B.5 HELIOPHYSICS LIVING WITH A STAR SCIENCE

NOTICE: Amended October 17, 2022. This amendment delays the Step-2 proposal due date for this program element due to the impact of Hurricane Ian. Invited Step-2 proposals are now due November 17, 2022

Corrected, July 22, 2022. The word "exclude" was removed from the first paragraph of Section 1.3. The word is retained as strikethrough so the change may be seen more readily.

Amended June 22, 2022. This amendment releases the final text for this program element, which had been listed as "TBD". Step-1 proposals are due September 8, 2022, and Step-2 proposals are due November 17 ~~10~~, 2022.

All proposers are to use the standard Heliophysics template for Current and Pending Support for the PI and all Co-Is, regardless of time commitment. Use of the DMP template is encouraged. See https://science.nasa.gov/researchers/templates-heliophysic-division-appendix-b-roses-proposals for more details.

1. Scope of Program

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. Every year the LWS Program solicits Focused Science Topics (FSTs) that address some part of this goal. This year's FSTs are described in Sections 1.1 and 2 - 3 below.

This goal poses two great challenges for the LWS program. First, the program seeks to address large-scale problems that cross discipline and technique boundaries (e.g., data analysis, theory, modeling, etc.); and second, the program will identify how this new understanding has a direct impact on life and society. Over time, the FSTs have provided advances in scientific understanding that address these challenges.

LWS is a component of the Heliophysics Research Program and proposers interested in this program element should read B.1 The Heliophysics Research Program Overview, for Heliophysics-specific requirements. Defaults for all ROSES elements are found in the ROSES 2022 *Summary of Solicitation* and for all NASA solicitations in the *Guidebook for Proposers*. The order of precedence is the following: This document (B.5) followed by B.1, followed by the ROSES *Summary of Solicitation*, and last the *Proposer's Guidebook*. Proposers should review all these resources to ensure compliance with Program requirements.

The LWS program goals are to:

1. Understand how the Sun varies and what drives solar variability.
2. Understand how the Earth and planetary systems respond to dynamic external and internal drivers.

3. Understand how and in what ways dynamic space environments affect human and robotic exploration activities.

The LWS Program seeks to make progress in understanding the complex Heliophysics system, focusing on the fundamental science of the most critical interconnections. Further information on the LWS Program can be found at the LWS website (http://lwstrt.gsfc.nasa.gov). The LWS Science program maintains a strategy with three basic components, namely, Strategic Capabilities, Focused Science Topics, and Cross-Disciplinary Infrastructure Building programs. Only the FSTs will be competed in this program element.

Further background material concerning relevant research objectives can be found on the LWS website, and in the following documents:

- The LWS TR&T SDT Report https://lwstrt.gsfc.nasa.gov/images/pdf/TRT_SDT_Report.pdf
- The LWS 10-Year Vision Beyond 2015 Report http://lwstrt.gsfc.nasa.gov/images/pdf/LWS_10YrVision_Oct2015_Final.pdf
- The Revised Strategic Science Areas https://lwstrt.gsfc.nasa.gov/assets/docs/lpag/LPAG_EC_report_2019_12_31.pdf
- The National Research Council Decadal Survey Report *Solar and Space Physics: A Science for a Technological Society* http://www.nap.edu/openbook.php?record_id=13060

1.1 Solicited Investigations

To be responsive, proposed investigations must have objectives suitable for one of the two following FSTs. Detailed descriptions of each FST are given in Sections 2 and 3.

The FSTs solicited for proposals this year are as follows:

1) Beyond F10.7: Quantifying Solar EUV Flux and its Impact on the Ionosphere – Thermosphere – Mesosphere System (described in Section 2); and
2) Coupling of the Solar Wind Plasma and Energy to the Geospace System (described in Section 3).

NASA desires a balance of research investigation techniques for each FST, including theory, modeling, data analysis, and simulations. This program element accepts proposals that lack a complete scientific study but instead describe a project that would enable or enhance the FST's activities (e.g., develop a data set or implement a model for use by the FST Team). Regardless of the project, all proposals must identify science questions responsive to the FST's goals that are addressed by the proposed work. FST teams will be formed from individual proposals that each address an aspect of the FST, and together cover the breadth of the FST (see Section 1.2 below).

A critical element in enhancing understanding and developing predictive capabilities is the determination of whether the model or data products being developed, and any associated simulations, are accurate and reliable. Consequently, a methodology for verification and validation of results, and quantification of uncertainty, is required as a key component of the proposed research. As mentioned below (Sections 2.4 3.4, and 4.3.5), all proposals must address data and model uncertainty. This is mentioned in Section 3.13 of the *NASA Guidebook for Proposers*, which indicates that all proposals

must address sources of error and uncertainties and what effect they may have on the robustness of potential results and conclusions.

1.2 Focused Science Teams

The selected investigators will form a Focused Science Team and will coordinate their research programs after selection of proposals. To foster the collaborations required to coordinate these team research efforts, one of the Principal Investigators (PIs) will serve as the Team Leader for the FST for which they proposed. The Team Leader will organize team meetings and will be responsible for producing a yearly report to NASA Headquarters describing team activities and progress in addition to the required annual progress report for their specific award.

Proposers wishing to serve as a Team Leader must state so in their proposal and must include a separate section describing their qualifications, interest, and approaches to team leadership (see Section 4.3.3). Recommendations for selection of Team Leaders will be made by the LWS Program Officer and final selections will be made by the Heliophysics selecting official. Guidance for the team development process will be provided by NASA after selection of the Team Leader.

Past experience has shown that Focused Science Teams usually need a year to get organized since team members may not have worked together before, followed by another three years to make significant progress on the FST. Thus, the expected duration of FST awards is four (4) years. While proposals with shorter duration are allowed, proposers are encouraged to propose up to four (4) years to ensure maximum overlap between individual contributions to the team efforts.

All proposers must include sufficient travel funds in their budgets to cover two team meetings per year. To leverage travel costs, one meeting per year may be held in conjunction with a major U.S. scientific meeting. Successful teams will participate in a Kickoff Workshop where the selected team members will meet and develop work plans for the anticipated 4-year period of performance, based on the requirements of the FST and the composition of the selected team.

1.3 Data Use in the LWS Program **[Corrected July 22, 2022]**

This program element has policies on the use of data in proposals that expand upon and supersede those given in B.1, the Heliophysics Research Program Overview. Data and data products necessary for successful completion of the proposed project must be in a publicly available archive at no cost at least thirty (30) days prior to the Step-2 deadline. This applies to both space-based and ground-based observations, as well as any data products derived from them. This 30-day requirement does not ~~exclude~~ apply to data products to be developed as part of a proposed study, only those existing in advance of Step-2 submission. Any questions about whether a data set or data product qualifies as publicly available must be submitted to the Program Officer of the element at least ten (10) days before the Step-1 deadline.

After an award is made, projects may incorporate new data that becomes available at no cost in a public archive, provided that their use does not alter the goals and objectives of the selected proposal. Any planned changes in the data used must be

described in the annual progress report submitted by the PI and approved by the LWS Program Officer.

While the inclusion of useful ground-based observations is allowed, proposals are expected to incorporate relevant space-based observations within the proposed investigation through, e.g., data analysis, model initialization, model validation, or other means. Regardless of the type of data that would be utilized in the proposed study (i.e., space-based, ground-based, or some combination thereof), the proposal must clearly demonstrate why the proposed data set or data sets are appropriate for addressing the proposed goals and objectives.

2. FST #1: Beyond F10.7: Quantifying Solar EUV Flux and its Impact on the Ionosphere – Thermosphere – Mesosphere System

2.1 Target Description

Solar extreme-ultraviolet (EUV) flux is a dominant heating and ionization source for the ionosphere – thermosphere – mesosphere (ITM) system. Solar activity fluctuates on several temporal scales – from minutes (flares) to days (27-day rotation) to decades (11-year cycle) – and initiates huge variations in the neutral density and temperature, ion and electron densities and temperatures, neutral winds, and electric fields in the ionosphere. Studies of the ITM often rely on the F10.7 index (solar radio flux at the wavelength of 10.7 cm) as a primary solar driver. This index does not directly describe the solar input in the EUV wavelength range below 102.5 nm that is directly responsible for much of the ionization of the thermosphere.

Recognizing that both periodic variations of EUV flux and transient events like solar flares are both important energy inputs to the ITM system, proposed investigations may examine a wide range of temporal scales. With EUV data from numerous satellite observations (e.g., SOHO/SEM, TIMED/SEE, SDO/EVE, GOES/EXIS, Hinode/EIS, IRIS, and others), new indices (e.g., S10.7, Y10.7, Mg II, Lyman-Alpha) and new proxies from solar irradiance models (SIP E10.7, FISM2 EUV) have become available within the last two decades. These indices and proxy measures can better characterize solar energy input to the thermosphere than the traditionally used F10.7 index.

The impact of using improved EUV indices has been studied in the thermosphere, and their usage substantially improves thermospheric density models. However, the impact of these indices on a wide range of ITM parameters (e.g., peak density of the F2 layer, total electron content (TEC), electron density in the D-region and topside ionosphere, nitric oxide concentration) is much less known/understood. Predictive capability requires detailed knowledge of the physical processes by which solar forcing impacts all key aspects of the ITM system.

2.2 FST #1 Science Goals and Objectives

The overarching goal of FST #1 is to develop the ability to reliably specify and predict the effects of solar variability on the ITM system. Specific objectives include: 1) identifying new and/or improved EUV indices for driving model predictions of ITM structure; 2) improved understanding of how particular portions of the EUV spectrum influence specific aspects of ITM structure (e.g., ionospheric profile shape, thermospheric composition, density, or temperature); and 3) exploring new EUV

observations characterizing the interactions between the ionosphere and thermosphere. Studies that validate predictions of ITM properties in response to rapid variations in EUV (e.g., from solar flares) will be necessary to evaluate the success of alternatives to F10.7.

2.3 FST #1 Types of Investigations

FST #1 encourages the innovative use of data, theory, models and simulation, as well as the development of tools and analysis techniques, in combinations necessary to address the science goals. Proposals to this FST may leverage advances brought by observations from one or more NASA satellite missions focusing on solar radiation inputs to the ITM (e.g., TIMED/SEE, SDO/EVE, GOES/EXIS, Hinode/EIS, IRIS, and others) in combination with observations of the ITM from both space-based (e.g., TIMED/SABER, GOLD, ICON, COSMIC, and others) and ground-based instruments (e.g., GNSS receivers, incoherent scatter radars, ionosondes) to enable studies of solar flux influences on the ITM system. Proposals focusing on model validation, both in EUV flux specification and in ITM modeling of EUV-driven phenomena, are also encouraged. Types of investigations addressing FST #1 objectives listed in Section 2.2 may include, but are not limited to:

- Understanding connections between observed EUV spectral irradiance variations and observed ITM responses;
- Development and testing of new solar spectral models for specification and prediction of ionospheric and thermospheric parameters;
- Development of new machine learning techniques that can improve the information content of EUV irradiance observations, indices, and proxies for historical (i.e., retrospective analysis) or forecast applications.
- Improving state-of-the-art thermospheric density prediction models through innovative use of EUV observations/indices and space-based density data

3. FST #2: Coupling of the Solar Wind Plasma and Energy to the Geospace System

3.1 Target Description

FST #2 seeks to improve our understanding of the flow of solar wind plasma and energy from the Sun into the geospace environment. The driving of the magnetosphere – ionosphere – thermosphere geospace system by the solar wind is fundamental to any understanding of magnetospheric physics and space weather. Currently there are significant gaps in understanding of the physical processes coupling these different regions of the geospace system, which collectively impede development of predictive capabilities. While it is well established that the dayside reconnection rate largely controls the degree of coupling between the solar wind and the geospace system, whether the reconnection rate is controlled by local plasma physics or by broader global processes remains an open question. Additionally, there is a need to quantify the possible role that plasma of magnetospheric and ionospheric origin plays in reducing the rate of dayside reconnection. The variability and turbulence within the solar wind and magnetosheath may also impact the efficiency of reconnection; however, the physics of these processes is not well understood, and their relative roles have not been adequately quantified. The types of solar wind variability that may lead to higher levels of magnetospheric coupling and increased geoeffectiveness are important to

understand. Additionally, the spatial extent of the reconnecting region at the dayside magnetopause greatly impacts the transfer of energy into the magnetosphere, yet it remains poorly known.

The coupling of energy and plasma into the magnetosphere may also take place through other physical processes outside of reconnection. These may include viscous interactions or boundary effects such as Kelvin-Helmholtz waves, or other processes. How these physical mechanisms may control the rate of plasma entry into the magnetosphere is not well understood.

There are also several unresolved questions associated with post-reconnection coupling. These include understanding how polar cap saturation may work and understanding how important solar wind coupling is to the polar cap ionosphere. Such coupling pathways may include large-scale reconfiguration of the magnetosphere's shape and dynamics.

3.2 FST #2 Science Goals and Objectives

The overarching goal of FST #2 is to investigate processes by which the solar wind drives the magnetosphere – ionosphere – thermosphere system. Specific objectives of this FST include: 1) identifying the parameters controlling the transfer of energy through dayside magnetopause reconnection; 2) establishing the role of ionospheric and magnetospheric plasmas in solar wind – magnetosphere coupling; 3) investigating the physical processes controlling non-reconnection coupling; 4) understanding the role of solar wind fluctuations in the coupling of the solar wind to the Earth; and 5) understanding the post-reconnection reconfiguration of the magnetosphere and ionosphere system in response to extreme solar wind–magnetosphere coupling.

3.3 FST #2 Types of Investigations

Proposals to FST #2 may include, but are not limited to, coupled efforts of theory, numerical and other advanced modeling and simulation techniques, data assimilation, innovative data analysis, and data – model comparisons to understand global properties of magnetopause reconnection and energy transfer from the solar wind into the magnetosphere. Multifaceted approaches may include constraining a model with observations or employing kinetic or hybrid models or components. Machine learning and system science tools may also be appropriate. Diverse measurements of the solar wind, the magnetosheath, the magnetosphere, ionospheric convection, and geomagnetic activity may need to be combined to study the transfer of energy and plasma through the magnetopause. Appropriate datasets may include MMS, THEMIS, Cluster, ACE, WIND, Van Allen Probes, and GEOTAIL, among others. Experimental datasets may also be combined to quantify the transport of plasma from the ionosphere to the magnetopause in response to solar wind driving.

4. Submission and Evaluation Guidelines

Each PI, or the Science PI if applicable, is allowed to submit one and only one proposal to this program element. The expectation is that the PI (or Science PI) will invest at least 20% of their time per year to the investigation.

In addition to the general requirements and restrictions (e.g., in Table 1 of the *ROSES-2022 Summary of Solicitation* and in B.1 Heliophysics Research Program Overview) this program element has specific compliance constraints for both format (e.g., Sections 4.2.1 and 4.3.1) and content, e.g., involving data (see Sections 1.3 and 4.3.4) and use of the standard Heliophysics template for Current and Pending Support for the PI and all Co-Is, regardless of time commitment. These compliance rules ensure fairness and are enforced strictly by the Heliophysics Division. Proposals that are deemed noncompliant may be returned without review or declined following review if violations are found during the evaluation process.

4.1 Two-Step Submission Process

To provide adequate notice to potential reviewers, this program uses a "binding" two-step proposal submission process described in Section IV(b)vii of the *ROSES-2022 Summary of Solicitation*.

In the two-step process a Step-1 proposal is required. Because potential reviewers are solicited based on the Step-1 proposal, investigators may not be added to the proposal team 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 cannot be changed such that they would significantly affect the scientific or technical expertise required to properly evaluate a proposal.

4.2 Step-1 Proposals

A Step-1 proposal is required and must be submitted electronically by the Step-1 due date given in Tables 2 and 3 of *ROSES-2022*. The Step-1 proposal must be submitted by an Authorized Organizational Representative (AOR) from the PI institution. No budget or other uploaded files are required. Step-1 proposals will be checked for compliance, but they will not be evaluated. Only proposers who submit a Step-1 proposal and who are invited are eligible to submit a Step-2 (full) proposal.

Submission of a Step-1 proposal does not obligate the offerors to submit a Step-2 (full) proposal.

4.2.1 *Step-1 Proposal Format*

The Step-1 proposal is restricted to a 4,000-character Proposal Summary text box on the NSPIRES web interface cover pages. It must include the following information:

- A description of the science goals and objectives to be addressed by the proposal;
- A brief description of the methodology to be used to address the goals and objectives;
- A brief description of the relevance of the proposed study to the scientific objectives of the FST, and the potential contributions of the proposed study to the Focused Science Team's effort.

No PDF attachment is required or permitted for Step-1 proposal submission. Proposers will be notified by NSPIRES whether they are invited to submit their Step-2 proposals. Proposers are strongly encouraged to provide names and contact information of up to five experts qualified to review their proposal. These experts must not be from the

institutions of the PI or Co-Is. This information can be supplied in response to NSPIRES cover page questions at the time of submission of the Step-1 proposal.

4.2.2 *Step-1 Compliance Criteria*

Step-1 proposals may be declared noncompliant if they fail to meet the submission guidelines or if they are outside the scope of either the LWS Science program or the specific FST selected by the proposer. PIs of noncompliant proposals will not be invited through NSPIRES to submit the associated Step-2 proposal and will be notified through NSPIRES to this effect.

4.3 Step-2 Proposals

A Step-2 (full) proposal must be submitted electronically by the Step-2 due date given in Tables 2 and 3 of the *ROSES-2022 Summary of Solicitation*. The Step-2 proposal must be submitted by an Authorized Organizational Representative (AOR) from the PI institution. A budget and other specified information is required.

Only proposers who submit a Step-1 proposal and who are invited are eligible to submit a Step-2 (full) proposal. Proposers that have received a noncompliance letter in response to their Step-1 proposal are not eligible to submit a Step-2 proposal.

4.3.1 *Step-2 Proposal Format*

All proposals submitted to ROSES must strictly conform to the formatting instructions specified in Section IV(b)ii of the *ROSES-2022 Summary of Solicitation* except where superseded by the requirements in this program element. Proposals that violate these instructions may be returned without review or declined following review if violations are found during the evaluation process.

Proposals are restricted to fifteen (15) pages for the Science/Technical/Management section.

Proposals must include a Data Management Plan (DMP), as described in Section 1.5 of B.1, the Heliophysics Research Program Overview. The Data Management Plan must be placed in a separate section, not to exceed two (2) pages in length, titled "Data Management Plan" immediately following the references and citations for the Science/Technical/Management section. The Data Management Plan does not count against the 15-page limit for the Science/Technical/Management section. Use of the DMP template is encouraged. See https://science.nasa.gov/researchers/templates-heliophysic-division-appendix-b-roses-proposals.

4.3.2 *Required Additional Section in Step-2 Proposal: Proposed Contribution to the Focused Science Team Effort*

Proposals to this program element must also address the proposed contribution to the Focused Science Team effort in a separate section, not to exceed two (2) pages in length, titled “Proposed Contribution to the Focused Science Team Effort”, immediately following the Data Management Plan section of the proposal. Formatting requirements for this section are the same as for the Science/Technical/Management section. This section on Proposed Contribution to the Focused Science Team Effort does not count against the 15-page limit for the Science/Technical/Management section. Proposals that fail to address the proposed contribution to the Focused Science Team effort may be

declared noncompliant and will typically be returned without review or declined following review if the lack of this section is discovered during the evaluation process.

This section must summarize the following three topics:

- The relevance of the proposed study to the scientific objectives of the FST outlined in Sections 2.2 or 3.2;
- The potential contributions of the proposed study to the Focused Science Team's effort outlined in Sections 2.3 or 3.3; and
- Metrics and milestones for determining the successful progress and outcome of the proposed research.

This summary must describe the goals of the proposed project and why they are aligned with the FST goals outlined in Sections 2.2 or 3.2. For proposals that address a Type of Investigation that is listed in Sections 2.3 or 3.3, this summary must also describe briefly how the proposed investigation addresses one or several of those investigations.

For proposals that address a type of investigation that is NOT listed in the FST description, the summary must briefly describe the proposed Type of Investigation and how the proposed investigation will meet the FST Goals and Measures of Success.

In addition, all proposers are expected to provide a set of metrics that they will use to identify progress toward their proposed goals. Proposers must also provide a set of milestones that should indicate the anticipated timing of the major achievements during the course of the proposed study.

The review panel will only consider material in this section when the relevance of the proposal to the Focused Science Team effort is evaluated (see Section 4.3.4).

4.3.3 *Optional Additional Section in Step-2 Proposal: Proposed Team Leader Contribution*

Proposers wishing to serve as a Team Leader must describe the proposed team leader activities in a separate section, not to exceed one (1) page in length, entitled “Proposed Team Leader Contribution” (see Section 1.2). When included, this section should follow the section on “Proposed Contribution to the Focused Science Team Effort” described in Section 4.3.2. This section on Team Leader Contribution does not count against the 15-page limit for the Science/Technical/Management section.

4.3.4 *Step-2 Compliance*

Noncompliant Step-2 proposals will be returned without review or may be declined after review if the noncompliance is found during the evaluation process. Step-2 proposals may be declared noncompliant if:

- The title has substantially changed from that of the Step-1 proposal;
- Investigators have been added since the Step-1 proposal without prior approval of the Program Officer;
- The science goals and objectives have substantially changed from that of the Step-1 proposal;

- The proposal has the same (or essentially the same) team and objectives as a Step-2 (full) proposal currently submitted to or selected by another Heliophysics program in the ROSES-22 announcement;
- The proposal violates the restrictions in Section 1.3 regarding use of data; or
- The proposal violates the formatting instructions in Section 4.3.1.

4.3.5 *Step-2 Evaluation Criteria*

Compliant proposals will be evaluated according to three main criteria: (1) Intrinsic Merit, (2) Potential Contribution to the Focused Science Team Effort (Relevance), and (3) Cost Reasonableness. The data management plan, described in Section 1.5 of B.1, the Heliophysics Research Program Overview, will be evaluated as part of Merit. The Intrinsic Merit and Cost criteria will be evaluated primarily as specified in the *ROSES-2022 Summary of Solicitation* and defined in the *NASA Guidebook for Proposers*, but Relevance is handled differently. Clarifications and additions specific to this program element are listed below.

The evaluation of intrinsic merit will include the following:

- Scientific Merit: Compelling nature and scientific priority of the proposed investigation's science goals and objectives, including the importance of the problem within the broad field of Heliophysics; the unique value of the investigation to make scientific progress in the context of current understanding in the field, and the importance of carrying out the investigation now; and
- Technical Merit: Appropriateness and feasibility of the methodology, including the appropriateness of the selected data, models, and analysis for completing the investigation and the feasibility of the methodology for ensuring scientific success.

The treatment of uncertainty will be evaluated as a methodology issue (intrinsic merit) and the review panel will assign a strength or weakness based on the treatment presented in the proposal. Proposers are free to choose any appropriate method of uncertainty analysis or validation of results, but it must be clearly addressed in the body of the proposal. Proposals that fail to address uncertainty will be assigned a Major Weakness in the evaluation and may be considered unselectable.

Intrinsic Merit and Relevance will be evaluated separately. Based on the above two factors (Scientific and Technical Merit), the evaluation will consider the overall potential science impact and probable success of the investigation and an adjectival grade for Intrinsic Merit will be assigned.

The evaluation of the potential contribution to the Focused Science Team effort (Section 4.3.2) will serve as the Relevance evaluation and a separate adjectival grade for Relevance will be assigned.

The final adjectival grade assigned to the overall evaluation will be the lower of the two adjectival grades for Intrinsic Merit and Relevance.

Evaluation of Cost Reasonableness will include a comparison of the scope of the proposed study to the proposed resources (personnel-time allocated, necessary computer resources, etc.). The panel will provide feedback to SMD but will not assign a

grade and this information will be considered by the Heliophysics selecting official during the selection process.

5. Award Types

The Heliophysics LWS Science program will only award funds through three vehicles: (1) grants, (2) interagency transfers, and (3) awards to NASA centers. This call will not award contracts, as it is not appropriate for the nature of the work. See Section IIa of the *ROSES-2022 Summary of Solicitation* for more information on award types.

6. Available Funds

Given the strategic nature of LWS, and the fact that strategically feasible tasks require sufficient investment, it is anticipated that FST proposals will have annual budgets in the range of $180K - $250K per year. (This includes fully encumbered Civil Servant labor, where appropriate.) It is left to individual PIs to decide whether a strategically feasible award size could be achieved by increased collaborative efforts, greater time commitment of investigators, or a combination of the two. PIs should be cognizant, however, that verification of the level of effort versus the actual work proposed will be part of the review panel process. Given the submission of proposals of adequate number, merit, and range of investigative techniques, NASA anticipates forming teams of ~5-7 selections for each of the two FST topics.

Team Leader activities should not be included in the proposal budget. The Team Leader will receive up to an additional $25,000 per year to support their leader activities, and the Team Leader's budget will be revised during final award negotiations.

7. Summary of Key Information

Expected annual program budget for new awards	~ $2.5M, see also Section 6, above.
Number of new awards pending adequate proposals of merit	~ 10-14, see also Section 6, above.
Maximum duration of awards	4 years
Due date for Step-1 proposals	See Tables 2 and 3 of this ROSES NRA
Due date for Step-2 proposals	See Tables 2 and 3 of this ROSES NRA
Planning date for start of investigation	No earlier than 6 months after the Step-2 proposal due date.
Page limit for the central Science/Technical/Management section of proposal	15 pages; up to 2 extra pages each for required separate sections describing the Data Management Plan (4.3.1) and the Proposed Contribution to the Focused Science Team Effort (4.3.2), and up to 1 extra page for an optional separate section for proposers to be a Focused Science Team Leader (see Section 4.3.3). See also Table 1 of *ROSES-2022* for the default components of a ROSES proposal.
Relevance	Proposals that are relevant to the FSTs in this program element are, by definition, relevant to

	NASA. See Section 4.3.4 regarding evaluation criteria.
General information and overview of this solicitation	See the *ROSES-2022 Summary of Solicitation*.
General requirements for content of proposals	See Section 3 of the *NASA Guidebook for Proposers* and Section IV and Table 1 of *ROSES-2022*.
Detailed instructions for the submission of proposals	See NSPIRES Online Help, Sections 3.22-4.4 of the *NASA Guidebook for Proposers* and Section IV(b) of *the ROSES-2022 Summary of Solicitation*.
Submission medium	Electronic proposal submission is required; no hard copy is permitted.
Web site for submission of proposals via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposals via Grants.gov	https://www.grants.gov/ (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH22ZDA001N-LWS
Points of contact concerning this program both of whom share the following postal address: Heliophysics Division Science Mission Directorate National Aeronautics and Space Administration Washington, DC 20546-0001	John McCormack Telephone: (202) 422-2796 Email: john.p.mccormack@nasa.gov Simon Plunkett Telephone: (202) 358-2034 Email: simon.p.plunkett@nasa.gov