

# Advanced Technologies and Instrumentation for the Astronomical Sciences (ATI)

## PROGRAM SOLICITATION

NSF 22-627

## REPLACES DOCUMENT(S):

NSF 18-576



**National Science Foundation**  
Directorate for Mathematical and Physical Sciences  
Division of Astronomical Sciences

### Submission Window Date(s) (due by 5 p.m. submitter's local time):

October 01, 2022 - November 15, 2022

October 1 - November 15, Annually Thereafter

## IMPORTANT INFORMATION AND REVISION NOTES

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in [Important Notice No. 147](#). In support of these efforts, proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov or via Grants.gov and may not be prepared or submitted via FastLane.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 22-1](#)), which is effective for proposals submitted, or due, on or after October 4, 2021.

## SUMMARY OF PROGRAM REQUIREMENTS

### General Information

#### Program Title:

Advanced Technologies and Instrumentation for the Astronomical Sciences (ATI)

#### Synopsis of Program:

The Advanced Technologies and Instrumentation for the Astronomical Sciences (ATI) program provides individual investigator and collaborative research grants for the development of new technologies and instrumentation for use in ground-based astronomy and astrophysics. The program supports achieving the science objectives of the Division of Astronomical Sciences. The development of innovative, potentially transformative, technologies and instruments are sought, even at high technical risk. Supported categories include (but are not limited to): advanced technology development, concept feasibility studies, and specialized instrumentation to enable new observations that are difficult or impossible to obtain with existing means. Proposals may include hardware and/or software development and/or analysis to enable new types of astronomical observations. Access to the ATI supported technology and instrumentation development efforts by the US astronomical community is viewed as an important metric of success. An annual Principal Investigators meeting is planned to disseminate information between the funded research efforts.

#### Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Matthew A. Bershad, telephone: (703) 292-2686, email: [mbershad@nsf.gov](mailto:mbershad@nsf.gov)

#### Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.049 --- Mathematical and Physical Sciences

## Award Information

**Anticipated Type of Award:** Standard Grant or Continuing Grant

**Estimated Number of Awards:** 10

About 10 projects will be funded per year, pending availability of funds.

**Anticipated Funding Amount:** \$8,000,000

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

## Eligibility Information

### Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

### Who May Serve as PI:

There are no restrictions or limits.

### Limit on Number of Proposals per Organization:

There are no restrictions or limits.

### Limit on Number of Proposals per PI or co-PI:

There are no restrictions or limits.

## Proposal Preparation and Submission Instructions

### A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via Research.gov: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg).
  - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=grantsgovguide](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)).

### B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:**

Not Applicable
- **Other Budgetary Limitations:**

Not Applicable

### C. Due Dates

- **Submission Window Date(s)** (due by 5 p.m. submitter's local time):

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## Proposal Review Information Criteria

### Merit Review Criteria:

National Science Board approved criteria. Additional merit review criteria apply. Please see the full text of this solicitation for further information.

## Award Administration Information

### Award Conditions:

Standard NSF award conditions apply.

### Reporting Requirements:

Standard NSF reporting requirements apply.

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## I. INTRODUCTION

The Division of Astronomical Sciences (AST) of the National Science Foundation is the primary source of federal funding support for ground-based astronomy in the U.S. The Division supports a broad range of activities from funding national observational facilities to the research programs of individual scientists and graduate students. As of July 1, 2022, AST supports the development and operation of six national astronomy centers: the National Optical-Infrared Astronomy Research Laboratory (NOIRLab), the National Solar Observatory (NSO), the Daniel K. Inouye Solar Telescope (DKIST), the National Radio Astronomy Observatory (NRAO), the Green Bank Observatory (GBO), and the Arecibo Observatory (AO). AST supports the construction and operation of the Vera Rubin Observatory (Rubin). The Division provides the U.S. share of funding for two international facilities—the operation of the Gemini Observatory and the operation of the Atacama Large Millimeter/submillimeter Array (ALMA).

Division programs also support the development of advanced technologies and instrumentation, mid-scale projects, the planning and design for future observational facilities and major collaborative projects in astronomy, and the management of the electromagnetic spectrum for scientific use.

The Division supports individual investigators and small groups engaged in a broad array of observational, theoretical, laboratory, and archival data studies. Special grants and fellowship programs for junior faculty, postdoctoral fellows, and undergraduate students are designed to encourage the activities of researchers engaged in education and outreach, and to increase the participation of those members from groups historically excluded and currently underrepresented in the Mathematical and Physical Sciences.

More information about the Division and its programs can be found at <https://www.nsf.gov/div/index.jsp?org=AST>.

## II. PROGRAM DESCRIPTION

The Advanced Technologies and Instrumentation for the Astronomical Sciences (ATI) program supports the overarching science objectives of the Division of Astronomical Sciences. Decadal surveys of Astronomy & Astrophysics may be consulted for examples of science objectives that are considered to be timely and important. The ATI program provides both individual investigator and collaborative research grants for development of new technologies and instrumentation for use in ground based astronomy and astrophysics research. Proposals may request support for advanced technology development, concept feasibility studies, and instrumentation to enable new observations that are difficult to obtain with existing means. This includes observing at wavelengths where there is electromagnetic interference from human and natural, radio and OIR sources. Proposals that principally deploy existing or off-the-shelf instrumentation should demonstrate an innovative use of such instrumentation.

The ATI program funds technology and instrument development projects that support the study of astronomical sources from ground-based observatories, which operate from optical through radio wavebands of the electromagnetic spectrum. Suitable proposal topics include innovative hardware, software and/or analysis methods that are applicable for use in research supported by the Division of Astronomical Sciences. A broad range of technologies are of relevance including (but not limited to): high contrast adaptive optics systems, extreme-precision radial velocity techniques, high resolution spectrometers, interferometers, massively multiplexed spectroscopy techniques, astrophotonics, imaging detectors, telescopes and antennae, optics and optical devices, and correlators and elements of radio cameras.

In all cases, proposals must adequately demonstrate the astronomical context of the work or it shall be returned without review. Submissions need to demonstrate that the technology, instrumentation, and/or software being proposed will significantly advance and improve ground-based astronomy observations. Such proposed developments may also have a secondary relevance to space based projects.

Routine upgrades to existing instruments and facilities will be given lower priority. This solicitation generally supports projects that are more exploratory, smaller in scope and may have higher risk than those suitable for the Mid-Scale Innovations Program or the Major Research Instrumentation Program. Please contact a cognizant NSF program officer if you have any questions about the suitability of your proposal for submission to the ATI Program.

The program supports making enhanced capabilities available to the wider astronomical community. Although technology and instrumentation intended for private observatories are permitted, such submissions must describe the specific benefits to the entire U.S. astronomical community. This is an important criterion upon which proposals will be evaluated. For more details, see Section VI.A, Additional Solicitation Specific Review Criteria.

The program supports community coordination and sharing of experience in technology development. Investigators are required to participate in an annual Principal Investigators (PI) meeting and should include travel funds to attend this meeting in their budgets. These meetings may be run in an in-person, virtual or hybrid mode and are scheduled in the September-October period.

Accomplishment-Based Renewal proposals will not be accepted to this solicitation and will be returned without review.

Proposals to this program are selected according to review criteria specified in Section VI of this solicitation. In particular, criteria that are unique to this solicitation are specified in section VI.A. Additional Solicitation Specific Review Criteria.

### Additional Funding Opportunities Inside the ATI Program

The ATI Program will accept Research in Undergraduate Institutions (RUI) proposals. RUI proposals submitted to the ATI program must meet the ATI requirements, guidelines, and deadlines. Information about the RUI program and the format of these proposals can be found at [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=5518](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5518).

The ATI Program will accept proposals for the Computational and Data Enabled Science and Engineering (CDS&E) funding opportunity, PD 22-8084. CDS&E proposals submitted to the ATI program must meet the ATI requirements, guidelines, and deadlines. CDS&E proposals submitted to the ATI Program must explicitly address the CDS&E program goals within the 15-page Project Description. More information about the CDS&E program can be found at <https://beta.nsf.gov/funding/opportunities/computational-and-data-enabled-science-and-engineering-cdse-0>

### Additional Funding Opportunities Outside the ATI Program

Funding for technology and instrumentation may be awarded within other programs, such as the NSF-wide Faculty Early Career Development (CAREER) program or the Major Research Instrumentation (MRI) program. In particular, the MRI program serves to increase access to multi-user scientific and engineering instrumentation for research and research training in our nation's institutions of higher education and not-for-profit scientific/engineering research organizations. MRI projects require cost-sharing, are subject to institutional limits, and have a maximum cost to the NSF of \$4 million. Within the Division of Astronomical Sciences, funding for technology and instrumentation may be awarded through the Mid-Scale Innovations Program (MSIP), which supports a variety of astronomical activities, typically with a total project cost exceeding \$4 million. Some support for technology and instrumentation may be awarded through the Astronomy and Astrophysics Grants (AAG) program. Proposers may contact the NSF Program Officer for guidance if there are questions as to which solicitation may be most appropriate for submission.

The guidelines in this solicitation do not apply to proposals submitted in response to other solicitations. This ATI solicitation also does not apply to requests for supplemental funding, conference proposals, Grants for Rapid Response Research (RAPID) or EARly-concept Grants for Exploratory Research (EAGER) proposals. Information on, and proposal preparation instructions for conferences, RAPIDs, and EAGERS are contained in the PAPPG Chapter II.E.

#### *Supplemental Funding Requests*

In order to receive full consideration, requests for [Research Experiences for Undergraduates](#) (REU), Research Opportunity Awards (ROA), Research Experiences for Teachers (RET), Alliances for Graduate Education and the Professoriate (AGEP) and other supplemental funding requests should be submitted by April 1 in the year for which the supplemental funds are requested. Later submissions of supplemental funding requests should be discussed with the cognizant AST program officer before submission. Guidance on preparing supplemental funding requests is contained in the [NSF Proposal & Award Policies & Procedures Guide](#).

#### *Conference Proposals*

AST supports conferences, symposia, and workshops in areas of science supported by AST that bring experts together to discuss current research, to expose other researchers or students to new research methods, and to discuss future directions. Conferences may be supported only if equivalent results cannot be obtained at regular meetings of professional societies or other established conference series. For guidance on preparing conference proposals, see Chapter II.E.9 in the most recent version of the PAPPG ([https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg)).

In particular, such proposals should be submitted at least 12 months before the anticipated conference or meeting date. Proposers are encouraged to contact an AST Program Officer prior to submission about the suitability of the proposed activity for support.

#### **Information Sharing with NASA**

NSF has a Memorandum of Understanding (MOU) with the National Aeronautics and Space Administration (NASA). Under the MOU, NSF may share information from proposals with NASA for consideration of joint funding and may invite NASA employees to attend merit review panels as observers.

### **III. AWARD INFORMATION**

**Anticipated Type of Award:** Standard Grant or Continuing Grant

**Estimated Number of Awards:** About 10 projects will be funded per year, pending availability of funds.

**Anticipated Funding Amount:** \$8,000,000

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

### **IV. ELIGIBILITY INFORMATION**

#### **Who May Submit Proposals:**

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

#### **Who May Serve as PI:**

There are no restrictions or limits.

#### **Limit on Number of Proposals per Organization:**

There are no restrictions or limits.

#### **Limit on Number of Proposals per PI or co-PI:**

There are no restrictions or limits.

### **V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS**

#### **A. Proposal Preparation Instructions**

**Full Proposal Preparation Instructions:** Proposers may opt to submit proposals in response to this Program Solicitation via Research.gov or Grants.gov.

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg). Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from [nsfpubs@nsf.gov](mailto:nsfpubs@nsf.gov). The Prepare New Proposal setup will prompt you for the program solicitation number.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: ([https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=grantsgovguide](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from [nsfpubs@nsf.gov](mailto:nsfpubs@nsf.gov).

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via Research.gov. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.C.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

The following supplements and/or deviates from the guidance in the PAPPG and NSF Grants.gov Application Guide.

**Collaborators & Other Affiliations Information:** When completing Table 4, you may list only the first three (3) co-authors. Instructions for Tables 1, 2, 3 and 5 are unchanged from the PAPPG.

## B. Budgetary Information

### Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

### Budget Preparation Instructions:

Awardees are required to participate in annual PI meetings. These meetings may be held in person at the NSF in Alexandria, VA or in a hybrid mode using the internet. Expenses for travel to the meeting can be supported by the award and included in the proposed budget.

## C. Due Dates

- **Submission Window Date(s)** (due by 5 p.m. submitter's local time):

October 01, 2022 - November 15, 2022

October 1 - November 15, Annually Thereafter

## D. Research.gov/Grants.gov Requirements

### For Proposals Submitted Via Research.gov:

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: [https://www.research.gov/research-portal/appmanager/base/desktop?\\_nfpb=true&\\_pageLabel=research\\_node\\_display&\\_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html](https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html). For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 or e-mail [rgov@nsf.gov](mailto:rgov@nsf.gov). The Research.gov Help Desk answers general technical questions related to the use of the Research.gov system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

### For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available

on the Grants.gov Applicant Resources webpage: <https://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: [support@grants.gov](mailto:support@grants.gov). The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

**Submitting the Proposal:** Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via Research.gov may use Research.gov to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

## VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: [https://www.nsf.gov/bfa/dias/policy/merit\\_review/](https://www.nsf.gov/bfa/dias/policy/merit_review/).

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Leading the World in Discovery and Innovation, STEM Talent Development and the Delivery of Benefits from Research - NSF Strategic Plan for Fiscal Years (FY) 2022 - 2026*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

### A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

#### 1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

## 2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
  - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
  - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and other underrepresented groups in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

### Additional Solicitation Specific Review Criteria

In addition to the above NSF-wide merit review criteria, ATI proposals will also be evaluated on the basis of the following specific criteria:



## **Motivation**

Proposals will be evaluated, in part, on the impact the technology development will make to new ground based observing capabilities. This impact may range from significant improvements over existing facilities to providing a totally new observing capability.

## **Innovation**

Proposals will be partially evaluated on their innovation. Proposals should have the potential to significantly advance the state-of-the-art and/or open new frontiers to science. Proposals for routine upgrades to existing facilities are discouraged.

## **Commitment to the Public**

Proposals will be partially evaluated on the benefit of the development to the larger US astronomy community. An example of such a benefit may include providing public access to the instrumentation developed via a specified amount of observing time open to the entire US community. Another example of a benefit would be community access to raw data, science-ready data and/or analysis software that can be used by the U.S. community. A data access description should be included that provides a discussion of any proprietary data periods planned and of the interface that enables community members to readily obtain such data. Projects that provide technology development are expected to make results publicly available through publications and presentations during the course of the project.

Such benefits to the US astronomy community may be decisive among proposals that are otherwise comparably ranked.

## **Technology Outreach**

If appropriate and relevant, proposers are encouraged to include a technology outreach description that details any planned interaction with US based industry in either the development of the technology or in the potential use of the technology to be developed. Such activity may provide opportunities for additional funding avenues within the NSF.

## **Project Management**

ATI projects are generally difficult to transfer between institutions while in progress. Proposals that have co-PIs who are post doctoral fellows or soft money scientists should include a discussion of the plans for the management of the project in the event that such a co-PI leaves the institution.

## **B. Review and Selection Process**

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements or the Division of Acquisition and Cooperative Support for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

## **VII. AWARD ADMINISTRATION INFORMATION**

### **A. Notification of the Award**

Notification of the award is made to *the submitting organization* by an NSF Grants and Agreements Officer. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

## B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)\*; or Research Terms and Conditions\* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

\*These documents may be accessed electronically on NSF's Website at [https://www.nsf.gov/awards/managing/award\\_conditions.jsp?org=NSF](https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF). Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from [nsfpubs@nsf.gov](mailto:nsfpubs@nsf.gov).

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg).

### Administrative and National Policy Requirements

#### Build America, Buy America

As expressed in Executive Order 14005, [Ensuring the Future is Made in All of America by All of America's Workers](#) (86 FR 7475), it is the policy of the executive branch to use terms and conditions of Federal financial assistance awards to maximize, consistent with law, the use of goods, products, and materials produced in, and services offered in, the United States.

Consistent with the requirements of the Build America, Buy America Act (Pub. L. 117-58, Division G, Title IX, Subtitle A, November 15, 2021), no funding made available through this funding opportunity may be obligated for an award unless all iron, steel, manufactured products, and construction materials used in the project are produced in the United States. For additional information, visit NSF's [Build America, Buy America](#) webpage.

## C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through [Research.gov](#), for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via [Research.gov](#) constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using [Research.gov](#). This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg).

## VIII. AGENCY CONTACTS

*Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.*

General inquiries regarding this program should be made to:

Matthew A. Bershad, telephone: (703) 292-2686, email: [mbershad@nsf.gov](mailto:mbershad@nsf.gov)

For questions related to the use of FastLane or Research.gov, contact:

- NSF Help Desk: 1-800-381-1532 Research.gov Help
- Desk e-mail: [rgov@nsf.gov](mailto:rgov@nsf.gov)

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: [support@grants.gov](mailto:support@grants.gov).

## IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at <https://www.grants.gov>.

## ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

*Facilitation Awards for Scientists and Engineers with Disabilities (FASED)* provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <https://www.nsf.gov>

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (703) 292-5111  
(NSF Information Center):
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

Send an e-mail to: [nsfpubs@nsf.gov](mailto:nsfpubs@nsf.gov)

or telephone: (703) 292-8143

- **To Locate NSF Employees:** (703) 292-5111

## PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See [System of Record Notices](#), NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton  
Reports Clearance Officer  
Policy Office, Division of Institution and Award Support  
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