

National Security Agency

MATHEMATICAL SCIENCES PROGRAM

Grants for Research in the Mathematical Sciences

2015 Summary

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):

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|---------------|------------------|--|
| 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 |
| Jesse | Kass | Singular Curves and Their Moduli Spaces |
| 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):

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| 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 Erdo's Problems in Discrete, Continuous and Arithmetic Settings |
| Jonathan | Pakianathan* | Groups actions and Erdo'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)

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| 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 |

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

Probability (1):

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|-------|----------|--------------------------------------|
| Ambar | Sengupta | Geometric and Probabilistic Problems |
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Statistics (5):

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|------------|--------------|---|
| Larry | Goldstein | Contemporary Applications of Malliavin Stein Methods |
| Hyokyoungh | 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):

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| 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 Thomas | Kaul Mathew | Extremal Combinatorics at Illinois III (EXCILL III) 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).