

Focused Research Groups in the Mathematical Sciences (FRGMS)

PROGRAM SOLICITATION

NSF 16-577

REPLACES DOCUMENT(S):

NSF 12-566



National Science Foundation

Directorate for Mathematical & Physical Sciences
Division of Mathematical Sciences

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

September 27, 2016

September 13, 2017

Second Wednesday in September, Annually Thereafter

IMPORTANT INFORMATION AND REVISION NOTES

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 19-1), which is effective for proposals submitted, or due, on or after February 25, 2019.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Focused Research Groups in the Mathematical Sciences (FRGMS)

Synopsis of Program:

The purpose of the Focused Research Group activity is to support collaborative groups employing innovative methods to solve specific, major research challenges in the mathematical sciences. A major challenge is an outstanding problem of significant importance that requires the focused and synergistic efforts of a collaborative group to solve, and whose solution will have wide impacts in the mathematical sciences and potentially in other areas. Groups may include, in addition to statisticians and mathematicians, researchers from other science and engineering disciplines appropriate for the proposed research. Risky projects are welcome. Interdisciplinary projects are welcome. Projects should be timely, limited in duration to up to three years, and substantial in their scope and impact for the mathematical sciences. Funded projects that show substantial progress in their first two years may be recommended for a creativity extension for up to an additional two years.

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.

- Pedro F. Embid, telephone: (703) 292-4859, email: pembid@nsf.gov
- Marian Bocea, telephone: (703) 292-2595, email: mbocea@nsf.gov
- Stefaan G. De Winter, telephone: (703) 292-2599, email: sgdwint@nsf.gov
- Zhilan J. Feng, telephone: (703) 292-7523, email: zfeng@nsf.gov
- Leland M. Jameson, telephone: (703) 292-4883, email: ljamesson@nsf.gov
- Swatee Naik, telephone: (703) 292-4876, email: snaik@nsf.gov
- Janet P. Striuli, telephone: (703) 292-2858, email: jstriuli@nsf.gov

- Gabor J. Szekely, telephone: (703) 292-8869, email: gszekely@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: 5 to 10

Approximately 5-10 awards annually.

Anticipated Funding Amount: \$10,000,000

Approximately \$10,000,000 will be available for this activity annually, subject to 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: 1

Because of the level of commitment expected from senior personnel, none can be part of more than one Focused Research Group proposal or award at a time as a PI or co-PI.

Proposals involving investigators from more than one institution are allowed and should be submitted as separately submitted collaborative proposals. See the NSF Proposal & Award Policies & Procedures Guide (PAPPG) for guidance on the simultaneous submission of proposals from different organizations.

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 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 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.
 - 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:**

None
- **Other Budgetary Limitations:**

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

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):
 - September 27, 2016
 - September 13, 2017
 - Second Wednesday in September, Annually Thereafter

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:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

Through the mechanism of the Focused Research Group activity, the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) aims to foster collaborative research projects that:

- address major research challenges of recognized importance to the mathematical sciences,
- are likely to produce substantial progress on these problems,
- and require the group's coordinated efforts to achieve that progress.

Risky projects, in which the likelihood of success is not certain, are welcomed. Interdisciplinary projects are welcomed. For all Focused Research Group projects, substantial progress on the problems should have widely felt consequences for mathematics or statistics.

Each Focused Research Group proposal should provide a focused plan for making significant progress on a research challenge of recognized importance to the mathematical sciences, should describe the novel, innovative, and creative aspects of the planned research, and should explain why the success of the proposed research project depends in a crucial way upon a group effort by the collaborators.

II. PROGRAM DESCRIPTION

The purpose of the Focused Research Group activity is to support synergistic research collaborations that respond to recognized scientific needs of pressing importance or that take advantage of current scientific opportunities; in each case, progress must depend on developing significant new advances in mathematics or statistics. Groups may include, in addition to mathematicians and statisticians, researchers from other scientific and engineering disciplines appropriate to the proposed research. Projects supported under this activity should be essentially collaborative in nature and depend for their advancement on the coordinated interaction of a group of researchers.

Each project should be focused on a significant and well-delineated major research challenge. A major challenge is an outstanding problem of significant importance whose solution will have wide impacts in the mathematical sciences and potentially in other areas; it is more than a collection of questions. It is not the intent of this activity to provide general support for group infrastructure. Projects should be timely, limited in duration to up to three years, and substantial in both their scope and likely impact. DMS anticipates that those funded Focused Research Group projects showing substantial progress in their first two years, consistent with the criteria for creativity extensions, could be recommended for a creativity extension for up to two additional years to foster breakthrough advances and innovations. However, Focused Research Group projects are intended to be time-limited. Therefore, no Focused Research Group project will be supported for more than five years. Proposed continuations of previously funded Focused Research Group projects may be appropriate for other competitions but are unlikely to be suitable for the FRGMS activity. Proposals to this program solicitation for work based on topics or approaches for which group members previously received Focused Research Group support will be returned without review. Questions about the suitability of a project for the FRGMS competition may be sent to a program officer for one of the relevant DMS programs.

Here is a list, by no means exhaustive, of indicators suggesting that a Focused Research Group approach might be appropriate. In each case, anticipated advances in other disciplines must be accompanied by significant anticipated advances and innovations in mathematics or statistics.

- Accumulated scientific results point to the possibility of a major, innovative breakthrough.
- A major recent breakthrough has created new possibilities for significant progress.
- New, interdisciplinary collaboration has revealed means to achieve accelerated progress through such cooperation, with corresponding advances and impacts in the mathematical sciences.

The aim of the activity is to support projects for which the collective effort by a group of researchers is necessary to reach the scientific goals in a timely manner. The advantages of pooled insights, complementary expertise, diverse points of view, and shared tasks make a successful research group more than the sum of its parts. Thus, Focused Research Group proposals must explain how interaction and group effort are critical to the success of the project. See the Additional Solicitation Specific Review Criteria.

The research group must include at least **three** senior personnel or other professionals. The group members may, but need not, come from more than one institution or discipline. Awards made under the Focused Research Group activity are intended to foster a crucial and unusual synergy between the group members that cannot be achieved with individual or ordinary collaborative grants. Focused Research Group researchers are expected to collaborate closely and intensely on the well-delineated, focused topic of the project. At the same time, the impact and promise of supported projects should be broad, significant, and long-term. Focused Research Group proposals are likely to be read by non-specialists at some stage of the review process. It is therefore particularly important that they be written to emphasize the impact of the projects in a broad mathematical context.

Examples of possible outcomes for Focused Research Group projects include the following:

- Through development of mathematical/statistical innovations, substantial progress is made toward solution of a set of major open questions.
- New research directions that have become possible due to recent advances are explored, and significant progress is achieved.
- As a direct result of the group effort, an important focused research agenda in mathematics or statistics as well as in science or engineering is advanced significantly.

Additional outcomes, such as training of students and postdoctoral researchers, are beneficial but secondary to the research outcomes of these projects. Focused Research Group projects should take advantage of opportunities and resources at or near the institutions at which the research will be performed. Research groups are required to disseminate the results of their work in a timely and effective fashion.

III. AWARD INFORMATION

Under this solicitation, proposals may be submitted for any funding amount from \$150,000 up to \$500,000 per year, for up to three years. The budget must be commensurate with the project and thoroughly justified in the proposal. DMS expects to fund approximately five to ten awards annually, depending on the quality of submissions and the availability of funds. The anticipated date of awards is April of each year.

In cases of exceptional progress shown in the first two years and high likelihood of further developments, DMS expects to recommend creativity extensions for up to two additional years.

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: 1

Because of the level of commitment expected from senior personnel, none can be part of more than one Focused Research Group proposal or award at a time as a PI or co-PI.

Proposals involving investigators from more than one institution are allowed and should be submitted as separately submitted collaborative proposals. See the NSF Proposal & Award Policies & Procedures Guide (PAPPG) for guidance on the simultaneous submission of proposals from different organizations.

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 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.

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 the NSF FastLane system. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

Proposals involving investigators from more than one institution are allowed and should be submitted as separately submitted collaborative proposals. See the NSF PAPPG for guidance on the simultaneous submission of proposals from different organizations.

The following instructions supplement or deviate from the PAPPG:

- a. Cover Sheet. To facilitate timely processing, the title of the proposed project should begin with the four characters "FRG:" and the title of a collaborative Focused Research Group proposal should begin with the designation "FRG: Collaborative Research:" All proposals in a collaborative group should have the same title and should be submitted to the same DMS program.
- b. Project Description.

Proposed Research. Narrative, not to exceed **twenty** pages, consisting of the following items:

- o An explanation of the scientific context and timeliness of the proposed project.
- o A description of the proposed research.
- o A justification for why a group effort is necessary to carry out the proposed project.
- o A timeline for the planned work and a justification for the duration.
- o Plans for disseminating the results.
- o Results from prior NSF support, if applicable, in accord with PAPPG requirements.

Management Plan. Provide a management plan that describes how the group effort will be coordinated and how decisions will be made regarding the conduct of the project. The estimated amount of time committed to the project and the role in the project must be provided for each of the key personnel; those with other supported research must also explain how they will allocate time and effort among the projects. This section may not exceed **three** pages.

- c. Biographical Sketches. For all key senior personnel, regardless of whether or not they are listed among the principal investigators or co-investigators, please provide biographical sketches following the guidelines specified in the PAPPG.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Indirect Cost (F&A) Limitations: None**Other Budgetary Limitations:**

Award size is limited to between \$150,000 and \$500,000 per year for up to three years duration

C. Due Dates

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

September 27, 2016

September 13, 2017

Second Wednesday in September, Annually Thereafter

D. FastLane/Research.gov/Grants.gov Requirements

For Proposals Submitted Via FastLane or Research.gov:

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

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. 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 National Science Board merit review criteria, reviewers will be asked to apply several specific criteria when reviewing Focused Research Group proposals. **These criteria collectively assess the features that distinguish FRGMS proposals from other proposals**, namely, the extent to which:

- the project clearly focuses on a well-delineated, important, and timely mathematical or statistical problem considered as a major research challenge, perhaps but not necessarily in the context of interdisciplinary research;
- the project is likely to produce substantial and innovative progress toward the solution of the problem, substantial mathematical or statistical developments are probable, and the progress is likely to be of wide impact;
- the project requires the group's coordinated efforts to achieve that progress, members bring appropriate and varied strengths to the project, and the whole team effort is likely to be greater than the sum of its parts; and
- project logistics support the research progress: the natures and degrees of involvement of senior personnel are sufficient, group structure and modes of collaboration are well-designed, and the proposed timeline and budget are realistic.

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 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) 292-8134 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.

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.

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:

- Pedro F. Embid, telephone: (703) 292-4859, email: pembid@nsf.gov
- Marian Bocea, telephone: (703) 292-2595, email: mbocea@nsf.gov
- Stefaan G. De Winter, telephone: (703) 292-2599, email: sgdewint@nsf.gov
- Zhilan J. Feng, telephone: (703) 292-7523, email: zfeng@nsf.gov
- Leland M. Jameson, telephone: (703) 292-4883, email: lameson@nsf.gov
- Swatee Naik, telephone: (703) 292-4876, email: snaik@nsf.gov
- Janet P. Striuli, telephone: (703) 292-2858, email: jstriuli@nsf.gov
- Gabor J. Szekely, telephone: (703) 292-8869, email: gszekely@nsf.gov

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

- FastLane and Research.gov Help Desk: 1-800-673-6188
FastLane Help Desk e-mail: fastlane@nsf.gov.
Research.gov Help Desk e-mail: 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.

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>.

While engagement of students or postdocs in Focused Research Group projects is appropriate, the FRGMS program is not centered on training activities. Groups of mathematical science researchers who have related research goals may apply to the DMS Research Training Groups (RTG) opportunity for funds to foster research-based group training activities. See the RTG Program Solicitation for more information. Proposals for workshops and conferences should be submitted in accord with the DMS Conferences and Workshops solicitation.

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 (FASSED) 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 [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
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314



National Science Foundation, 2415 Eisenhower Avenue, Alexandria, Virginia 22314, USA
Tel: (703) 292-5111, FIRS: (800) 877-8339 | TDD: (703) 292-5090 or (800) 281-8749

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