

APPENDIX D. ASTROPHYSICS RESEARCH PROGRAM

D.1 ASTROPHYSICS RESEARCH PROGRAM OVERVIEW

1. Introduction

The objectives of research solicited in program elements described in program elements D.2 through D.14 of this NASA Research Announcement (NRA) are focused on achieving the goals of the Science Mission Directorate's Astrophysics Research Program, as defined in the *NASA Science Plan* (available at <http://science.nasa.gov/about-us/science-strategy>). Proposers to the elements described in Appendix D are encouraged to read this *NASA Science Plan* to gauge the relevance of their research to the Astrophysics Research Program.

The *NASA Guidebook for Proposers* and the *ROSES Summary of Solicitation* (Section IV) provide clear and specific requirements for the format of proposals submitted in response to this solicitation: page limits, acceptable font sizes, line spacing, margins, etc. See also Table 1 of the *ROSES Summary of Solicitation*. Some of the program elements listed below also include formatting requirements. These requirements have been developed to ensure a level playing field for all proposers. The Astrophysics Division takes these requirements seriously, and proposals found to violate them will be penalized, even to the extent of not being evaluated or considered for funding. It is the responsibility of the proposer to ensure that a submission complies with all formatting requirements.

Proposers are reminded that it is the PDF version of their proposal in NSPIRES that will be judged for compliance. In rare cases, cross-platform translation of PDF documents can alter the formatting of a document. To ensure that they still conform to all formatting requirements, proposers are strongly urged to download copies of all documents after upload to NSPIRES.

1.1 Data Management Plans and Archiving

New in ROSES-2020: The data management plan (DMP) will be evaluated as part of the Intrinsic Merit of the proposal and must be included in a special section (see below).

Most proposals to ROSES will require a data management plan (DMP) or an explanation of why one is not necessary given the nature of the work proposed. Instrument development programs are an exception. Strategic Astrophysics Technology (SAT; D.7) and Nancy Grace Roman Technology Fellowship (RTF; D.8) are exempted from providing a DMP at all, under the presumption that no significant research data will be generated. However, even if a DMP is not required with the proposal, if peer-reviewed publications result from the award then any data behind figures or tables must be available electronically at the time of release, ideally in supplementary material with the article and code developed should be made publicly available when it is practical and feasible to do so, and when there is scientific utility in doing so.

Starting in ROSES-2020, the default presumption is that when a DMP is required, the sufficiency of the data management plan will be part of Merit and thus may have a bearing on whether or not the proposal is selected.

The DMP must cover any data needed to validate the scientific conclusions of peer-reviewed publications, particularly data underlying figures, maps, and tables. It also needs to cover any other data and software that would enable future research or the replication/reproduction of published results.

"Data" does not include preliminary and other unpublished data, data in prepublication documents, private communications, or certain other types of information that have been specifically exempted from the DMP requirement.

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

The DMP 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;
- A discussion of roles and responsibilities of team members in accomplishing the DMP. (If funds are required for data management activities, these should be covered in the normal budget and budget justification sections of the proposal.)

DMPs will be reviewed as part of the overall NASA research proposal review process. Proposals that do not address each of these items in their DMP, even if determined to be selected or selectable for funding, may not be funded until an adequate DMP is submitted. Funded researchers, research institutions, and NASA centers are responsible for ensuring and demonstrating compliance with the DMPs approved as part of their awards. Awardees who do not fulfill the intent of their DMPs may have continuing funds withheld and this may be considered in the evaluation of future proposals.

For some program elements, the nature of the work is inexorably linked to the handling of data so DMP is part of the page limited for Scientific/Technical/Management (S/T/M) section of the proposal, e.g., D.2 Astrophysics Data Analysis (ADAP). With the exception of those elements where it explicitly says otherwise, all proposals to any of the ROSES elements that require DMPs must place it in a special section of the proposal, not exceed two pages in length entitled "Data Management Plan" immediately following the references and citations for the S/T/M portion of the proposal. The two-page DMP section does not count against the 15-page limit of the S/T/M section. Formatting requirements for DMPs are the same as for the S/T/M section. For programs that use the 2-phase submission process (Guest Investigator/Observer/Scientist programs D.5, D.6, and D.9-D.12) no DMP is required.

The DMP must cover any data needed to validate the scientific conclusions of peer-reviewed publications, particularly data underlying figures, maps, and tables. It also

needs to cover any other data and software that would enable future research or the replication/reproduction of published results.

Software, whether a stand-alone program, an enhancement to existing code, or a module that interfaces with existing codes, created as part of a ROSES award, should be made publicly available when it is practical and feasible to do so, and when there is scientific utility in doing so. Stand-alone code that is not straightforward to implement, or whose utility is significantly outweighed by the costs to share it, is not expected to be made available. This expectation extends to three types of software, defined as follows:

<u>Short Name</u>	<u>Name</u>	<u>Description</u>	<u>Examples</u>
Libraries	Libraries and toolkits	Generic tools implementing well-known algorithms, providing statistical analysis or visualization, and so on, that are incorporated in other software categories.	Numerical Recipes, NumPy, general FFTs, LAPACK, scikit-learn, AstroPy, GDAL
Analysis software	Analysis, post-processing, or visualization software	Generalized software (not low-level libraries) used to manipulate measurements or model results to visualize or gain understanding.	Stand-alone image processing, topology analysis, vector-field analysis, satellite analysis tools, and so on
Frameworks	Modeling frameworks	Multicomponent software systems that incorporate a variety of models and couple them together in a complex way.	Community Earth System Model (CESM) is a collection of coupled models including atmospheric, oceanographic, sea ice, land surface, and other models

SMD expects that the source code, with associated documentation sufficient to enable use of the code, will be made publicly available as Open Source Software (OSS) under an appropriately permissive license (e.g., Apache-2, BSD-3-Clause, GPL). This includes all software developed with SMD funding used in the production of data products, as well as software developed to discover, access, visualize, and transform NASA data. OSS is defined as software that can be accessed, used, modified, and shared by anyone. Awardees will not be required to continue maintenance of their software beyond the submission of the software to an appropriate repository

1.2 Dual-Anonymous Peer Review

Beginning in ROSES-2020, proposals submitted to some program elements within the Astrophysics Research Program will be evaluated using a dual-anonymous peer review (DAPR) process in which, not only are proposers unaware of the identity of reviewers, but the reviewers are not told the proposing teams or organizations until after they have evaluated the scientific merit of all of the anonymized proposals. The overarching objective of dual-anonymous peer review is to reduce unconscious bias in the

evaluation of the merit of a proposal. This is described in Sections IV(b)i and VI(b) of the ROSES-2020 *Summary of Solicitation* and the descriptions for each of these elements provides instructions on how to prepare 'anonymized' proposals, a [link to a special web FAQ on this subject](#), and each element has a corresponding "Guidelines for Anonymous Proposals" document located on its NSPIRES page. DAPR will be applied to proposals submitted to D.2 Astrophysics Data Analysis and all Astrophysics Guest Investigator/Observer/Scientist programs (D.5, D.6, and D.9-D.12).

Unless otherwise noted in the individual program elements, the Astrophysics Division does not anticipate awarding contracts in response to proposals submitted to program elements in Appendix D, because it would not be appropriate for the nature of the work solicited. If a prospective proposer to a program element that excludes contracts thinks that their work should be a contract, they should communicate with the point of contact for that program element and cc sara@nasa.gov.

The program elements included as of the release date of this ROSES NRA are described below. Abstracts of previously selected investigations may be found online at <http://nspires.nasaprs.com/> by choosing "Solicitations" followed by "Closed/Past Selected", searching on the name or abbreviation of the program (e.g., ADAP), and downloading the selections PDF file from the home page of that program element.

2. Prohibition on Duplicate Proposals

Proposers may not submit full proposals for the same, or essentially the same, work to more than one program element described here concurrently. This prohibition is active for a particular submitted proposal until the PI is notified through NSPIRES that the proposal was 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-2019 proposal may not be submitted in response to ROSES-2020). 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.

If a second proposal contains substantive changes in areas that are critical to the intrinsic merit evaluation, such as the goals, objectives, or methodology, then it is not considered to be a duplicate proposal.

Changes to a proposal that would fall outside of the merit evaluation are not considered substantive, and two proposals with only changes in these areas may be considered duplicates. Examples of proposal sections not considered in merit evaluation include:

- Current and pending support section;
- Relevance statement;
- Budget section; and
- Data management plan.

In addition, minor changes to aspects of a proposal covered by the merit evaluation (team, concepts, implementation, target, etc.) may not be considered substantive.

If it is unclear if changes to a proposal are substantial enough for that proposal to not be considered a duplicate proposal, or it is unclear to which program a proposal should be

submitted, proposers should contact the point of contact for the program element most likely to be appropriate for the proposal, before the proposal deadline.

3. Astrophysics Data Analysis

The Astrophysics Data Analysis Program (ADAP; program element D.2) supports research with a primary emphasis on the analysis of archival data from current and past NASA space astrophysics missions. The magnitude and scope of the archival data from those missions enables science that transcends traditional wavelength regimes and allows researchers to answer questions that would be difficult, if not impossible, to address through an individual observing program. The program now also supports the analysis of publicly available data from the Neutron star Interior Composition Explorer (NICER), the Transiting Exoplanet Survey Satellite (TESS), and some approved Guest Observer (GO) programs using Spitzer, even if those observations have yet to be executed, or the data are still within their proprietary period. Proposals to D.2 ADAP will be evaluated using dual-anonymous peer review, as mentioned in Section 1 above.

4. Astrophysics Research and Analysis

The Astrophysics Research and Analysis program (APRA; program element D.3) supports suborbital and suborbital-class investigations, development of detectors and supporting technology, and laboratory astrophysics. Basic research proposals in these areas are solicited for investigations that are relevant to NASA's programs in astronomy and astrophysics, including the entire range of photons, gravitational waves, and particle astrophysics. The emphasis of this solicitation is on technologies and investigations that advance NASA astrophysics missions and goals. Projects devoted to technology development efforts (Detector Development and Supporting Technology categories) that do not generate scientific data need not provide a data management plan and proposers may simply cite this statement as the entirety of their Data Management Plan.

5. Astrophysics Theory

The Astrophysics Theory Program (ATP; program element D.4) supports theoretical investigations or modeling of the astrophysical phenomena targeted by past, current, or future NASA astrophysics space missions. Laboratory work related to NASA strategic goals in gravitation and fundamental physics is now supported in the Astrophysics Research and Analysis program (APRA; program element D.3). Theoretical work pertaining to atomic and molecular astrophysics and other topics directly related to Laboratory Astrophysics should also be proposed to APRA. Beginning in ROSES-2017, the Astrophysics Theory Program (ATP) element of ROSES converted to soliciting proposals on a biennial basis. Thus, NASA did solicit ATP proposals as part of ROSES-2019, but is not soliciting ATP proposals in ROSES-2020. ATP proposals will be solicited in ROSES-2021.

6. Astrophysics General Observer / General Investigator Programs

Five program elements support science investigations that require and/or support new data obtained with currently operating NASA astrophysics space missions. Guest investigator programs are included for the Neil Gehrels Swift Observatory gamma-ray

burst explorer (program element D.5), the Fermi Gamma-ray Space Telescope (program element D.6), the Nuclear Spectroscopic Telescope Array (NuSTAR) (program element D.9), the Transiting Exoplanet Survey Satellite (TESS, program element D.10), and the Neutron star Interior Composition Explorer (NICER, program element D.11).

Beginning in ROSES-2020, all the above General Observer / General Investigator Programs will be evaluated using dual-anonymous peer review, Section 1, above.

Guest investigator programs for the Hubble Space Telescope (<http://www.stsci.edu/hst/>), the Chandra X-ray Observatory (<http://cxc.harvard.edu/>), and the Stratospheric Observatory for Infrared Astronomy (SOFIA) (<https://www.sofia.usra.edu/>) are solicited separately by the respective science centers of those missions.

7. Strategic Astrophysics Technology

The Strategic Astrophysics Technology program (SAT; program element D.7) supports focused development efforts for key technologies to the point at which they are ready to feed into major missions in the three science themes of the Astrophysics Division: Exoplanet Exploration, Cosmic Origins, and the Physics of the Cosmos. This program is specifically designed to address middle technology readiness level (TRL) "gaps" between levels 3 and 6: the maturation of technologies that have been established as feasible, but which are not yet sufficiently mature to incorporate into flight missions without introducing an unacceptable level of risk. NASA does not require a data management plan for proposals to SAT.

8. Nancy Grace Roman Technology Fellowship Program

The goals of the Nancy Grace Roman Technology Fellowship (RTF) program in Astrophysics are to provide early-career researchers the opportunity to develop the skills necessary to lead astrophysics flight instrument development projects, including suborbital investigations, in preparation to become principal investigators (PIs) of future astrophysics missions; to develop innovative technologies for space astrophysics that have the potential to enable major scientific breakthroughs; and to foster new talent by putting early-career instrument builders on a trajectory towards long-term positions.

The RTF program, as described in program element D.8, now consists of two components with two different submission procedures. The first component is a one-page application from an eligible early-career individual to be named a Roman Technology Fellow. The application is submitted as part of a proposal submitted to the Astrophysics Research and Analysis (APRA) or Strategic Astrophysics Technology (SAT) Program described in program elements D.3 and D.7 of this ROSES solicitation. The second component is the subsequent submission of a proposal for Fellowship Funding by a previously selected Roman Technology Fellow once that individual obtains a permanent or permanent-track position, in order to start a laboratory or develop a research group at the Fellow's institution. Projects devoted to technology development that will not generate scientific data need not provide a data management plan and proposers may simply cite this statement as the entirety of their Data Management Plan.

9. X-Ray Imaging and Spectroscopy Mission (XRISM) Guest Scientist (XGS) Program

The objective of the XRISM Guest Scientist (XGS) program element D.12 of ROSES-2020 is to enhance the scientific return during the Performance Verification (PV) phase (sometimes referred to as the Guaranteed Time Observing (GTO) phase) of XRISM by opening the opportunity to participate in the analysis of data collected on individual targets during the XRISM PV phase to US-based scientists who are not members of the NASA-appointed instrument team. Proposals to D.12 XGS will be evaluated using dual-anonymous peer review, as mentioned in Section 1, above.

10. Astrophysics Explorers U.S. Participating Investigators

ROSES program element D.13 for Astrophysics Explorers U.S. Participating Investigators solicits potential Astrophysics Explorers 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.

11. Theoretical and Computational Astrophysics Networks

The Theoretical and Computational Astrophysics Networks (TCAN) program element D.14 supports coordinated efforts in fundamental theory and computational techniques in order to make groundbreaking advances in astrophysics and strengthen theoretical and computational astrophysics in the U.S. by uniting researchers in collaborative networks that cross institutional and geographical divides.

12. Exoplanet Research Program (XRP)

The cross-division program on exoplanets is described in program element E.3. Investigations related to the detection and characterization of planetary systems that are directly tied to the NASA strategic goal to search for Earth-like planets are of interest to the Astrophysics Division.

13. Topical Workshops

All proposals for topical conferences, workshops, or symposia related to the Astrophysics Division Research Program must be submitted in response to program element E.2, Topical Workshops, Symposia, and Conferences, of this NRA. Proposers to E.2 should specifically identify the Astrophysics research program element to which the conference, workshop, or symposium is most closely related, and refer to the goals and objectives of that program element in demonstrating relevance.
