

Mathematical Sciences Research Institutes

PROGRAM SOLICITATION

NSF 17-553

REPLACES DOCUMENT(S):

NSF 10-592



National Science Foundation

Directorate for Mathematical & Physical Sciences
Division of Mathematical Sciences

Letter of Intent Due Date(s) (required) (due by 5 p.m. submitter's local time):

December 14, 2018

December 14, 2023

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

March 14, 2019

March 14, 2024

IMPORTANT INFORMATION AND REVISION NOTES

This program solicitation invites proposals for new institute projects from U.S. sites as well as renewal proposals from any of the U.S.-based institutes that have had previous funding from NSF.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised NSF Proposal & Award Policies & Procedures Guide (PAPP) ([NSF 18-1](#)), which is effective for proposals submitted, or due, on or after January 29, 2018.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Mathematical Sciences Research Institutes

Synopsis of Program:

Mathematical Sciences Research Institutes are national resources that aim to advance research in the mathematical sciences through programs supporting discovery and dissemination of knowledge in mathematics and statistics and enhancing connections to related fields in which the mathematical sciences can play important roles. Institute activities help focus the attention of some of the best mathematical minds on problems of particular importance and timeliness. Institutes are also community resources that involve a broad segment of U.S.-based mathematical sciences researchers in their activities. The goals of the Mathematical Sciences Research Institutes program include advancing research in the mathematical sciences, increasing the impact of the mathematical sciences in other disciplines, and expanding the talent base engaged in mathematical research in the United States.

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.

- Joanna Kania-Bartoszyńska, telephone: (703) 292-4881, email: jkaniaba@nsf.gov
- Nandini Kannan, Program Director, telephone: (703) 292-8104, email: nakannan@nsf.gov

- Junping Wang, telephone: (703) 292-4488, email: jwang@nsf.gov
- Henry A. Warchall, telephone: (703) 292-4861, email: hwarchal@nsf.gov

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

- 47.049 --- Mathematical and Physical Sciences

Award Information

Anticipated Type of Award: Continuing Grant

Estimated Number of Awards: 5 to 8

Anticipated Funding Amount: \$30,000,000

Up to this amount will be initially available for this activity in FY 2020, subject to availability of funds and quality of proposals. Award amounts are anticipated to range from approximately \$2.5 million per year to \$5 million per year for up to five years.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities or four-year colleges accredited in, and having a campus located in, the US acting on behalf of their faculty members; and nonprofit, nonacademic organizations located in the US that are directly associated with educational or research activities. Multi-institutional consortia are permitted, but a single entity must accept overall management responsibility.

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:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
 - Full Proposals submitted via FastLane: *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.
 - 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).

B. Budgetary Information

- **Cost Sharing Requirements:**

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

Not Applicable
- **Other Budgetary Limitations:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. submitter's local time):

December 14, 2018

December 14, 2023

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

March 14, 2019

March 14, 2024

Proposal Review Information Criteria

Merit Review Criteria:

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

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) supports a number of research institutes in the mathematical sciences. The goals of the Mathematical Sciences Research Institutes program include advancing research in the mathematical sciences, increasing the impact of the mathematical sciences in other disciplines, and expanding the talent base engaged

in mathematical research in the United States. Institutes have proven to be an effective means of achieving these goals. Two institutes were established in 1980; since then, the portfolio of Mathematical Sciences Research Institutes has evolved, and DMS now supports several U.S.-based institutes. Further information about DMS-supported institutes is available through the web site <http://www.mathinstitutes.org/>

Mathematical Sciences Research Institutes are large-scale projects that collectively have several important impacts:

- Institutes advance research in the mathematical sciences, encourage research that is timely and potentially transformative, and assist rapid and broad dissemination of new ideas;
- Institutes focus effort and excellence in the mathematical sciences, operating on a national scale to reach across the mathematical disciplines, to explore emerging frontiers of those disciplines, and to engage with scientific opportunities in other fields;
- Institutes provide intellectual infrastructure for research collaborations within the mathematical sciences and at the interface of the mathematical sciences and other disciplines;
- Institutes increase the impact of the mathematical sciences in other disciplines by sponsoring interdisciplinary activities and enhancing synergistic approaches to significant scientific problems;
- Institutes provide opportunities for students and postdoctoral fellows to interact with leading researchers;
- Institutes support the exchange of information with business, industry, government, and national laboratories, providing access to expertise in the mathematical sciences;
- Institutes demonstrate leadership in promoting diversity in the mathematical sciences enterprise;
- Institutes provide opportunities for outreach to the scientific community and the public at large;
- Institutes play an important role in fostering international collaborations.

The mathematical sciences have gone through a period of spectacular growth and excitement. New ideas have been developed within the discipline and some significant long-standing open problems have been solved. At the same time, the mathematical sciences have been embraced as an enabling technology in many areas of application, from the physical sciences and engineering to the life sciences and finance. The Mathematical Sciences Research Institutes have played an important role in these developments, and this role is expected to grow.

The Division of Mathematical Sciences invites proposals for projects that contribute to this important, influential activity. This competition welcomes new projects from U.S. sites as well as renewal proposals from any of the U.S.-based institutes that have had previous funding from NSF. The Division of Mathematical Sciences intends that awards resulting from this competition will be five-year continuing grants and that renewal proposals following those awards may be submitted to the next competition in this series, circa FY 2024.

II. PROGRAM DESCRIPTION

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) seeks proposals for Mathematical Sciences Research Institutes that will advance research in the mathematical sciences, increase the impact of the mathematical sciences in other disciplines, and expand the talent base engaged in mathematical research in the United States. DMS is particularly interested in proposals that are creative, demonstrate vision, and involve the fullest spectrum of the mathematical sciences appropriate to the proposed institute's mission.

The structure of a proposed institute is unspecified. The Division of Mathematical Sciences encourages prospective applicants to consider the structure of the Mathematical Sciences Research Institutes currently supported by the Division and, where appropriate, to propose alternative structures that complement the existing ones and increase the potential to transform the mathematical sciences landscape.

The following considerations should inform the proposed activity.

National Resources

While hosting a DMS research institute confers benefits on a hosting organization, DMS intends research institute activity to be first and foremost a service to the mathematical sciences community as a whole. Proposals centered on the interests or advancement of a particular institution are not appropriate for the Mathematical Sciences Research Institutes program.

Mathematical Sciences Research Institute activities are expected to involve the mathematical sciences community on a national, if not international, scale. Institute activities should reflect broad community involvement, not only in participation but also in genesis of programmatic activities. Institute programs must be open to applications from members of the entire relevant constituency across the nation. Proposals should include detailed plans to recruit and involve participants from a wide range of institution types, demographic types, and career seniority. Proposals should include description of an explicit mechanism for selection of program organizers and program participants that is open and aims to reflect such balance.

It is expected that institute activity will be subject to direction and oversight by distinguished governing boards. Such governing boards must be constituted broadly, with membership across the relevant community, and proposals should describe the mechanisms by which governing boards will be appointed and through which oversight will be conducted.

DMS particularly values the research institutes for their ability to reach a much wider community of U.S. mathematical scientists than those directly supported by DMS through its Individual Investigator grant programs. Proposed projects should include explicit mechanisms to ensure the participation and support of U.S.-based mathematical scientists without other sources of grant support.

While institute programs will often naturally involve foreign participants, the bulk of DMS funding for participants in institute programs is expected to support U.S.-based participants, reflecting the investment of U.S. federal funds in Mathematical Sciences Research Institutes.

Workforce Development

While institute activities are expected to center on advancing research in the mathematical sciences and related fields, the Mathematical Sciences Research Institutes also play a significant role in the training through research involvement of the next generation of mathematical scientists. Proposals should include plans for the involvement of students and postdoctoral associates in institute activities, as appropriate.

Knowledge Dissemination and Outreach

It is anticipated that Mathematical Sciences Research Institute activities will catalyze new discoveries. To enhance this process of discovery, institutes are expected to disseminate outcomes of programmatic activities, and proposals should include plans for such dissemination. In addition to their primary goals in research advancement and workforce development, Mathematical Sciences Research Institutes can provide unique and highly visible venues for outreach to the general public as well as to the scientific community broadly, and proposals should include ideas for potential outreach activities.

Evaluation and Reporting

Projects on the scale of Mathematical Sciences Research Institutes call for regular, ongoing evaluation to monitor and evaluate progress in meeting goals, to provide feedback, and to suggest potential changes and improvements. Mathematical Sciences Research Institute awards are subject to specific reporting requirements about the programmatic activities and the participants involved. In addition, proposals should describe plans for formative evaluation during the course of the institute activities and for summative evaluation of progress toward the institute's goals.

In short, a proposal should describe the vision for the proposed institute as a national resource; the challenges motivating this vision; and the rationale for an institute to address these challenges. It should define the mission and goals of the proposed institute; describe how these goals will be achieved, together with appropriate measures to evaluate progress toward these goals; and make a compelling case for the institute's national scope and anticipated impact on the mathematical sciences. It should indicate the governance and management structure of the proposed institute; describe the process of generating, selecting, and evaluating the activities of the proposed institute; and give criteria for the selection of participants and the allocation of funds. It should contain a plan reflecting a proactive approach to diversity; describe how this plan will be implemented; and outline how its outcomes will be measured. It should address the ways in which training of the next generation of mathematical scientists will be integrated with the research program of the proposed institute; and discuss plans for outreach activities and the dissemination of knowledge generated at the proposed institute.

Proposals from existing institutes seeking renewal under this solicitation must describe both the institute's past accomplishments and its plans for future development.

III. AWARD INFORMATION

Up to eight awards will be made, depending on the quality of the submissions and the availability of funds. A total amount of up to \$30 million may be available in FY 2020 for this activity. Award amounts are anticipated to range from approximately \$2.5 million per year to \$5 million per year for up to five years. Awards are expected to be continuing grants; funds are released annually subject to approval by DMS and the availability of funds.

In Year 5, institutes are welcome to submit a renewal proposal for a subsequent five years of funding. A renewal proposal may be funded depending on the results of prior support and merit review, always subject to the availability of funds. The review of renewal proposals will emphasize evaluation of the results under prior support as well as plans for future activity. At the conclusion of the review of a renewal proposal, DMS will inform the awardee whether DMS finds that the institute's activities warrant renewal for an additional five-year period, or whether a plan must be put into effect for phase-out of DMS support. Renewal proposals may be funded with phase-out awards of duration fewer than five additional years. However, it is anticipated that except in unusual circumstances the first renewal proposal for a well-functioning newly-created institute will receive an additional five years of support.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities or four-year colleges accredited in, and having a campus located in, the US acting on behalf of their faculty members; and nonprofit, nonacademic organizations located in the US that are directly associated with educational or research activities. Multi-institutional consortia are permitted, but a single entity must accept overall management responsibility.

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

Letters of Intent (*required*):

Potential proposers may not submit a full proposal without first submitting a corresponding Letter of Intent (LOI), compliant with the instructions below, by the LOI submission deadline. Submitting a Letter of Intent does not obligate potential proposers to submit a full proposal. If a collaborative proposal is planned, a single LOI should be submitted by the lead institution only. LOIs are not subject to merit review but instead are used for internal planning purposes. Investigators should not expect to receive any feedback on their Letters of Intent.

Each LOI must include the following information:

In the Synopsis section, include a brief overview of the plans for the institute.

In the Project PI and Senior Personnel section, list the full names and institutional affiliations for all PIs, Co-PIs, and senior personnel on the planned project, including any intended subawardees. The point of contact for NSF inquiries must be the same as the project PI, with the project PI's e-mail address specified.

In the Participating Organizations section, list all of the institutions involved in the planned project.

If the Project PI and Senior Personnel and Participating Organizations sections do not provide enough space, continuations may be entered in the Other Comments section.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- Submission by an Authorized Organizational Representative (AOR) is not required when submitting Letters of Intent.
- A Minimum of 0 and Maximum of 4 Other Senior Project Personnel are permitted
- A Minimum of 0 and Maximum of 12 Other Participating Organizations are permitted
- Submission of multiple Letters of Intent is permitted

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & 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. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- 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). 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) 292-7827 or by e-mail from nsfpubs@nsf.gov.

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.

Full proposals must conform to the NSF Proposal & Award Policies & Procedures Guide (PAPPG) requirements, with the following modifications:

a. Cover Page

Proposers are reminded to identify the program solicitation number, identify the Division of Mathematical Sciences as the organizational unit and the Mathematical Sciences Research Institutes as the program to receive the proposal. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

Any multi-institutional collaboration must be submitted as a single proposal with subawards.

b. Project Description

The project description is subject to page limits as described below, which will be strictly enforced. The Project Description, limited to 30 pages total, consists of each of the following topics:

- o The intellectual focus of the proposed institute; the rationale for the proposed institute, its mission and goals, and its expected impact; plans for future growth and resource development; proposed steps toward developing its role as a national resource; and results of prior NSF support of the institute if applicable. (This section is not to exceed 20 pages total including results of prior NSF support, which may take up to 5 pages.)
- o A tentative schedule of scientific activities, with plans for Year 1 and a provisional schedule for Years 2 and 3. Plans for a new institute should reflect a "ramp-up" period of up to two years, with a full complement of activities no later than the beginning of Year 3 of the award.
- o Plans for human resource development, including the selection and mentoring of student and postdoctoral participants, as appropriate, and the selection and involvement of researchers at all career levels.
- o Plans for outreach and for dissemination of outcomes.

c. Biographical Sketches

For all key personnel, provide a brief biographical sketch, using the format spelled out in the NSF Proposal & Award Policies & Procedures Guide (PAPPG).

d. Budget

Provide a five-year budget for the proposed activity. For new institute proposals, this budget should reflect a ramp-up of the institute's activities during Years 1 and 2, with a full complement of activities implemented no later than the beginning of Year 3. The Budget Justification section should take whatever space is necessary to provide a breakdown of planned expenditures in composite budget categories such as Participant Support Costs, including projected headcounts for participants.

The budget should include funds to support travel to an annual PI meeting for two members of the institute's leadership team.

e. Facilities, Equipment and Other Resources

Include a description of the facilities (including any laboratories or computational facilities) that will be made available for the institute activities.

f. Supplementary Documentation

Submit Supplementary Documents containing the following information:

• Governance and Management

The governance and management structure of the proposed institute, including a list of individuals who have agreed to serve as members of a governing board or advisory council; mechanisms for fiscal and management oversight by a governing board or other group; plans for governing/advisory-board membership terms and succession; mechanisms for focusing the proposed institute's activities; mechanisms for choosing programs, selecting participants, and allocating funds; mechanisms for recruitment, selection, and appointment involved in institute leadership succession and other leadership changes; and rationales for the proposed management practices. (This section is not to exceed 5 pages total.)

• Management Plan

A Management Plan describing the duties and expected contributions of each individual in the institute leadership team. (This section is not to exceed 5 pages total.)

• Broadening Participation

A plan reflecting the proposed institute's approach to increasing diversity, broadening participation, and encouraging involvement of underrepresented groups; a description of how this plan will be implemented; and an outline of how its outcomes will be measured. (This section is not to exceed 5 pages total.)

• Evaluation

Measures to evaluate progress toward the proposed institute's goals; and a plan for quantitative and qualitative methods to assess the effectiveness and impact of the proposed institute's activities. (This section is not to exceed 5 pages total.)

• Letters of Collaboration

Any letters of collaboration documenting arrangements of significance for the proposed project, including commitments for space, faculty and staff positions, equipment, and access to facilities. Letters of support or endorsement and letters of a laudatory nature for the proposed project are not acceptable.

• Other Required Supplementary Documents

Please see the NSF Proposal & Award Policies & Procedures Guide (PAPPG) for information about other required Supplementary Documents.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

Award amounts are anticipated to range from approximately \$2.5 million/year to \$5 million/year for proposals submitted in response to this solicitation.

Budget Preparation Instructions:

The Budget Justification section should take whatever space is necessary to provide a breakdown of planned expenditures in composite budget categories such as Participant Support Costs, including projected headcounts for participants.

For new institute proposals, the 5-year budget should reflect a ramp-up of the institute's activities during Years 1 and 2, with a full complement of activities implemented no later than the beginning of Year 3.

C. Due Dates

- **Letter of Intent Due Date(s) (required)** (due by 5 p.m. submitter's local time):

December 14, 2018

December 14, 2023

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

March 14, 2019

March 14, 2024

D. FastLane/Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane 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: <http://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. 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 FastLane are strongly encouraged to use FastLane 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/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. 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 underrepresented minorities 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 criteria, the following will be used in the evaluation process:

Scope and Significance

- The scope and significance of the stated missions and goals of the institute;
- The likelihood that the proposed activities will be effective in meeting the goals;
- The likelihood that the proposed institute will attain significance as a national resource;
- The likely overall impact of the proposed scientific activities on the mathematical sciences.

Leadership, Governance, and Oversight

- The capabilities of the institute leadership, including management and organizational ability of the proposed director(s), and the commitment of the proposed leadership team;
- The potential of the institute's leadership and advisory teams to identify and engage with scientific challenges in the mathematical sciences;
- The design, structure, and management of the operation of the institute, including the quality and effectiveness of the management plan (including plans for interaction among the institute staff);
- Prospects for recruitment on the national scale for advisory committees, program organizers, and participants.

Breadth

- The likely effectiveness of the method of selection of activities to develop an overall institute program of appropriate scientific breadth;
- The prospects for involvement of appropriate subfields of the mathematical sciences;
- The extent, where appropriate, to which communication and interaction with other areas of science and engineering are fostered;
- The likely effectiveness of the method of selection of participants to involve the mathematical sciences community on a national scale and to recruit and involve participants from a wide range of institution types, demographic types, and career seniority;
- The level of the institutional commitment to promoting diversity and the quality of the institute's plan to broaden participation in mathematical sciences research.

Workforce Development

- The quality and appropriateness of the institute's training activity, especially plans to attract, involve, and mentor graduate students and early-career researchers.

Dissemination and Outreach

- The likely effectiveness of plans for dissemination of outcomes;
- The likely effectiveness of plans for support of remote participation in institute activities, where appropriate;
- The likely effectiveness of plans for outreach to the general public, if appropriate.

Evaluation and Assessment

- The quality of formative evaluation plans -- plans for ongoing assessment (of all institute activities) used to inform and improve both daily institute activities and long-range institute planning;
- The quality of the plans for summative evaluation of progress toward the proposed institute's goals, including plans for

gathering quantitative and qualitative data in support of evaluation practices, for follow-through, and for tracking of participants.

Resources and Infrastructure

- The reasonableness and appropriateness of the budget;
- The quality and likely effectiveness of plans for future institute growth and resource development;
- The quality and appropriateness of the infrastructure support for the institute (including, but not limited to, space, administrative staff, equipment, and access to facilities) and the suitability of location with regard to office space, laboratory space if needed, computing environment, access to library facilities, transportation, and housing.

Results under Prior Institute Support

- The quality of prior activities conducted with current or prior NSF support under Mathematical Sciences Research Institutes program awards with start date in the past five years, if any.

B. Review and Selection Process

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

Proposals submitted in response to this program solicitation will be reviewed by ad hoc review and/or panel review. Proposed institutes may receive a site visit review as well.

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 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 a Grants Officer in the Division of Grants and Agreements. 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. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from 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.

Special Award Conditions:

- The project will be funded for up to five years. Any award will be a continuing grant; funds are released annually subject to approval by DMS and the availability of funds.
- Only those Participants who furnish an Open Researcher and Contributor ID (ORCID) identifier to the institute may be supported with award funds.
- In connection with DMS oversight of investments in the Mathematical Sciences Research Institutes program, grantees are required to keep DMS apprised of meetings of institute governing boards and advisory councils and to allow DMS personnel to observe these meetings.
- The grantee will collaborate with other DMS-supported institutes in maintaining a common web site (currently <https://mathinstitutes.org/>) that publicizes upcoming activities and disseminates results of the institutes' activities.
- The grantee will collaborate with other DMS-supported institutes in coordinating programming to avoid redundancy and enhance complementarity among Mathematical Sciences Research Institutes activities.
- The PI or his/her representative(s) will attend an annual meeting of DMS Institute PIs/Directors, at a time and place to be mutually agreed upon.

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.

The grantee responsibilities include:

- Progress reports must include:
 - A Participant List in a standardized and mutually agreed upon format;
 - A Financial Support List in a standardized and mutually agreed upon format;
 - An Income and Expenditure Report: A summary in spreadsheet form of the budget expenditures by activity and funding source for the reporting period;
 - A copy of the minutes of the most recent Institute Directors Meeting;
 - A Participant Summary Table providing the total number of participants and subtotals for the numbers of participants who report being: U.S.-based; U.S. citizens and permanent residents; women; and members of racial/ethnic groups underrepresented in the mathematical sciences.
- The grantee shall post NSF progress reports annually on the Institute's website, with proprietary information deleted but including Participant Summary tables.
- The grantee shall provide to DMS electronic source material for the Participants List and Financial Support list. The grantee and DMS will collaborate on the format and design for these files.

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:

- Joanna Kania-Bartoszynska, telephone: (703) 292-4881, email: jkaniaba@nsf.gov
- Nandini Kannan, Program Director, telephone: (703) 292-8104, email: nakannan@nsf.gov
- Junping Wang, telephone: (703) 292-4488, email: jwang@nsf.gov
- Henry A. Warchall, telephone: (703) 292-4861, email: hwarchal@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@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.

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 <http://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** (NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**
 - Send an e-mail to: nsfpubs@nsf.gov
 - or telephone: (703) 292-7827
- **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 Systems of Records, [NSF-50](#), "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and [NSF-51](#), "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). 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
 Office of the General Counsel
 National Science Foundation
 Alexandria, VA 22314

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