The National Security Agency Mathematical Sciences Program (MSP) was started at NSA in 1987 in response to an increasingly urgent need to support mathematics in the United States. Indeed, the NSA realizes the mutual benefits of maintaining a healthy academic community and is proud to offer funding opportunities for eligible faculty members through the MSP.

Program Overview

The MSP supports self-directed, unclassified research, conferences, workshops, and other efforts in the areas of Algebra, Discrete Mathematics, Number Theory, Probability, and Statistics. The program no longer accepts proposals that involve cryptology. Research and conference proposals are reviewed by a Mathematics Review Panel, which is appointed and administered by the American Mathematical Society. Members of the Panel meet annually in May to discuss and to rank the proposals. During the annual panel meeting, panelists use external reviews and their own assessments of the merits of the proposals to arrive at a rating for each proposal. The panelists in each subject area then use these ratings to create a ranked list of proposals within each subject area. The final review panel recommendations are used by the NSA Mathematical Sciences Program Office to make funding decisions.

Annual Statistics

The NSA Mathematical Sciences Program entertained a total of 340 research proposals in 2015. After all proposals were thoroughly peer reviewed by the AMS and rated by the NSA’s internal process, final decisions on awards were made in accordance with current MSP policies. Those policies emphasize the intellectual quality of the research proposed together with its broad impact of the technical field. Approximately one seventh of the submissions, a total of 45 proposals, were awarded funding as follows: 21 in Algebra, 6 in Discrete Mathematics, 12 in Number Theory, 1 in Probability, and 5 in Statistics. The number of proposals funded in each category was based upon several factors, such as the cost per proposal (e.g. proposals in probability and statistics cost more on average), and the desire to award roughly the same proportion of proposals in a subject category as were received in that category.

It is the MSP’s desire to recognize as many PIs as possible with funding during a period of decline in government research funding. To accomplish this, the MSP implemented a policy that prohibits the award of MSP research grants to individuals who possess grants from other United States government agencies (such as the NSF and the ARO) that supports their research for the same time period. There were 14 researchers who declined the MSP award since their research was also recognized by either the NSF or the ARO.

The Mathematics Review Panel also evaluated 22 conference proposals, 14 of which were selected for funding. A complete list of new research awards and new conference awards is listed at the conclusion of this report.
Other Outreach Efforts

In addition to research and conference grants, the NSA offers other opportunities for students and faculty members in the mathematical sciences. One of the initiatives of the MSP and of the Agency at large is the development and training of a future generation of mathematicians. As part of this initiative, the NSA offers a summer internship program called the Director’s Summer Program (DSP). The DSP is the Agency’s premier outreach effort to the nation’s most talented undergraduates in mathematics and computer science. Participants in the program spend the summer using their mathematical skills to help solve actual problems involving NSA’s cryptologic and signals analysis mission. A similar program exists for graduate students, the Graduate Mathematics Program. The NSA is also keenly interested in promoting the involvement and advancement of underrepresented populations in the mathematical sciences. The Mathematical Sciences Program devotes a portion of its resources to conferences for undergraduates and graduate students, Research Experiences for Undergraduates (REUs), and other efforts that enhance participation in the mathematical sciences. In the past, the MSP has funded efforts such as the Infinite Possibilities Conference, the National Research Experience for Undergraduates Program, and the Mathematical and Theoretical Biology Institute Research Program for Undergraduates.

Further information on the Mathematical Sciences Program may be obtained from the website http://www.nsa.gov/research/math_research/index.shtml, or by contacting the following individuals.

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New Research Grants

**Algebra (21):**
Paolo Aluffi
Theory and Applications of Segre Classes and Related Intersection Theoretic Invariants

Dan Barbasch
Unipotent Representations and Nilpotent Orbits

Dustin Cartwright
Tropical Complexes and Moduli of Curves

Sebastian Casalaina-Martin
Geometry of Moduli Spaces, Period Maps, Abelian Varieties and Theta Divisors

Mark Colarusso
New Directions in Geometric and Combinatorial Representation Theory

Hailong Dao
Problems in Commutative Algebra, With Applications

Michael Davis
Complements of Arrangements, Artin Groups, and Related Topics

Maksym Fedorchuk
Variation of Moduli Spaces and Positivity

Noah Giansiracusa
Tropical Scheme Theory

Rostislav Grigorchuk
Intermediate Growth and Amenability of Groups

Jonathan Kujawa
The Interface of Representation Theory and Geometry

Brian Lehmann
Positivity of Cycles

Valery Lunts
Triangulated Categories and Algebraic Geometry

Constantin L. Mihalcea
Quantum Cohomology and Quantum K Theory of (Affine) Flag Manifolds

Gregory Muller
Emerging Problems in the Geometry of Cluster Algebras

Dmitri Nikshych
Symmetries of Tensor Categories and Classification of Hopf Algebras

Edward Richmond
Combinatorics and Geometry of Schubert Varieties

Daniel Rogalski
Noncommutative Birational Geometry and Calabi-Yau Algebras

David Rose
Dualities in Higher Representation Theory and Low-dimensional Topology

Benjamin Steinberg
The Algebraic Analysis of Markov Chains

**Discrete Mathematics (6):**
Benjamin Braun
Reflexive Polytopes, Lecture Hall Partitions, and Euler-Mahonian Distributions

James Davis
Constructions of Difference Sets, Bent Functions, and Association Schemes Using Covering Extended Building Sets

Paul Horn
Curvature and Geometric Analysis of Graphs

Alex Iosevich*
Groups actions and Erdø’s Problems in Discrete, Continuous and Arithmetic Settings

Jonathan Pakianathan*
Groups actions and Erdø’s Problems in Discrete, Continuous and Arithmetic Settings

Vladimir Tonchev
Combinatorial Designs, Error-Correcting Codes, and Finite Geometry

Cun-Quan Zhang
Flows and Colorings

*PIs will conduct research under the same grant

**Number Theory (12)**
Jeffrey Achter
Periods and Point Counts

Samit Dasgupta
Cycles on Shimura Varieties, p-adic Families of Eisenstein Series, and Applications to the Conjectures of Stark, Beilinson, Gross, and Greenberg

Brooke Feigon
Problems in Automorphic Forms and L-functions

Dorian Goldfeld
Trace Formulae, L-functions, and Analytic Number Theory

Leo Goldmakher
The Geometry of Bounded Multiplicative Functions
Joseph Hundley Fourier Coefficients, Eisenstein Series and L-functions
Krzysztof Klosin Residually Reducible Galois Representations and p-adic Properties of Automorphic Lifts
Pace Nielsen Computational Number Theory: Covering Systems, Probabilistic Methods, and Sieves
Brian Smithling Arithmetic, Geometry, and Local Models of Shimura Varieties
Katherine Stange The Underlying Geometry of Recurrence Structures
Dinesh Thakur Multizeta and Related Structures in Function Field Arithmetic
Frank Thorne Analytic Methods in Arithmetic Statistics

Probability (1):
Ambar Sengupta Geometric and Probabilistic Problems

Statistics (5):
Larry Goldstein Contemporary Applications of Malliavin Stein Methods
Hyokyoung Hong Semiparametric Quantile Regression for Bounded Data
X. Jessie Jeng Detecting Weak Signals in High-Dimensional Data Analysis
Dennis Lin Dimensional Analysis in Statistics: Theory and Applications
Arindam RoyChoudhury Fast Likelihood Estimation of Very Large Species/Population Trees Through Order of Divergence

New Conference Grants

Conferences (14):
Ruth Charney Connections for Women: Geometric Group Theory
Sergi Elizalde Conference in Formal Power Series and Algebraic Combinatorics, 2016
Wayne Goddard 2016 and 2017 Clemson Mini-Conference on Discrete Mathematics and Algorithms
Hemanshu Kaul Extremal Combinatorics at Illinois III (EXCILL III)
Thomas Mathew 10th Annual Probability and Statistics Day at UMBC: Celebrating Bimal Sinha's 70th Birthday
Tyrrell McAllister The 2016 Rocky Mountain - Great Plains Graduate Research Workshop in Combinatorics
Susan Morey Southwest Local Algebra Meeting 2016
Alexey Ovchinnikov Series of Workshops in Differential and Difference Algebra
Sebastian Pauli UNCG Summer School in Computational Number Theory
Julia Pevtsova Geometric and Topological Aspects of the Representation Theory of Finite Groups
Jeremy Rouse 2016 Automorphic Forms Workshop
Zoran Sunik Geometric and Probabilistic Methods in Group Theory and Dynamical Systems
Pham Huu Tiep Conference “Finite Simple Groups: Thirty Years of the ATLAS and Beyond”
Karen Vogtmann Introductory Workshop on Geometric Group Theory

For a list of the research grants whose second years are now being funded, please request a copy of the Year 2014 Summary on the Mathematical Sciences Program (available either from Kim Kuda of the AMS, kak@ams.org, or from the NSA MSP).