Physical Sciences), the program shares responsibility for learning about the Earth, our Solar System, the Universe, and their interrelationships.
1.1 Solicited Programs

As of the time of release in February 2024, ROSES-2024 program elements are listed below. It is the overall purpose of each of these program elements to contribute as effectively and directly as possible to the achievement of the overarching goal and three science objectives of NASA Heliophysics. Priority for selection is given to those proposals that most clearly demonstrate the potential for such contributions.

The program elements are as follows:

- B.2 Heliophysics Supporting Research (HSR)
- B.3 Heliophysics Theory, Modeling, and Simulations (HTMS) – not solicited this year
- B.4 Heliophysics Guest Investigators Open (HGIO)
- B.5 Living With a Star Science (LWS)
- B.6 Living With a Star: Strategic Capabilities (LWS-SC) – not solicited this year
- B.7 Space Weather Science Applications Research 2 Operations 2 Research (SWR2O2R)
- B.8 Heliophysics Technology and Instrument Development for Science (H-TiDeS)
- B.9 Heliophysics Low Cost Access to Space (H-LCAS)
- B.10 Heliophysics Flight Opportunities Studies (H-FOS)
- B.11 Heliophysics Flight Opportunities for Research & Technology (H-FORT)
- B.12 Heliophysics Data Environment Enhancements (HDEE)
- B.13 Heliophysics U.S. Participating Investigator (H-USPI)
- B.14 Heliophysics Early Career Investigators Program (ECIP)
- B.15 Heliophysics Innovation in Technology and Science (HITS)
- B.16 Heliophysics AI/ML-Ready Data (H-ARD)
- B.17 Interdisciplinary Science for Eclipse (ISE) – not solicited this year
- B.18 Living With a Star (LWS) Tools and Methods (LWSTM) – not solicited this year
- B.19 Living With a Star Infrastructure (LWSIS) – not solicited this year
- B.20 Heliophysics Tools and Methods (H-TM)
- B.21 Citizen Science Investigations (H-CSI)

Each element above contains element-specific requirements, e.g., scope, content, length. General Heliophysics-specific requirements are included in this document in Section 1. Common requirements for all ROSES elements are found in the ROSES Summary of Solicitation and The NASA Proposer's Guide (formerly the Guidebook for Proposers).

The order of precedence is the following: the particular ROSES Element B.2 through B.21, followed by the Heliophysics Overview, ROSES Element B.1 (this document), followed by the ROSES Summary of Solicitation, followed by The Proposer's Guide. Proposers should be familiar with all of these resources and should especially read each element (above) carefully.
1.1.1 What’s New in Appendix B This Year

The requirements around archiving of data, code, and publications have been updated, see Section 1.6.

This year one program element accepts proposals throughout the year at any time without any preliminary statement such as a Notice of Intent. Proposals will be evaluated quarterly. Additional details can be found in Section 1.4.

Other changes in or additions to the Heliophysics program include:

HPD encourages the use a standardized format for a researcher’s Current and Pending Support information (See Section 1.11).

Proposals submitted to the following programs will be evaluated using dual-anonymous peer review (DAPR) in which the identities of proposers are not explicitly disclosed to the members on the review panel, and the reviewers are not given information about the proposing teams or organizations:

- Supporting Research (B.2)
- Guest Investigator Open (B.4)
- Living With a Star Science (B.5)
- Heliophysics AI/ML-Ready Data (B.16)

DAPR is described in Section V(b) of the ROSES Summary of Solicitation and Section 1.9, below.

1.2 General Proposal Content

Proposals require three core aspects: (1) a clear statement of the specific objective(s), (2) a justification of why the objective(s) is important, and (3) a description of how the objective(s) will be achieved. Successful proposals clearly lay out each aspect for reviewers. They often lead with clear, achievable objectives and then just enough background to justify why the objectives are important, followed by an extensive detailed description of how the objectives will be achieved.

Proposals should be focused enough to be achievable within the lifetime of the award. Proposals should include adequate personnel commitments to ensure achievable results.

1.3 Two-Step Process

Proposal submission to many elements in Heliophysics use a two-step proposal submission process. Use of the two-step process increases the notice provided to potential reviewers. The overall description of a two-step process can be found in Section IV(b)vii of the ROSES Summary of Solicitation.

In the two-step process a Step-1 proposal is required. Potential reviewers are solicited based on the Step-1 proposal. The proposal team members may not be changed between the Step-1 and Step-2 proposals unless prior approval is obtained from the Program Officer of the element. The title and broad science goals of the proposal may not be changed such that they would significantly affect the scientific or technical expertise required to properly evaluate a proposal. Changes in a proposal that impact the review will result in a proposal being declared non-compliant.
All Step-1 and Step-2 proposals for the Heliophysics elements must be submitted electronically by the due date (see Tables 2 and 3 of ROSES). Both Step-1 and Step-2 proposals must be submitted by the organization’s Authorized Organizational Representative (AOR). No budget or other elements are required for a Step-1 proposal. Only proposers who submit a Step-1 proposal are eligible to submit a Step-2 proposal.

All Heliophysics programs with Step-1 proposals will review the Step-1 proposals for compliance and will require a description that is limited to the 4000-character text box on the NSPIRES cover page that includes (1) the science goals and objectives, and (2) the proposed methodology. All compliant proposals submitted to these calls will be "invited" to submit a Step-2 proposal.

1.4 Rolling Submissions - Quarterly Evaluation

Proposals to B.15 Heliophysics Innovation in Technology and Science (HITS) may be submitted at any time without any preliminary statement such as a Notice of Intent or Step-1 proposal and they will be evaluated quarterly. Certain restrictions related to duplicate proposals and resubmissions are described below. The NSPIRES page for this program element displays a "Proposals Due" date, but that is simply the end date for the current ROSES, after which proposals may be submitted to the program element with the same name in the next ROSES. Programs such as these will review proposals quarterly. Proposals must be submitted electronically via NSPIRES or Grants.gov by the organization’s Authorized Organizational Representative (AOR). A budget and other specified information is required.

- A PI may at most submit two distinct (different) proposals to HITS in any given ROSES year.
- A PI may resubmit the same or slightly modified proposal to HITS at most once in any given ROSES year.
- A proposal with more than 50% new content is counted as a new proposal and not a resubmitted proposal.

1.5 Multiple Submissions and Duplication

Except for those programs with no due date, above, proposers are limited to one submission (full or Step-1/Step-2 paired proposal) per Principal Investigator (PI or Science PI) per program element, i.e., they may submit one and only one proposal as PI to each, unless otherwise specified in the program call.

Proposers may not submit Step-2 (or full) proposals for the same or essentially the same work to more than one program element concurrently. Each proposal may be submitted only once until it is accepted, declined, or withdrawn. This covers all program elements in Appendix B and also all cross-divisional ROSES program elements (Appendix F) supported by the Heliophysics Division. This prohibition includes switching the PI and a Co-I while submitting the same or essentially the same work.

This prohibition is active for a particular submitted proposal until the PI is notified that the proposal was accepted or declined, or until the proposal is withdrawn. The prohibition on duplicate proposals applies across ROSES years as well (e.g., a duplicate of a pending ROSES-2023 proposal may not be submitted in response to ROSES-2024). If a second proposal is submitted while a duplicate proposal is still...
pending in another program element, only the first proposal will be evaluated; the duplicate proposal may not be evaluated or considered and may be returned without review.

1.6 Open Science and Data Management Plans and Archiving

The requirements regarding archiving of data, code, and publications are: 1) As-accepted manuscript versions of publications that derive from ROSES awards must be publicly available at the time of publication 2) Data and software developed using ROSES funding in support of a peer-reviewed publication shall be made publicly available at the time of publication, 3) Scientifically useful data and software developed during the award that was not already published must be made publicly available by the end of the award, and 4) To be eligible to receive funding, PIs and Co-Is must provide their digital persistent identifier (e.g., ORCID) via NSPIRES under Account Management → Personal Profile.

Most proposals to ROSES require an "Open Science and Data Management Plan", (formerly called a data management plan) or an explanation of why one is not necessary given the nature of the work proposed. The Open Science and Data Management Plan (OSDMP) must address how publications, data, and software will be made available, see below. Proposers requiring a OSDMP are strongly encouraged to use the HPD OSDMP template, that may be downloaded as a Word document, from: https://science.nasa.gov/researchers/templates-heliophysic-division-appendix-b-roses-proposals.

For those program elements that require an OSDMP, its sufficiency will be evaluated as part of Merit and thus may have a bearing on whether or not the proposal is selected. Unless otherwise stated in the program element, the OSDMP will be placed in a 2-page section in the proposal PDF immediately following the references and citations for the Scientific/Technical/Management (S/T/M) section of the proposal and does not count against the page limit for the S/T/M Section. See https://science.nasa.gov/researchers/sara/faqs/OSDMP and the new SMD Open-Source Science Guidance at http://science.nasa.gov/oss-guidance. When appropriate or required by the program element, letters of support from the Heliophysics Data Archives: the Solar Data Analysis Center (SDAC), and the Space Physics Data Facility (SPDF) may be included in a Statements of Commitment and Letters of Support, Feasibility and Endorsement section of the proposal (see Table 1 of ROSES-24 regarding letters).

Individual program elements may provide instructions that amplify or supersede the default requirements described here. For example, for some program elements, the nature of the work is inexorably linked to the handling of data, so the OSDMP is part of the page-limited Scientific/Technical/Management (S/T/M) section of the proposal, e.g., B.12 Heliophysics Data Environment Emphasis.

The OSDMP should explain the roles and responsibilities of team members in accomplishing the plan. If funds are required for information management activities, these should be covered in the normal budget and budget justification sections of the proposal.
1.6.1 Data

Data needed to validate the scientific conclusions of peer-reviewed publications resulting from a ROSES award, particularly data underlying figures, maps, and tables must be made available at the time of publication. The remaining scientifically useful data must be made available by the end of the award, consistent with the OSDMP.

"Data" does not include laboratory notebooks, preliminary analyses, private communications, or certain other types of information that have been specifically exempted by SPD-41a.

In the case of a project that would produce no data, as defined above, or only data specifically exempted, the OSDMP must state that no data preservation or data sharing is needed, but must also explain why. In a case where no appropriate archive exists for a particular data set, the OSDMP should discuss alternative methods for making the data publicly available.

The OSDMP must contain the following elements, as appropriate to the project, in adequate detail for review:

- A description of data types, volume, formats, and (where relevant) standards;
- A description of the schedule for data archiving and sharing;
- A description of the intended repositories for archived data, including mechanisms for public access and distribution;
- A discussion of how the plan enables long-term preservation of data;

For more information about meeting these requirements, see 'Data Management and Sharing' in the SMD Open-Source Science Guidance. No later than 2025, SMD plans to provide additional options for the long-term hosting of data produced from SMD ROSES awards. This may include hosting at NASA or Federal data repositories, community-based repositories, or other instructions for how the data should be archived. Thus, researchers need not include the cost of public access to their data or storing their data beyond the end of the period of performance of their award in their budgets. Future guidance and instructions related to how to publicly share the data will be made available via the Scientific Information Policy website.

1.6.2 Software

Software needed to validate the scientific conclusions of a peer-reviewed publication resulting from an award, must be made available at the time of publication. The remaining scientifically useful software must be made available by the end of the award, consistent with the OSDMP.

For more information, see 'Software Management and Sharing' in the SMD Open-Source Science Guidance. The method of archiving software will not result in a weakness for proposals to ROSES-2024. No later than 2025, SMD plans to provide additional options for the long-term archiving of software produced from SMD ROSES awards. Thus, researchers need not include the cost of public access to their software, maintaining their software, or storing their software beyond the end of the period of performance of their award in their budgets. Future guidance and instructions related to how to publicly share software will be made available via the Scientific Information Policy website.
Policy website. Guidance on how to share software including providing a DOI is described in the SMD Open-Source Science Guidance.

1.6.3 Publications

As accepted manuscript versions of peer-reviewed publications (hereinafter "manuscripts") must be made available at the time of publication. There are two options for how to comply with this requirement: Either (1) the manuscript is individually uploaded to NASA PubSpace by the time of publication or (2) It is published in a journal indexed by either CHORUS, ADS, or NASA Science Explorer (scixplorer.org), and that makes it openly available at the time of publication that makes it openly available at the time of publication and also it is indexed by either CHORUS or ADS. For more information about meeting the requirements see "How to Share Publications" at https://science.nasa.gov/researchers/sara/faqs/OSDMP. SMD encourages publications to be published Open Access, and any cost to do so may be included in the budget. SMD also encourages publications to be posted on community appropriate preprint servers.

1.7 Data Eligibility

All spacecraft mission data must be available in the SDAC, SPDF, or an equivalent, publicly accessible archive, at least 30 days prior to the full proposal submission deadline, unless otherwise specified in the program call. If proposers are utilizing a publicly accessible archive other than SPDF or SDAC, then a link to that archive must be included in the proposal.

1.8 Organizing Science Reviews

Heliophysics has established two questions that must be answered for all proposals submitted to Elements in Appendix B on the NSPIRES cover page. The answers define the Research Regime and Science Topic for the proposal and help to organize the evaluation and peer review. Unless otherwise specified in the program call, the values will default to what is listed here. The default values for Research Regime are Sun, Heliosphere, Magnetosphere, Ionosphere-Thermosphere-Mesosphere (ITM) and System-Interdisciplinary. The default values for Science Topic are listed below.

1. Solar Interior
2. Photosphere
3. Solar Transient Events
4. Solar Atmosphere - Corona
5. Particle Acceleration, Transport, Modulation
6. Turbulence, Waves, Composition
7. Interplanetary CMEs / Magnetic Clouds
8. Outer Heliosphere - Interstellar Boundary
9. Dayside Magnetosphere
10. Inner Magnetosphere
11. Magnetotail
12. Ionosphere – Atmosphere Coupling
13. Neutral Atmosphere
14. Solar-Heliosphere Coupling
15. Solar Wind – Magnetosphere Coupling
16. Magnetosphere – Ionosphere Coupling
17. Solar–Ionosphere/Atmosphere Coupling
18. Space Weather
19. Multi/Inter-disciplinary

Note: Do not choose Heliosphere meaning Heliophysics; they are not synonymous. This wastes time and resources to redirect; such misdirected proposals may be returned without review.

1.9 Dual-anonymous Reviews

SMD is strongly committed to ensuring that the review of proposals is performed in an equitable and fair manner that reduces the impacts of any unconscious biases. To this end and motivated by a successful pilot program conducted for the Hubble Space Telescope, proposals for the Living with a Star Science, Heliophysics AI/ML-Ready Data, Supporting Research, and Heliophysics Guest Investigator Open programs will be evaluated using dual-anonymous peer review (DAPR) process in which the identities of proposers are not explicitly disclosed to the members on the review panel and the reviewers are not given information about the proposing teams or organizations until after the evaluation of the merit, relevance and cost reasonableness of the proposal. The overarching objective of DAPR is to mitigate unconscious bias in the evaluation of the proposal.

Proposers to LWS, H-ARD, HSR, and HGIO must adhere to the instructions in the call on how to prepare proposals so as to allow dual-anonymous peer review, and detailed instructions for the preparation of proposals will be posted on the NSPIRES page for this ROSES element and at https://science.nasa.gov/researchers/dual-anonymous-peer-review.

Proposers should consult the "Guidelines for Anonymous Proposals" document under "Other Documents" on the NSPIRES page for DAPR program elements for detailed instructions on writing proposals appropriate for dual-anonymous peer review. Neither Step-1, if required, nor Step-2/full proposals may include anything that identifies the names of investigators or their institutions. When submitting Step-2/full proposals all proposers must also upload a separate "Expertise and Resources Not Anonymized" (E&R) document, which is not anonymized. The "Guidelines for Anonymous Proposals" contains complete information on how to write this separate document.

The forms filled out on the NSPIRES web pages with Proposal Summary, Budget, Proposal Team and Program Specific and Business Data known as the NSPIRES "cover pages" will be partly hidden for the peer reviewers. The Proposal Summary must be anonymized but all other sections of the NSPIRES cover page should be completed as normal and NSPIRES will hide the identifying information from the reviewers. The proposal document must be anonymized, and proposers must upload a separate "Expertise and Resources Not Anonymized" document, that contains all of the personally (and organizational) identifying information. After the evaluation of the anonymized proposal has been finalized for all proposals, panelists will be provided with the E&R documents, typically for a subset of proposals that scored highly (depending on the grades and projected selection rates).
In order to meet the objectives of dual-anonymous peer review, review panels will be instructed to evaluate the anonymized proposals without taking into account the proposing team qualifications. As a final check, and only after the evaluation is finalized for all proposals, the panel will be provided with the E&R documents. The panel will assess the qualifications of the team and verify that all resources discussed in the proposal body are indeed available and assess the team capabilities required to execute a given proposed science investigation.

A summary of the key factors for PIs to keep in mind are:

- Step-1 and Step-2 Proposals may not include language that identifies the names of investigators or their institutions, as discussed in the Guidelines for Anonymous Proposals.
- PIs are required to upload along with their Step-2/full proposal an additional "Expertise and Resource Not Anonymized" PDF through NSPIRES as a separate upload when submitting the Step-2/full proposal.
- SMD understands that dual-anonymous peer review represents a major shift in the evaluation of proposals and, as such, there may be occasional slips in writing anonymized proposals. However, SMD reserves the right to return without review proposals that are particularly egregious in terms of the identification of the proposing team.

1.10 Citizen Science Projects

Citizen science is a form of open collaboration in which individuals or organizations participate voluntarily in the scientific process. Proposers to any ROSES program element are invited to incorporate citizen science and crowdsourcing methodologies into their submissions, where such methodologies will advance the objectives of the proposed investigation. Proposers who are including a Citizen Science element should select the NSPIRES checkbox indicating Citizen Science, to ensure an appropriate review of the citizen science methodology.

1.11 Standardized Templates

Proposers to all Appendix B Program Elements are strongly encouraged to use the standard Heliophysics templates for Current and Pending Support for PIs and all Co-Is, regardless of time commitment, and the template for the mandatory summary table of work effort. PDF, MS Excel and MS Word templates of this table and instructions can be found at https://science.nasa.gov/researchers/templates-heliophysical-division-appendix-b-roses-proposals.

1.12 High-Risk/High Impact

Proposers to any ROSES program element are invited to submit proposals that are high risk – high impact, or include high risk – high impact components, as appropriate for the scope or conduct of the investigation.

1.13 Award Types

NASA Heliophysics primarily awards grants, Inter-Agency Transfers (IATs), and awards to NASA centers, as these are the most appropriate to the nature of the work. These are the default award types for program elements in Appendix B, unless stated
otherwise in a specific program element. NASA does not anticipate awarding contracts in response to proposals submitted to program elements in Appendix B because it would not be appropriate for the nature of the work solicited.

2. Program Elements

2.1 Introduction

A brief description of each program element offered in the Heliophysics Research Program is given below. The intent of the following summaries is to give the prospective proposer some insight into the element’s purpose within the context of the overall program structure. Detailed descriptions of each element are to be found in Program Elements B.2 through B.21. Please note that the numbering and names of the program elements may have changed from ROSES last year.

2.2 Heliophysics Supporting Research

The Heliophysics Supporting Research (HSR) program solicits research investigations of significant magnitude that employ a variety of techniques to address Heliophysics goals and objectives. The investigations that will be of highest priority to the HSR program will be those that use data from current or historical NASA spacecraft, or from non-NASA data, together with theory, modeling and/or numerical simulation to address one of the Heliophysics Decadal Survey goals as summarized in Section 1. Innovative ideas and techniques are welcome. The Heliophysics Supporting Research program is described in Program Element B.2. HSR will be evaluated using Dual-Anonymous Review (see Section 1.9).

2.3 Heliophysics Theory, Modeling, and Simulations

The Heliophysics Theory, Modeling, and Simulations (HTMS) Program uses numerical simulations and modeling synergistically with data analyses and rigorous theory development to solve the fundamental problems of Heliophysics. The HTMS program is described in Program Element B.3.

The HTMS Program is not being solicited in ROSES-2024. It is anticipated that it will be next solicited no earlier than 2025.

2.4 Heliophysics Guest Investigators

The Heliophysics Guest Investigators Open (H-GIO) program is intended to maximize the scientific return from operating missions of the Heliophysics System Observatory (HSO) by providing support for research that is beyond the scope of work of the mission science teams. All H-GIO investigations must be intensive data analysis efforts that provide specific justification how any additional resources (e.g., simulations, secondary data sets, or machine learning tools) help analyze HSO observations. H-GIO was evaluated in recent years using Dual-Anonymous Review and this will continue this year (see Section 1.9). The Heliophysics Guest Investigators Open program (H-GIO) is described in Program Element B.4.

2.5 Living With a Star Science

The Living With a Star (LWS) Program emphasizes the science necessary to understand those aspects of the Sun and Earth’s space environment that affect life and
society. The ultimate goal of the LWS Program is to provide a scientific understanding of the system that leads to predictive capability of the space environment conditions at Earth, other planetary systems, and in the interplanetary medium. To ensure this, the LWS Science program solicits proposals for Focus Teams to conduct coordinated large-scale investigations that cross discipline and technique boundaries and have a direct impact on life and society. HSR will be evaluated using Dual-Anonymous Review (see Section 1.9). The details of the Living With a Star (LWS) Science program are described in Program Element B.5.

2.6 Living With a Star: Strategic Capabilities

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 to enable exploration of outer space and testing new mission concepts. The development of these models is generally conducted in terms of Strategic Capabilities and is described in Program Element B.6.

The LWS-SC Program is not being solicited in ROSES-2024. It is anticipated that it will be next solicited no earlier than 2025.

2.7 Space Weather Science Applications

In response to the National Space Weather Action Plan (SWAP), NASA established the Space Weather Science Applications Program (SWxSA). The component of SWxSA that addresses the aspect of transitioning knowledge between research and operations is reflected in the SWxSA Research-to-Operations-to-Research (R2O2R) program. For the purpose of this opportunity, NASA, NOAA, and NSF working under the tri-agency Space Weather MOU, have determined that the focus of this year’s call is open. Please note that the proposal, in order to demonstrate relevance to R2O2R, must address how the research will directly advance the information needed by users of space weather information in the proposed focus area. The Space Weather Science Applications R2O2R Program Element is not being solicited in ROSES-2024.

2.8 Heliophysics Technology and Instrument Development for Science

The Heliophysics Technology and Instrument Development for Science (HTIDeS) program seeks to advance the development of technologies and their application to enable investigation of key heliophysics science questions. This is done through incubating innovative concepts and development of prototype technologies. It is intended that technologies developed through HTIDeS then be proposed to H-LCAS, H-FOS, or H-FORT to mature by demonstration in a relevant environment. HTIDeS utilizes the following sub-elements:

- Laboratory Nuclear, Atomic, and Plasma Physics (LNAPP) Program: The LNAPP program supports studies that probe fundamental nuclear, atomic, and plasma physical processes and produce chemical and spectroscopic measurements that support spacecraft observations and atmospheric models.
• Instrument Technology Development (ITD) Program: This includes innovative technology development and instruments that may be proposed as candidate experiments for future space flight opportunities.

• Instrument Technology Development from Non-Heliophysics Technologists (ITD-NHT): This new sub-element includes innovative instrument and technology development that may be proposed as candidate experiments for future space flight opportunities. The goal of this sub-element is to invite technologists from outside our Heliophysics community who can infuse innovative and transformative ideas to enable future Heliophysics Science Goals and Objectives.

The HTIDeS program does not solicit Step-1 proposals or NOIs. Only a full proposal is solicited. HTIDeS with sub-elements LNAPP, ITD and ITD-NHT is described in Program Element B.8.

2.9 Heliophysics Low Cost Access to Space

Heliophysics Low Cost Access to Space (H-LCAS) was previously part of Flight Opportunities for Research and Technology (H-FORT) but now has been split out on its own. Like H-FORT, H-LCAS seeks to advance the development of technologies and their application to enable investigation of key heliophysics science questions. H-LCAS includes technology and associated science investigations that can be carried out with instruments flown on suborbital rockets, stratospheric balloons, or NASA airborne platforms, collectively referred to as Low Cost Access to Space. H-LCAS is described in Program Element B.9.

2.10 Heliophysics Flight Opportunities Studies

The Heliophysics Flight Opportunities Studies (H-FOS) solicits proposals for studies to enable application of new technologies (platform and/or instrumentation) to heliophysics flight missions. H-FOS awardees will receive a 12-month award to complete the study. NASA intends to award a range of studies across the spectrum of heliophysics science and mission cost. Investigations must be responsive to the science goals of the Heliophysics Division Science Goals and have identified a potential future mission.

H-FOS was previously part of Flight Opportunities for Research & Technology (H-FORT) but now has been split out on its own. After completion, H-FOS awardees can propose for a flight opportunity to, e.g., H-FORT (Section 2.11).

The H-FOS program does not solicit Step-1 proposals or NOIs. Only a full proposal is solicited. H-FOS is described in Program Element B.10.

2.11 Heliophysics Flight Opportunities for Science and Technology

Heliophysics Flight Opportunities for Science and Technology (H-FORT) is the flight opportunity for SmallSats and rideshare. H-FORT seeks to advance the development of technologies and their application to enable investigation of key heliophysics science questions. This is done through demonstration of innovative technologies and associated science investigations in a relevant environment. H-FORT includes technology and associated science investigations that can be carried out with instruments flown on SmallSats (including CubeSats) and payloads on the International Space Station (ISS), Department of Defense (DoD), or other rideshare opportunities.
The H-FORT program does not solicit Step-1 proposals or NOIs. Only a full proposal is solicited. H-FORT is described in Program Element B.11.

2.12 Heliophysics Data Environment Enhancements:

The goal of the Heliophysics Data Environment Enhancements (H-DEE) program is to enable breakthrough research in Heliophysics by providing both a state-of-the-art data environment and necessary supporting infrastructure to maximize the scientific return of the NASA missions. It is essential that observations be properly recorded, analyzed, released to the general public, documented, and rapidly turned into scientific results. The H-DEE program is described in Program Element B.12.

2.13 Heliophysics U.S. Participating Investigator:

The purpose of the Heliophysics U.S. Participating Investigator (H-USPI) program element is to solicit potential Heliophysics investigations in which investigators participate as a Co-Investigator (Co-I) for an instrument, experiment, or technology demonstration that is being built and flown by a sponsor agency other than NASA. The Heliophysics U.S. Participating Investigator program is described in Program Element B.13.

2.14 Early Career Investigators Program:

The Early Career Investigator Program (ECIP) in Heliophysics is designed to support outstanding scientific research and career development of scientists and engineers at the early stage of their professional careers. The program aims to encourage innovative research initiatives and cultivate diverse scientific leadership in Heliophysics. This program is designed to foster the empowerment, inspiration, and education of the next generation of space researchers. The ECIP Program is described in Program Element B.14.

2.15 Heliophysics Innovation in Technology and Science:

This Heliophysics Innovation in Technology and Science (HITS) Program element solicits proposals that advance the goals and objectives of NASA Heliophysics by conducting outstanding, innovative and novel ideas to advance Heliophysics research that can be accomplished in one year or the developed to the point that it is appropriate to be submitted to another ROSES element in a subsequent year.

Proposals will be accepted throughout the year at any time and evaluated quarterly. The HITS Program is described in Program Element B.15.

2.16 Heliophysics Artificial Intelligence/Machine Learning-Ready Data:

This Heliophysics artificial intelligence/machine learning (AI/ML)-Ready Data (H-ARD) Program element solicits proposals that enable the advancement of the goals and objectives of NASA Heliophysics by developing new tools and methods for the generation of AI/ML-ready datasets from existing research and mission data. H-ARD will be evaluated using Dual-Anonymous Review (see Section 1.9). The H-ARD program is described in Program Element B.16.
2.17 Interdisciplinary Science for Eclipse

When it is solicited, the Interdisciplinary Science for Eclipse program element supports development of new research or enhancement of existing research, applied to solar eclipses. When it is solicited, this element seeks proposals that would utilize the unique opportunity presented by the solar eclipse to study any relevant Heliophysics research topic, for example, a topic focused on the Sun or on the Ionosphere-Thermosphere-Mesosphere system. This program element supports scientific research and development and deployment of existing and/or new technology.

The Interdisciplinary Science for Eclipse program is not being solicited in ROSES-2024.

2.18 Living With a Star Tools and Methods

The Living With a Star (LWS) Tools and Methods (LWSTM) Program solicits tools, techniques and/or methods that enable critically needed science advances in the area of heliophysics research covered by LWS objectives. Proposed tools and/or methods must be "shovel-ready", that is, able to proceed expeditiously leading to completion in one and one half years. The LWSTM program is described in Program Element B.18.

The LWS-TM Program is not being solicited in ROSES-2024. It is anticipated that it will be next solicited in 2025.

2.19 Living With a Star Infrastructure

The Heliophysics Living with a Star Infrastructure (H-LWSIS) program solicits proposals to train and develop the next generation of heliophysicists to address complex cross-discipline system-wide problems that are central to understanding and modeling the Sun-Solar System connection. This element specifically covers the administration of the Jack Eddy Postdoctoral Fellowship (JEPF) Program over a period of 4 years and the management of the LWS Heliophysics Summer School (HSS). The LWSIS program is described in Program Element B.19.

The LWSIS Program is not being solicited in ROSES-2024. It is anticipated that it will be next solicited in 2026.

2.20 Heliophysics Tools and Methods

The Heliophysics Tools and Methods (HTM) program encompasses the software tools and method needs throughout Heliophysics, including Solar, Heliospheric, Magnetosphere, and Ionosphere/Thermosphere/Mesosphere (ITM). As part of a mission-oriented agency, the Tools and Methods (HTM) program preferentially seeks to fund those efforts that directly impact NASA missions or interpretation of their data. The HTM program is described in Program Element B.20.

2.21 Heliophysics Citizen Science Investigations

The primary goal of the Heliophysics Citizen Science Investigations (H-CSI) is to advance the use of citizen science in heliophysics scientific research, specifically to enhance science observations and return for the Heliophysics Big Year strategic initiative in 2023-2024. Investigations will develop and implement capabilities to augment and enhance NASA scientific data, knowledge, and capacity through voluntary
observations, interpretations, or other direct participation by members of the general public. The HCSI program is described in Program Element B.21.