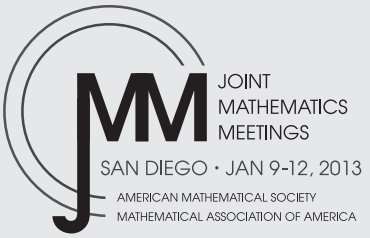

January 2013 Prizes and Awards

4:25 P.M., Thursday, January 10, 2013

Program

Opening Remarks
Eric Friedlander, President
American Mathematical Society

Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics
Mathematical Association of America

Euler Book Prize
Mathematical Association of America

Levi L. Conant Prize
American Mathematical Society

David P. Robbins Prize
American Mathematical Society

Oswald Veblen Prize in Geometry
American Mathematical Society

Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman
Association for Women in Mathematics

Louise Hay Award for Contributions to Mathematics Education
Association for Women in Mathematics

M. Gweneth Humphreys Award for Mentorship of Undergraduate Women in Mathematics
Association for Women in Mathematics

Norbert Wiener Prize in Applied Mathematics
American Mathematical Society
Society for Industrial and Applied Mathematics

Communications Award
Joint Policy Board for Mathematics

Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student
American Mathematical Society
Mathematical Association of America
Society for Industrial and Applied Mathematics

Chauvenet Prize
Mathematical Association of America

Certificates for Meritorious Service
Mathematical Association of America

Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics
Mathematical Association of America

E. H. Moore Research Article Prize
American Mathematical Society

Ruth Lyttle Satter Prize in Mathematics
American Mathematical Society

Leroy P. Steele Prize for Seminal Contribution to Research
American Mathematical Society

Leroy P. Steele Prize for Mathematical Exposition
American Mathematical Society

Leroy P. Steele Prize for Lifetime Achievement
American Mathematical Society

Closing Remarks
Paul Zorn, President
Mathematical Association of America

Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics

In 1991 the Mathematical Association of America instituted the Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics in order to honor college or university teachers who have been widely recognized as extraordinarily successful and whose teaching effectiveness has been shown to have had influence beyond their own institutions. Deborah Tepper Haimo was President of the Association, 1991–1992.

Citation

Matthias Beck

Matthias Beck uniquely and excellently combines teaching and research with writing textbooks, mentoring, and outreach to the wider community. Students in his classes at all levels—from classes for prospective elementary school teachers to analytic number theory—are interested and active participants. Dr. Beck is an accomplished research mathematician who also knows pedagogy. Colleagues who have observed Dr. Beck's classes testify that he is a superb lecturer, one who asks just the right questions to keep the students thinking about the key issues. His presentations appear almost spontaneous, but through Dr. Beck's choice of examples and order of development, reveal a master teacher at work.

Dr. Beck has received a National Science Foundation (NSF) research grant and was a member of the Editorial Board of the *Journal of Number Theory* and of *Expositiones Mathematicae*. Dr. Beck is the author of forty-seven published papers, most in prominent journals. Eleven of these papers, which include publications in the *Journal of Combinatorial Theory Series A*, *Mathematische Annalen*, and *Mathematische Zeitschrift*, have student co-authors. Dr. Beck has co-authored two well-reviewed undergraduate textbooks published by Springer, *The Art of Proof: Basic Training for Deeper Mathematics* and *Computing the Continuous Discretely: Integer-Point Enumeration in Polyhedra*. Both books appear on the MAA's Basic Library List; Springer has published the second also in German and Japanese.

Another grant from NSF supports Dr. Beck's work in enhancing the preparation of graduate students, with the goal of increasing the percentage entering Ph.D. programs, particularly among underrepresented minorities. In the first two years of this program, fifteen of the sixteen M.A. students supported were accepted into Ph.D. programs, all but one with funding. One of the students Dr. Beck mentored in the program won the award for Best Graduate Presentation in Mathematics at the 2011 SACNAS (Society for the Advancement of Chicanos and Native

Americans in Science) national conference. Another such student, currently in graduate school at a major research university, speaks for many in calling Dr. Beck "a professor, advisor, and mentor who is both skillful in mathematics and in the ways of life." Since 2005 Dr. Beck has been co-director of the San Francisco Mathematics Circle, an integrated program for public school teachers and their students in grades 6–11. He has involved in the Circle both graduate students in his NSF-sponsored program and also undergraduates in a community service course organized for that purpose. His students collaborate with public school teachers to enrich their students' mathematics experiences. His work in the Circle thus benefits middle-school students, high-school students, mathematics graduate students, and middle-school and high-school mathematics teachers.

Biographical Note

After studies at the University of Würzburg, SUNY Oneonta, and Temple University, and postdoctoral positions at SUNY Binghamton, the Mathematical Sciences Research Institute (MSRI), and the Max Planck Institute in Bonn, **Matthias Beck** arrived at San Francisco State University, where he is currently an associate professor in the mathematics department. His research is situated in the intersection of combinatorics, geometry, and number theory; he is particularly fond of counting integer points in polyhedra and the application of these enumeration functions to various combinatorial and number-theoretic topics and problems. His two books, *Computing the Continuous Discretely* (with Sinai Robins) and *The Art of Proof* (with Ross Geoghegan), hint at the fact that he enjoys mixing research and teaching activities; another sign of the same fact is his track record of mentoring numerous research students and postdocs at MSRI-UP, SF State, and UC Berkeley.

Response from Matthias Beck

I am humbled and honored to have been selected for the 2013 Haimo Award. I am grateful to the many wonderful students at SF State and around the world with whom I get to teach, mentor, and do research. I try to convince them that mathematics is an art, and they inspire me with their creativity, motivation, and hard work. I feel fortunate to have had numerous role models among my teachers and colleagues, including Harald Kohl, Günter Köhler, David Manes, and Hartmut Stapf, who first got me hooked onto math, the late Marvin Knopp, who taught me to always have time for my students, Sinai Robins and Tom Zaslavsky, who opened my eyes toward so much beautiful mathematics, Tatiana Shubin and Paul Zeitz, who introduced me to Math Circles, and Ross Geoghegan, who introduced me to Moore-method-style teaching and writing. I am most grateful to my colleagues in the SF State mathematics department, in particular David Bao, Joseph Gubeladze, Eric Hayashi, and Serkan Hosten, who kindly nominated me for this award. Last and most importantly, I thank my partner, colleague, and best friend Tendai Chitewere, who is my biggest source of inspiration, advice, and support. I dedicate the tremendous honor of the Haimo award to all of these kind beings.

Citation

Margaret Robinson

Margaret Robinson is a dedicated professor with a deep passion for mathematics and an incredible understanding of people. She is praised for her energy, joyful and generous spirit, creativity, imagination, patience, and ability to inspire. Her students appreciate her hands-on, animated teaching style and her ability to bring the inquisitive nature of mathematics to life. Her colleagues admire the way in which she is able to inspire students to do "Herculean amounts of work" in order to meet the high standards she sets for her classes. She pushes students to move beyond their comfort zone while providing a supportive and encouraging learning environment. She has a special gift for transforming students into mathematicians.

Exhibiting incredible flexibility, Margaret brings her passion for mathematics into every one of her courses—courses that span the introductory and upper levels, as well as the pure, applied, and interdisciplinary. In her twenty-five years at Mount Holyoke she has taught well over eighteen different courses, including an interdisciplinary introductory course entitled Unity of Science, an intermediate course (developed with a biologist and a physicist) entitled Making Sense of Biological Signals, Introductory Statistics, Design of Experiments and Analysis of Variance, Differential Equations, History of Mathematics, Real Analysis, Complex Analysis, Abstract Algebra, Algebraic Geometry, and Elliptic Curves.

Most notably, Margaret's success shines in a course entitled Laboratories in Mathematical Experimentation, a course in which students learn to make conjectures and write their first proofs. Margaret empowers her students to explore and to create their own mathematical ideas while treating her students as less experienced equals. Her success in guiding majors into mathematical research is extraordinary, and she has shared this success with over thirty-five other undergraduates from across the nation who have participated in the seven REUs in number theory she has conducted over the past two decades. In 2010, Margaret's success was recognized with the Mount Holyoke College Teaching Award.

Margaret has also had a profound impact on numerous young women nationwide who have been fortunate enough to participate in short courses she has taught through the Summer Math Program (SMP) at Carleton College and the Summer Program for Women and Mathematics at the Institute for Advanced Study (IAS). In 2009 and again in 2011 she taught an intensive four-week course in p-adic analysis for the SMP, and in 2006 she taught a course exploring zeta functions for the IAS program. These young women cite admiration for Margaret's talents and appreciation for the role model she has become for them.

Biographical Note

Margaret Robinson, professor of mathematics at Mount Holyoke College, received her B.A from Bowdoin College in 1979 and her Ph.D. from Johns Hopkins University in 1986. Before coming to Mount Holyoke College, she taught for one year at Hampshire College. Her research interests are in number

theory, especially p-adic analysis and local zeta functions. She conducted her first summer REU program during the summer of 1992, and in 1997 her department jointly co-authored the book *Laboratories in Mathematical Experimentation: A Bridge to Higher Mathematics* using materials from the course that had already become central to the Mount Holyoke mathematics major. Her experiences working with REU students and teaching the laboratory class have been central to her growth as a teacher of mathematics.

Response from Margaret Robinson

It is a great honor to receive the Haimo award from the MAA. We all have teachers, and my most important ones over the past twenty-five years have been the members of my department and my students. Without the advice, guidance, and inspiration of my colleagues in the Mathematics and Statistics Department at Mount Holyoke, my professional life would have been unsuccessful and lonely. So first I would like to thank my colleagues: Harriet Pollatsek, Jessica Sidman, Janice Gifford, Giuliana Davidoff, Donal O'Shea, Lester Senechal, Bob Weaver, Laurie Kamins, George Cobb, Mark Peterson, Alan Durfee, Jim Morrow, Char Morrow, Ji Young Kim, Jung-Jin Lee, Jillian McLeod, Dylan Shepardson, Blerta Shtylla, and Jeremy Pecharich. And then there are my students! At Mount Holyoke, I have been tremendously lucky to have had loyal, patient students who are gentle with their suggestions and criticisms. I would also like to give my heartfelt thanks to Deanna Haunsperger and Stephen Kennedy for inviting me to teach at the Summer Mathematics Program at Carleton College where I have been inspired and invigorated by teaching with Erica Flapan and Pam Richardson and by working with the wonderful SMP women. Finally, I would like to thank my husband, Alan Robinson, and our two daughters, Phoebe and Margot.

Citation

Francis Su

Francis Su is an outstanding teacher who inspires students to discover and explore the fun and excitement of mathematics. In a memorable 2006 James R. C. Leitzel Lecture that served as the basis for a 2010 *American Mathematical Monthly* article, Professor Su describes how he aims to turn students into discoverers, teachers into co-adventurers. He accomplishes this laudable goal not only with his own students at Harvey Mudd College, but also with middle-school students that he regularly visits, with students around the world who read his fun facts and watch his videos on the Internet, and with fellow teachers who read his articles and attend his presentations and workshops.

Professor Su teaches a wide repertoire of courses at Harvey Mudd College. Students at all levels praise his enthusiasm and clarity, while colleagues effuse that he maintains very high standards. He has instituted a highly successful program of undergraduate student research that has produced twelve peer-reviewed papers with undergraduate co-authors, with several more in progress. More impressive than the research findings of these projects is the impact that

the research experiences have had on students, the vast majority of whom have continued their study of mathematics and credit Professor Su with kindling their love of mathematics and their ability to think mathematically.

Professor Su has also been involved with curricular reform at Harvey Mudd College, developing innovative courses for both math majors and general education students. He has also overseen an explosion of interest in the Putnam Exam on his campus. Outreach to middle-school students is another passion and talent of Professor Su. He has developed and led discovery-based mathematical enrichment lessons for local middle-school students and also for Math Path, a summer camp for children aged 11 to 14. Participants in these lessons have remarked that Professor Su changed their conception of what mathematics is.

Professor Su's impact has embraced the Internet as a vehicle through which to reach larger groups of students. He developed a habit of starting each of his classes with a mathematical "fun fact" that captured students' interest, and he has produced a website that allows students and teachers around the world to learn about these fun facts. This website receives about one million visits per year. Moreover, he has recorded videos of real analysis lectures that have become very popular online. Other avenues through which Professor Su popularizes mathematics are his award-winning expository writing and extensive public speaking.

Biographical Note

Francis Edward Su is the Benediktsson–Karwa Professor of Mathematics at Harvey Mudd College. He received his B.S. in mathematics from the University of Texas at Austin and his Ph.D. from Harvard University. His research is in geometric combinatorics and applications to the social sciences, and he has co-authored numerous papers with undergraduates. He also has a passion for teaching and popularizing mathematics. From the MAA, he received the 2001 Merten M. Hasse Prize for expository writing and the 2004 Henry L. Alder Award for distinguished teaching. He authors the popular *Math Fun Facts* website and iPhone app. His hobbies include songwriting, gardening, and photography, and he is active in multiple ministries of his church. Just like mathematics, these are modes of creative expression that divinely blend structure and freedom, truth and beauty, reflection and action.

Response from from Francis Su

I am grateful to the MAA for this honor, which should really be credited to those who have influenced my teaching. First and foremost, my wonderful colleagues at Harvey Mudd have provided a vibrant community in which to grow as a teacher; I could not have a better set of friends to work with. Art Benjamin and Lisette dePillis have given me wise counsel over the years. I am also grateful to many mentors, especially Mike Starbird, Persi Diaconis, and Michael Moody, who believed in me at critical times and whose teaching styles I emulate in various ways. I cherish my students, who inspire me and who have been co-adventurers with me! If teaching were only about communicating facts, it would be a dry and lifeless enterprise. But as Pascal acknowledges, "We know truth, not only by reason, but also by the heart." My heart is full with yawps and meaningful

moments I have shared with all these friends. Finally, I must thank my sister Debbie, who has been my biggest supporter, and my deepest Christian friends—they know my shortcomings, walk alongside me in my struggles, and love me without condition. They model for me, Jesus, the ultimate teacher and friend.

Euler Book Prize

The Euler Book Prize is awarded annually to the author of an outstanding book about mathematics. The Prize is intended to recognize authors of exceptionally well-written books with a positive impact on the public's view of mathematics and to encourage the writing of such books.

The Euler Prize, established in 2005, is given every year at a national meeting of the Association, beginning in 2007, the 300th anniversary of the birth of Leonhard Euler. This award also honors Virginia and Paul Halmos, whose generosity made the award possible.

Citation

Persi Diaconis and Ron Graham

Magical Mathematics: The Mathematical Ideas that Animate Great Magic Tricks, Princeton University Press, 2011.

This magical book, based on the authors' lifelong passion for magic and mathematics, presents a selection of entertaining tricks that are easy to perform and yet have interesting mathematics inside them. The tricks are surprising yet curiously difficult to explain; the mathematics is simple yet fundamental; the explanations are beautifully clear and even elegant. Along the way we are treated to interesting asides about the people and ideas that inspire magical mathematics.

Many of the card tricks discussed are mathematically elegant and some are new. Usually a trick is described by its effect, followed by how and why it works, and for many tricks, variations. For some tricks the discussion continues with new mathematics, new tricks, and suggestions for further investigation. The exposition is enlivened by personal anecdotes, some history of the tricks or of outstanding magicians, and digressions to related topics. Martin Gardner and the authors were longtime friends, and nine pages of Chapter 10 include several of Gardner's tricks.

The mathematical prerequisites (e.g., permutations, binary arithmetic, modular arithmetic) are gently introduced and accessible to novices. But there's also plenty of substance for mathematicians, who will enjoy interesting applications of basic graph theory, combinatorics, topology, de Bruijn sequences, Penrose tiles, Steiner trees, elementary group theory, and a special shuffle leading to a result known as the Ultimate Gilbreath Principle with its mysterious connection to the Mandelbrot set.

The writing is relaxed and conversational and so casual and unstudied that even the theorems and proofs are irresistible. It's a perfect coffee table book that can

be picked up, thumbed through, and sampled at will, with lots of pictures and diagrams to make it tempting. The book perfectly fits the description of the Euler Book Prize, being "exceptionally well written," having "a positive impact on the public's view of mathematics," and presenting "mathematics as it is related to other areas of arts and sciences."

Martin Gardner's expository mathematics has been described as "capable of turning innocent youngsters into mathematicians and mathematicians into innocent youngsters." This book is a worthy companion to Gardner's collection and will have the same effect. Diaconis and Graham have made a significant contribution to the literature of expository mathematics.

Biographical Notes

Persi Diaconis is the Mary Sunseri Professor of Mathematics and Statistics at Stanford University. He works in probability, mathematical statistics, combinatorics, and group theory with a focus on real world applications, such as "How many times should a deck of cards be shuffled to mix it?" (work with David Bayer), and "Is coin tossing 'physics' or 'random'?" (work with Susan Holmes and Richard Montgomery). He has been on the faculty of Harvard and Cornell but is most well known from ten years on the road as a traveling magician. An early MacArthur Fellow, Diaconis is a member the U.S. National Academy of Sciences.

Ron Graham is the Irwin and Joan Jacobs Professor of Computer and Information Sciences and Professor of Mathematics at the University of California at San Diego. He works in a variety of mathematical areas that include combinatorics, number theory, discrete geometry, and theoretical computer science. He spent many years at Bell Labs, during which time he also taught at Princeton, Stanford, Caltech, UCLA, and Rutgers. He has served as President of both the American Mathematical Society and the Mathematical Association of America, as well as President of the International Jugglers Association. He is a recipient of the Leroy P. Steele Prize for Lifetime Achievement from the AMS, and he is a member of the U.S. National Academy of Sciences.

Joint Response from Persi Diaconis and Ron Graham

We are pleased and proud that our MAA community likes *Magical Mathematics*. It took us more than 25 years to finish. Part of the problem was that new ideas and variations kept popping up. These sometimes required real work to understand and became papers instead of chapters for "Martin Gardner's audience." Another problem was two types of uncertainty: First, are we "allowed" to expose magic tricks? The magic community seems to have forgiven us. Second, can we sully our beautiful mathematics by mixing it up with entertainment? The Euler Book Prize suggests that the mathematics community forgives us too.

We are particularly happy that this prize is connected to Paul Halmos. Paul was a wonderful mathematician and a longtime friend to both of us. He was also an inspiring author whose depth and clarity will illuminate mathematics far into the future. It is humbling to share his light.

Levi L. Conant Prize

This prize was established in 2000 in honor of Levi L. Conant to recognize the best expository paper published in either the *Notices of the AMS* or the *Bulletin of the AMS* in the preceding five years. Levi L. Conant (1857–1916) was a mathematician who taught at Dakota School of Mines for three years and at Worcester Polytechnic Institute for twenty-five years. His will included a bequest to the AMS effective upon his wife's death, which occurred sixty years after his own demise.

Citation

John Baez and John Huerta

The 2013 Levi L. Conant Prize is awarded to John Baez and John Huerta for their article, "The algebra of grand unified theories" (*Bulletin Amer. Math. Soc.*, 47 (2010), no. 3, 483–552).

The Standard Model of particle physics is one of the central theoretical constructs of twentieth century physics. It attempts to describe all particles and all the forces of nature except gravity. Although the Standard Model seems complicated and somewhat arbitrary, it has been very successful in describing mathematically what we see in reality. Physicists are not fully satisfied with it because it does leave out gravity, described by Einstein's general theory of relativity which has not been reconciled with the Standard Model, and it may not be able to account for dark matter. Looking beyond the Standard Model leads to string theory, loop quantum gravity, and theories based on noncommutative geometry.

In the second half of the twentieth century, a program of "grand unification" commenced whose aim was to unify particles and the forces, save gravity, within the confines of the Standard Model using Lie groups, Lie algebras, and their representations. Such a theory features a compact Lie group G, called the gauge group. Particles lie in a representation of G on a finite-dimensional complex vector space V. More precisely, particles are the basis vectors of the associated irreducible representations on V. Ideas coming from the era of grand unification persist into the twenty-first century and are still important today. The article focuses upon the group representation theory that describes particles in the Standard Model. The authors eschew symmetry breaking (particle interaction) so they can limit the discussion to algebraic ideas that mathematicians not coming from theoretical physics will find familiar. Their goal is to introduce the unfamiliar ways in which physicists use these algebraic ideas.

Even with the simplifications inherent in the restricted range of the Standard Model alluded to above, it is a daunting task to convey decades of work in one, relatively short article. A grand unified theory is based on different versions of extending the Standard Model. The gauge group of the Standard Model is $G_{SM} = U(1) \times SU(2) \times SU(3)$. An extension of this gauge group, together with an appropriate representation, compose a grand unified theory. The article deals with three such extensions whose gauge groups are $SU(2)\times SU(2)\times SU(4)$, $SU(5)$ and $Spin(10)$. It transpires that the third theory can be viewed as an extension of the first two, thereby uniting the points of view. The article finishes with some intriguing theorems that lead to interesting speculations about the nature of matter and force in the universe. Along the way, we are treated to a running account of the Standard Model, how it began with the Heisenberg model of the proton and neutron, and how it has evolved with grand unification. Such wonderful physical notions as color, spin, handedness, anti-matter, and the like make their appearance along the way. At the same time, concrete theory of the aforementioned Lie groups and their representations are related to these physical notions, and the group theory is shown to lead to interesting physical conclusions and puzzles. The authors do an excellent job of keeping the mathematics within reach of even a well-educated, advanced graduate student, and alternate nicely between the physics and the mathematics.

The article is a very well-written piece about an interesting and important topic. Too often the expository aspect of an article is limited to the initial sections, so that once a reader is "hooked," he or she has to continue through much drier material. That is not the case in this article. The authors are able to maintain an engaging tone throughout the seventy pages it takes to tell this marvelous tale. And as with the stories in *The Thousand and One Nights*, we are left hoping for more.

Biographical Notes

John Baez is Professor of mathematics at UC Riverside. Until recently he worked on higher category theory and quantum gravity. His internet column "This Week's Finds" dates back to 1993 and is sometimes called the world's first blog. In 2010, concerned about climate change and the future of the planet, he switched to working on more practical topics and started the Azimuth Project, an international collaboration to create a focal point for scientists and engineers interested in saving the planet.

John Huerta is starting a post-doctoral fellowship at Instituto Superior Técnico in Lisbon, where he will work with Roger Picken on higher gauge theory and its role in string theory. Before that he was a postdoc at the Australian National University where he studied the smallest exceptional Lie group and its relationship with a rolling ball.

He was a Ph.D. student of John Baez, studying supersymmetry, higher gauge theory, and their connection to division algebras. Though he studied mathematics, he's always loved physics, and derives great inspiration from it. His

interest began with a popular astronomy book that his sister gave to him as a child. This evolved into a fascination with stars, with physical laws, and eventually the underlying mathematics and its conceptual interplay.

Response from John Baez

I put a lot of energy into explaining math and physics online. Blogging is no substitute for more formal writing about academic subjects, but it fills a gap, especially for the millions who don't live near a good research university. Socrates complained that "writing is unfortunately like painting, for the creations of the painter have the attitude of life, yet if you ask them a question they preserve a solemn silence." This is no longer true with blogs: the author is there to answer your questions! So, I am hoping that eventually blogs will be taken seriously by academia and the AMS will have an award for the best mathematics blog. But I am very happy to receive this prize for a more traditional form of mathematics exposition.

Response from John Huerta

It is a great honor to receive this award, and to share it with my mentor, John Baez. I know there were many other worthy contenders for this award, which only adds to my gratitude. I hope, if nothing else, the attention this honor brings leads more people to learn this wonderful story we did our best to tell.

This was our first paper together, and my first publication. I remain deeply proud of it, but it belongs to more people than I can name. I'd like to thank the AMS for their top-notch editors, UC Riverside Mathematics for having me as a student, my parents and my friends for their love and support. But most of all, I want to thank John, for being tough and for being kind, and for teaching me how to write.

David P. Robbins Prize

This prize was established in memory of David P. Robbins by members of his family. Robbins, who died in 2003, received his Ph.D. in 1970 from MIT. He was a long-time member of the Institute for Defense Analysis Center for Communication Research and a prolific mathematician whose work (much of it classified) was in discrete mathematics. The Prize is for a paper with the following characteristics: it shall report on novel research in algebra, combinatorics or discrete mathematics and shall have a significant experimental component; and it shall be on a topic which is broadly accessible and shall provide a simple statement of the problem and clear exposition of the work. This Prize is awarded every three years.

Citation

Alexander Razborov

The 2013 David P. Robbins Prize is awarded to Alexander Razborov, of the University of Chicago, for his paper, "On the minimal density of triangles in graphs" (*Combinatorics, Probability and Computing* 17 (2008), no. 4, 603–618), and for introducing a new powerful method, *flag algebras*, to solve problems in extremal combinatorics.

Razborov solves an old extremal problem about the minimum possible number of triangles in a graph with n vertices and m edges. The origin of this problem goes back more than one hundred years to one of the oldest results in extremal combinatorics, by Mantel, who proved that any such graph with more than $n^2/4$ edges must have a triangle. This leads to the natural question of how many such triangles (as a function of the number of edges) should exist. Although the problem has been studied by leading combinatorialists for decades, it remained open until its recent solution by Razborov.

The paper of Razborov not only settled a long-standing open problem, much more importantly it introduced a new method, called *flag algebra calculus*, for attacking a large class of extremal questions. This method was originally invented by Razborov to study the triangle density problem and was developed in full generality in his closely related paper, "Flag algebras" (*J. Symbolic Logic* 72 (2007), no. 4, 1239–1282).

The solution of many extremal problems requires finding inequalities involving densities of small subgraphs of large graphs. Until recently this was done by ingenuity and the trial-and-error method. Remarkably, the work of Razborov gives a systematic approach to these arguments. His flag algebra calculus provides a formalism through which the problem of finding relations between subgraph

densities can be reduced to a semi-definite programming (SDP) problem. This in turn enables the use of computers to find solutions, with rigorous proofs, to problems in extremal combinatorics. This method already had a great impact on the area, and it has been used to settle a number of long-standing open problems in extremal graph theory.

Biographical Notes

Alexander Razborov was born in 1963 in the small Siberian town of Belovo. He received his B.Sc. in mathematics from Moscow State University and his Ph.D. from the Steklov Mathematical Insitute (Moscow). Currently, he is an Andrew MacLeish Distinguished Service Professor at the Department of Computer Science at the University of Chicago, with part-time appointments at Steklov Mathematical Institute and Toyota Technological Institute at Chicago. He received the Rolf Nevanlinna Prize in 1990 and the Godel Prize in 2007, was an invited speaker at the ICM (Berkeley 1986), and was elected as a corresponding member of the Russian Academy of Sciences in 2000. His research spans several areas in theoretical computer science, including computational complexity, proof complexity, quantum computing, and computational complexity, as well as related mathematical areas, notably discrete mathematics and combinatorial group theory.

Response from Alexander Razborov

I am truly grateful and honored to receive this Prize, and I am equally delighted to receive it for this particular topic, which is very close to my heart.

All my professional career so far has been spent on the interface between computer science and mathematics, and I genuinely believe that certain amusing cultural differences between the two communities look really insignificant when compared to the amount of inspiration and fresh and novel ideas their interaction brings to both disciplines. In a sense, the work I am being awarded for is a quintessence of this philosophy. In order to be able to do something really computational (computer-aided theorem proving in extremal combinatorics using packages for semi-definite programming), one has to be able to reveal and understand fundamental, albeit somewhat simple by mathematical standards, algebraic and analytical structures behind this activity, and be guided by them. Thank you again, both for the recognition of my own contribution and for promoting this important interdisciplinary ideology!

I would like to use this opportunity and thank all institutions I have been fortunate to be affiliated with (Steklov Mathematical Institute, IAS, University of Chicago, Toyota Technological Institute) for the stimulating intellectual environment that encouraged work on difficult and interesting problems. I am very grateful to my own collaborators on the project (Hamed Hatami, Jan Hladky, Daniel Kral, Sergei Norin, Oleg Pikhurko), as well as to many other young “flag algebraists” for developing this theory. Last but not the least my special thanks go to my wife, Iren, and my children, Andrew and Maria, for humorously bearing with the half-absence of their husband and daddy even when he appears to be fully present physically.

Oswald Veblen Prize in Geometry

This prize was established in 1961 in memory of Professor Oswald Veblen through a fund contributed by former students and colleagues. The fund was later doubled by the widow of Professor Veblen. It is awarded in recognition of a notable research memoir in geometry or topology published in the preceding six years. To be considered, either the nominee should be a member of the Society or the memoir should have been published in a recognized North American journal. Currently, the prize is awarded every three years.

Citation

Ian Agol

The 2013 Oswald Veblen Prize in Geometry is awarded to Ian Agol for his many fundamental contributions to hyperbolic geometry, 3-manifold topology, and geometric group theory. In particular, Agol is cited for the following papers.

I. Agol, P. Storm, and W. P. Thurston, "Lower bounds on volumes of hyperbolic Haken 3-manifolds" with an appendix by Nathan Dunfield, *J. Amer. Math. Soc.* 20 (2007), no. 4, 1053–1077.

I. Agol, "Criteria for virtual fibering," *J. Topol.* 1 (2008), no. 2, 269–284.

I. Agol, D. Groves, and J. F. Manning, "Residual finiteness, QCERF and fillings of hyperbolic groups," *Geom. Topol.* 13 (2009), no. 2, 1043–1073.

In 2004 Agol (and independently Calegari and Gabai) proved the Marden tameness conjecture which led to many important results in hyperbolic geometry, among them the Ahlfors measure conjecture.

Agol subsequently proved a number of important results on volumes of hyperbolic 3-manifolds, including an important inequality, found with Nathan Dunfield in the first cited paper, relating the volume of a closed hyperbolic 3-manifold with that of a drilled manifold and the tube radius of the drilled geodesic. This played an important role in the proof (by Gabai, Meyerhoff, and Milley) that the Weeks manifold is the unique lowest volume closed orientable hyperbolic 3-manifold.

In the second paper Agol found a key group theoretic criterion for a closed irreducible 3-manifold to have a finite sheeted covering space that fibers over the circle. With Daniel Groves and Jason Manning he showed in the third paper that if all hyperbolic groups are residually finite, then any quasiconvex subgroup of a hyperbolic group is separable.

In April 2012 Agol posted an article to the ArXiv announcing a proof of a conjecture of Daniel Wise implying both Waldhausen's virtual Haken conjecture and Thurston's virtual fibering conjecture. The proof involves a generalization of the methods of these papers, clever new ideas, and it makes crucial use of results of Wise and joint work of Haglund and Wise. The resolution of these conjectures is a milestone achievement in the theory of three-dimensional manifolds.

Biographical Note

Ian Agol was born in Hollywood, CA, in 1970 and received his Ph.D. at University of California (UC) San Diego in 1998 under the supervision of Michael Freedman. He held post-doctoral positions at UC Davis and University of Melbourne, before teaching at the University of Illinois at Chicago. He moved to UC Berkeley in 2007. He received a Guggenheim fellowship in 2005 and spoke at the ICM (Madrid, 2006).

He shared the 2009 Clay Research Award with Danny Calegari and David Gabai for the solution of the Marden tameness conjecture. He received the 2012 Senior Berwick Prize for his cited paper, "Criteria for virtual fibering."

Response from Ian Agol

It is an honor to share the 2013 Oswald Veblen Prize in Geometry with Dani Wise.

I owe a debt of gratitude to my family for their support, especially my mother who made sure that I had a top-notch education and encouraged me to pursue a career in a field I am passionate about, and my wife Michelle for her support. I also share this award in spirit with my collaborators, especially Nathan Dunfield, Peter Storm, Daniel Groves, Jason Manning, and the late Bill Thurston, with whom I collaborated on the papers mentioned in the citation. My research on the virtual Haken conjecture was influenced heavily by the work of Dani Wise and his collaborators Nicolas Bergeron, Tim Hsu, Michah Sageev, and especially Frédéric Haglund. Without Wise's insights, this approach to the conjecture would have been impossible, and his vision completely changed my perspective on the problem. Another key contribution was made by Jeremy Kahn and Vlad Markovic on the surface subgroup problem. The subject of hyperbolic groups and CAT(0) cube complexes, introduced by Misha Gromov, has reached a mature state, which I think is now made evident by the first Veblen Prize given to a geometric group theorist after Gromov himself.

In the 1980s, Bill Thurston laid out his vision for three-dimensional topology and Kleinian groups. Over the past thirty years, his vision has been validated, with such milestones achieved as the geometrization theorem, the ending lamination theorem, the tameness theorem, the density theorem, and now the virtual fibering theorem. The virtual Haken theorem (originating as a question of Waldhausen) is a purely topological statement; however, its resolution is in some sense mostly geometrical and depends on many developments from outside the field, including PDEs, Riemannian and Alexandrov geometry, dynamics, representation theory, and geometric group theory.

I hope that 3-manifolds and Kleinian groups will give back equally to these and other subjects in the future. Moreover, I think the most important project for the future is to make connections between this highly developed area of geometric 3-manifold topology and other approaches, such as various flavors of Floer homology, topological quantum field theory, knot theory and 4-manifolds, and other types of geometric structures on 3-manifolds.

Citation
Daniel Wise

The 2013 Veblen Prize in Geometry is awarded to Daniel Wise, for his deep work establishing subgroup separability (LERF) for a wide class of groups and for introducing and developing with Frédéric Haglund the theory of special cube complexes which are of fundamental importance for the topology of three-dimensional manifolds. In particular Wise is cited for the following papers.

D. T. Wise, "Subgroup separability of graphs of free groups with cyclic edge groups," *Q. J. Math*. 51 (2000), no. 1, 107–129.

A subgroup is separable if it is the intersection of all the finite index subgroups that contain it. This is an important condition in 3-manifold topology since up to homotopy an immersed surface in a closed irreducible 3-manifold lifts to an embedded surface in some finite sheeted cover if the immersion induces an isomorphism of the fundamental group of the surface with a separable subgroup of the fundamental group of the 3-manifold.

D. T. Wise, "Residual finiteness of negatively curved polygons of finite groups," *Invent. Math.* 149 (2002), no. 3, 579–617.

This paper is representative of a long arc of work in which Wise describes powerful and ingenious criteria for showing that a group is residually finite or, more generally, that all of its quasiconvex subgroups are separable.

F. Haglund and D. T. Wise, "Special cube complexes," *Geom. Funct. Anal*. 17 (2008), no. 5, 1551–1620.

F. Haglund and D. T. Wise, "A combination theorem for special cube complexes," *Ann. of Math.* 176 (2012), no. 3, 1427–1482.

In the first of these papers, Wise and Haglund introduced the concept of a "special cube complex." The fundamental groups of such complexes have various remarkable properties. For example, they embed into right-angled Artin groups and their quasiconvex subgroups are separable. Generalizing the methods of the two papers of Wise cited above, Wise and Haglund show that a group obtained from two virtually special hyperbolic groups that are amalgamated along quasiconvex malnormal subgroups is virtually special. In subsequent work Wise used this to prove that the fundamental groups of Haken hyperbolic 3-manifolds are virtually special.

Beyond what is cited in these papers, Wise made the far-reaching conjecture that a Gromov hyperbolic group that acts cocompactly and properly on a CAT(0) cube complex is the fundamental group of virtually special cube complexes. Ian Agol proved this conjecture making essential use of the technology of Wise and his collaborators. Combined with the work of Jeremy Kahn and Vladimir Markovic, and with the work of Michah Sageev, this gives a positive solution to the long-standing Waldhausen virtual Haken conjecture.

Biographical Note

Daniel Wise was born in 1971 and grew up in the NYC area. He received a B.A. in 1991 from Yeshiva College and a Ph.D. in 1996 from Princeton University. After stints at UC Berkeley, Cornell University, and Brandeis University, he joined McGill University, where he has been teaching since 2001. Dani lives in Montreal with his wife, Yael, and their four children. Their house is full of music, art, laughter, and sleep deprivation.

Response from Daniel Wise

I am grateful to be the recipient, together with Ian Agol, of the Oswald Veblen Prize of the AMS. I share my part of this recognition with my coauthors Nicolas Bergeron, Chris Hruska, Tim Hsu, Michah Sageev, and especially Frédéric Haglund. This is a welcome opportunity to thank Jonathan Sondow and Sylvain Cappell who launched me into mathematics, Martin Bridson who initiated my interest in geometric group theory, my colleagues and students at McGill, my friends and family, and my wife Yael.

I was attracted to residual finiteness at the very beginning of my career—and latched on to the idea of a "clean complex" in 1993. From that point onward I progressively nurtured a belief that a variant of this was a key toward understanding basic properties of fundamental groups of 3-manifolds. I made progress in 1997 toward understanding that many prime alternating link groups are virtually fundamental groups of clean complexes. In 2000, I realized that most small-cancellation groups had codimension-one subgroups, made the connection to Michah Sageev's work on dual CAT(0) cube complexes, and then began a crusade to "cubulate" all groups in sight. To my great fortune, Frédéric Haglund visited in 2002, and we developed the notion of a "special cube complex." These "generalized graphs" improved upon clean complexes in a manner that I had only dreamed about beforehand. My previous work was readapted in this more elegant context with no two-dimensional limitation, and this began to catch the attention of the geometric group theory community. There was now something concrete to aim for—and at the 2004 Spring Topology and Dynamics conference, I laid out a plan for understanding groups: first cubulate and then find a special cover. I explained that my conjecture, that each hyperbolic 3-manifold M is virtually special, is equivalent to the pair of well-known conjectures that $\pi_1 M$ has separable quasiconvex subgroups and that $\pi_1 M$ has sufficiently many quasiconvex surface subgroups (now a recent accomplishment of Kahn and Markovic). Though some topologists were reluctant to believe in the cubical route, by 2005 I had mapped out a strategy for proving a significant case: the virtual specialness

of “hyperbolic groups with a quasiconvex hierarchy.” The various parts of this plan were accomplished with the great help of my collaborators, and during my 2008–09 sabbatical at the Hebrew University, I was able to write up details of this work. I remain deeply grateful to Zlil Sela for his feedback and encouragement during that time. It brings tremendous satisfaction to have seen Ian Agol bring this program to completion among his many great achievements.

Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman

In 1990, the Executive Committee of the Association for Women in Mathematics (AWM) established the Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman. This prize honors Alice T. Schafer (1915–2009), one of the founders of AWM and its second president, who contributed greatly to the advancement of women in mathematics throughout her career. The criteria for selection include, but are not limited to, the quality of the nominees' performance in mathematics courses and special programs, an exhibition of real interest in mathematics, the ability to do independent work, and, if applicable, performance in mathematical competitions.

AWM is pleased to present the twenty-third annual Alice T. Schafer Prize to **MurphyKate Montee**, University of Notre Dame.

Additionally, the accomplishments of four outstanding young women, all senior mathematics majors, were recognized on Wednesday, January 9, 2013. AWM was pleased to honor **Yuhou (Susan) Xia**, Bryn Mawr College, as **runner-up** for the 2013 Schafer prize competition. **Thao Do**, Stony Brook University, **Rebecca Gleit**, University of Michigan, and **Yangzhou Hu**, Massachusetts Institute of Technology, were recognized as **honorable mention** recipients in the Schafer prize competition. Their citations are available from the AWM.

Citation

MurphyKate Montee

MurphyKate Montee is a senior Honors Mathematics Major at University of Notre Dame and a member of its Seminar for Undergraduate Mathematics Research Program. At Notre Dame, MurphyKate has consistently excelled in mathematics classes at both the undergraduate and graduate level and has received numerous merit scholarships rewarding her extraordinary ability and promise.

MurphyKate has participated in multiple undergraduate research projects at Notre Dame and in two summer NSF-REU programs. Her time at the Louisiana State University REU led to a co-authored paper on the recursive behavior of ribbon graph polynomials. The following summer, MurphyKate attended the SMALL program at Williams College, where she produced two papers. The first was a single-authored paper "with lots of clever geometric arguments" predicted to appear in a strong mathematics research journal. The second, "Knot Projec-

tions with a Single Multi-Crossing," is hailed by her advisor as "perhaps the best work I have ever done with students," containing results that will have a significant influence on future knot theory research.

MurphyKate's mentors uniformly praise her motivation and "infectious" enthusiasm for the subject, calling her "one of the most mathematically mature students I have ever known" and "exceptionally gifted." Those who have worked with MurphyKate expect that she will have many more "impressive results" and an "amazing career" ahead of her, in part because of her uncanny ability to get right at the heart of a problem.

Response from MurphyKate Montee

I am honored to be selected as the recipient of the Alice T. Schafer Prize. I would like to thank the AWM for offering this award to support young women in mathematics, and the selection committee in particular for choosing me. I am incredibly grateful to so many people for helping me get here: to my family and friends for their constant support, and to the Notre Dame math department, as well as to the REUs at LSU and Williams College. Special thanks to Mr. Cliff Wind, for going above and beyond for me in high school; his obvious love of math and brilliant teaching inspired me to pursue a career in mathematics. To Professor Neal Stoltzfus, who mentored me in my first research experience, and who helped me find my own mathematical style. To Professor Colin Adams, whose endless stream of interesting questions is exciting and inspirational, and whose support and encouragement means more to me than I can say. To my advisor, Professor Frank Connolly, who has worked with me since my sophomore year to keep me challenged, and who has always pushed me beyond what I thought myself capable of.

Louise Hay Award for Contributions to Mathematics Education

In 1990, the Executive Committee of the Association for Women in Mathematics (AWM) established the Louise Hay Award for Contributions to Mathematics Education. The purpose of this award is to recognize outstanding achievements in any area of mathematics education, to be interpreted in the broadest possible sense. While Louise Hay was widely recognized for her contributions to mathematical logic and for her strong leadership as head of the Department of Mathematics, Statistics, and Computer Science at The University of Illinois at Chicago, her devotion to students and her lifelong commitment to nurturing the talent of young women and men secure her reputation as a consummate educator. The annual presentation of this award is intended to highlight the importance of mathematics education and to evoke the memory of all that Hay exemplified as a teacher, scholar, administrator, and human being.

Citation

Amy Cohen

The 2013 Louise Hay Award is presented to Amy Cohen in recognition of her contributions to mathematics education throughout an outstanding 40-year career at Rutgers University. Like Louise Hay, her career is remarkable for her achievements as a teacher, scholar, administrator, and human being. An elected fellow in American Association for the Advancement of Science, Amy has won many awards including the MAA's Distinguished Service Award and a teaching award from her MAA Section.

She is principal investigator (PI) for the New Jersey Partnership for Excellence in Middle School Mathematics, an NSF-funded Math and Science Partnership Program. As part of that grant, she led the development of a geometry course for teachers. Earlier curriculum work included new mathematics courses for elementary and high school teachers, the revision of her department's precalculus program, and a course, "Introductory Algebra for Returning Adults."

She has served as Dean of Rutgers' University College, co-PI for her department's VIGRE grant, and as a liaison to the School of Education, serving on many education committees.

Amy has made important contributions to mathematics education through her writing, the many talks she has given, and her service to professional organizations. For the MAA she has been a Project NExT consultant, member of the Committee on the Undergraduate Program in Mathematics, and chair of the

committee to select the Leitzel Lecturer. For the AMS she was a member of the Committee on Research in Undergraduate Mathematics Education. She is on the MSRI Education Advisory Committee and was on the organizing committee for two Critical Issues in Mathematics Education workshops. For the American Institute of Mathematics, she was a co-PI and organizer for two workshops on Finding and Keeping Graduate Students in the Mathematical Sciences. For AWM, Amy has served as Treasurer, member of the Education Committee, and as an AWM mentor.

Amy Cohen richly deserves the Louise Hay Award.

Response from Amy Cohen

It is an honor to receive this award—and a challenge to remain worthy of it.

Expressions of sincere gratitude are due to many: (a) to AWM for supporting women in many paths through the world of mathematics; (b) to my teachers for guidance, for encouragement, and sometimes for evoking an obstinate desire to prove their nay-saying wrong; (c) to my students for both encouraging and challenging feedback; (d) to my parents who revised their feelings that math was an unsuitable job for a woman; and finally (e) to my son for thriving in the family business.

When I entered the profession, there was a broad consensus that women had to choose between teaching and research and that most should choose to teach. I am particularly grateful that the participation of women in our mathematics profession is now well-enough established that it is now okay for a female to be interested in both teaching and in research.

In an essay for a CBMS volume, I once argued that research was essentially easier than teaching because a researcher had so much more control than a teacher. Researchers can choose topics that suit their interests and strengths. A theorem doesn't care whether it is proved. Teachers (including professors) can rarely influence the curriculum and the preparation of their classes, and students have all sorts of issues about being taught. There are serious intellectual questions about structuring instruction that engages learners and helps them learn math, especially those who don't find mathematics "obvious." Addressing those questions takes time and effort, but it can make teaching more satisfying for teachers as well as for learners. A recent Steele Prize winner once told me long ago, "Teaching is more fun when students learn."

M. Gweneth Humphreys Award for Mentorship of Undergraduate Women in Mathematics

This award is named for M. Gweneth Humphreys (1911–2006). Professor Humphreys graduated with honors in mathematics from the University of British Columbia in 1932, earning the prestigious Governor General's Gold Medal at graduation. After receiving her master's degree from Smith College in 1933, Humphreys earned her Ph.D. at age 23 from The University of Chicago in 1935. She taught mathematics to women for her entire career, first at Mount St. Scholastica College, then for several years at Sophie Newcomb College, and finally for over thirty years at Randolph Macon Woman's College. This award, funded by contributions from her former students and colleagues at Randolph-Macon Woman's College, recognizes her commitment to and her profound influence on undergraduate students of mathematics.

Citation

James Morrow

The Association for Women in Mathematics is pleased to present its third annual M. Gweneth Humphreys Award to Professor James Morrow of the Department of Mathematics at the University of Washington (UW).

The letters of nomination describe Jim as a superb teacher. Annually, he teaches the year-long Honors Advanced Calculus at UW in which he teaches students how to approach and enjoy problem solving. He challenges the students with tough problems, but also provides motivation and enormous support to get them to discover the solutions. He has an outstanding record of motivating women students to pursue advanced degrees and research careers in the mathematical sciences. He accomplishes this by encouraging his students, by fostering their confidence, and by understanding and anticipating their needs as they follow their interests.

A mid-career shift in Jim's research program from complex geometry to discrete inverse problems fortuitously extended his already well-established influence on undergraduate women (and men), primarily through the NSF-funded REU he co-founded in 1988 at UW. Often described by the NSF as a model program, it has attracted a stellar group of students in its 24 years of existence. Included in this group are nearly 30 women who have gone on to do graduate work in the mathematical sciences, often at top-tier universities.

In support of Jim's nomination, several women expressed sentiments conveyed in these excerpts:

"I am very grateful to Jim Morrow for the course my life has taken over the past several years. He saw potential in my application to his REU way back when I was a junior in college and I had not taken many advanced classes… Like too many other mathematically talented women, I didn't really think about graduate school as a possibility; no one had suggested it to me… Thanks to Jim, I did consider it, and now I am a successful student at a very good graduate school."

"I'm pretty sure that if it weren't for Jim, I never would have become a mathematician."

"Jim was the most influential professor in my undergraduate career… His devotion to his students is unparalleled."

The AWM is proud to honor Jim Morrow's outstanding achievements in inspiring undergraduate women to discover and pursue their passion for mathematics.

Response from James Morrow

My first reaction when I was notified that I had received the M. Gweneth Humphreys Award was disbelief. There are so many deserving candidates that I thought it very unlikely that I would get the award. When our Chair, Selim Tuncel, walked in to the first day of this summer's REU program and asked me if I had read my email and told me the news, I was stunned into speechlessness.

My second, and lasting reaction, is that my students are the ones who deserve the award. I am supremely lucky to have been able to work with such outstanding people. I feel like I am just an observer and my only contribution is to listen, encourage, and help my students realize their potential. Seeing these students do so well is my main joy in teaching. My students seem like they are my children, and my main duty is to help them make good decisions. I hope that they can be as lucky as I have been to have a rewarding life in which their work is something they deeply love.

I prefer not to single out any of them, but I'd like to quote two of them.

"If you hadn't encouraged me to apply to your REU program, I doubt I would have become a mathematician. And I love my work!"

"You are one of the truly gender-blind math teachers I've ever had (including women), and that in and of itself is a blessing to your female students."

Norbert Wiener Prize in Applied Mathematics

This prize was established in 1967 in honor of Professor Norbert Wiener and was endowed by a fund from the Department of Mathematics of the Massachusetts Institute of Technology. The prize is awarded for an outstanding contribution to "applied mathematics in the highest and broadest sense." The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico. This prize will be awarded every three years.

Citation

Andrew J. Majda

The 2013 Norbert Wiener Prize in Applied Mathematics is awarded to Andrew J. Majda for his groundbreaking work in theoretical fluid mechanics and its application to problems in atmospheric science and oceanography. His many outstanding contributions to the field include his work on vortex dynamics, turbulent diffusion, concentration phenomena for the Euler equations, multi-dimensional shock fronts, and absorbing boundary conditions for wave propagation. Mathematicians and geophysicists alike have embraced Majda's pioneering advances on important and recalcitrant issues arising in climate modeling and prediction. This work includes the development and exploitation of the methods of statistical physics in geophysical problems, as well as the multi-scale analysis of moist fluid dynamics in the atmosphere.

Biographical Note

Andrew J. Majda is Morse Professor of Arts and Sciences at the Courant Institute of New York University. He was born in East Chicago, IN, on January 30, 1949. He received a B.S. degree from Purdue University in 1970 and a Ph.D. degree from Stanford University in 1973. Majda began his scientific career as a Courant Instructor at the Courant Institute from 1973–75. Prior to returning to the Courant Institute in 1994, he held professorships at Princeton University (1984–94), the University of California, Berkeley (1978–84), and the University of California, Los Angeles (1976–78).

Majda is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and has received numerous honors and awards, including the National Academy of Science Prize in Applied Mathematics, the John von Neumann Prize of the Society of Industrial and Applied Mathematics, and the Gibbs Prize of the American Mathematical Society. He has been awarded the Medal of the College de France twice, and he is a Fellow of the Japan Society for the Promotion of Science. Majda has received three honorary doctorates,

including one from his undergraduate alma mater, Purdue University. He has given plenary one-hour lectures at both the ICM (Kyoto 1990) and the first ICIAM (Paris 1987) and is both an AMS and SIAM Fellow.

In his years at the Courant Institute, Majda has created the Center for Atmosphere Ocean Science with seven multi-disciplinary faculty to promote cross-disciplinary research with modern applied mathematics in climate modeling and prediction.

Response from Andrew J. Majda

I am honored and delighted to receive the 2013 Norbert Wiener Prize from the American Mathematical Society and the Society for Industrial and Applied Mathematics. I believe in modern applied mathematics with the broadest possible toolkit blending asymptotic methods, numerical methods, and rigorous mathematical analysis with physical reasoning used to attack the most difficult and pressing scientific problems, such as climate modeling or turbulence. In this way, both a scientific discipline and mathematics can enrich each other in amazing ways. As a young scientist, I found I truly loved the serendipity between applied mathematics and complex physical phenomena, and I would like to thank Peter Lax and Joe Keller for being role models, in very different ways, during my early days at Courant. I would like to thank my many collaborators, Ph.D. students, and post-doctoral fellows for all of their insight, help, and friendship. For my cited earlier works, I would like to mention especially Tom Beale, Bjorn Engquist, and Ron DiPerna, a truly brilliant mathematician who left us too soon. For my cited work in climate atmosphere ocean science and applied mathematics, I would like to acknowledge Eric Vanden-Eijnden, Rupert Klein, Boualem Khouider, Sam Stechmann, and Dimitri Giannakis. Finally, I would like to thank my many friends and colleagues at the Courant Institute, especially David McLaughlin, for the wonderful, supportive atmosphere for genuine interdisciplinary research with mathematics and applications.

Joint Policy Board for Mathematics Communications Award

This award was established by the Joint Policy Board for Mathematics (JPBM) in 1988 to reward and encourage communicators who, on a sustained basis, bring mathematical ideas and information to nonmathematical audiences. Both mathematicians and nonmathematicians are eligible. Currently, the award is made annually. JPBM represents the American Mathematical Society, the American Statistical Association, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.

Citation

John Allen Paulos

The 2013 JPBM Communications Award is presented to John Allen Paulos, professor of mathematics at Temple University. Professor Paulos's books, columns, reviews, speeches, and editorials have for more than twenty-five years brought mathematically informed ideas, information, opinion, and humor to a broad nonspecialist audience.

One of Professor Paulos's early books, *Innumeracy: Mathematical Illiteracy and Its Consequences* (Farrar, Strauss, and Giroux (Hill and Wang Division), New York, 1988), was a New York Times bestseller for over four months in 1989. *A Mathematician Plays the Stock Market* (Basic Books, New York, 2003) appeared on *BusinessWeek's* bestseller list in 2003. His many mathematical articles and reviews have appeared in *Scientific American*, the *Guardian*, *The New York Times*, *The Nation*, *The American Scholar*, the *London Review of Books*, and his "Who's Counting" column on ABCNews.com has been running for more than a decade. He has given talks at countless venues, ranging from the Smithsonian and the National Academy of Sciences to Harvard's Hasty Pudding Club and the *Late Show with David Letterman*.

Professor Paulos's writings combine real-world stories, forthright opinion, and wide-ranging mathematics to entertain and inform the public, both about timely issues and about how mathematics often can and should underlie public discussion of policy.

Biographical Note

John Allen Paulos is a best-selling author, popular public speaker, monthly columnist for ABCNews.com, and contributor to a variety of other publications. Professor of math at Temple University in Philadelphia, he earned his Ph.D. in

the subject from the University of Wisconsin-Madison. He is married and has two children, two grandchildren, and a dog named Shmata.

His writings include *Innumeracy* (*New York Times* bestseller for 18 weeks), *A Mathematician Reads the Newspaper* (on Random House's reader compilation of best nonfiction books), *Once Upon a Number* (chosen by the Los Angeles Times as one of the best books of 1998), and *A Mathematician Plays the Stock Market* (a brief tenant in 2003 on the *BusinessWeek* bestsellers list). He has also written scholarly papers on mathematical logic and related areas as well as scores of OpEds, book reviews, and articles in publications such as *The New York Times*, *Scientific American*, the *Wall Street Journal*, *Forbes*, *The Nation*, *Discover*, *The American Scholar*, and the *London Review of Books*.

The audiences he's addressed range from those in classrooms to members of the Smithsonian, from Harvard's Nieman Fellows to its Hasty Pudding Club, from mathematical associations to stock market forums, and from NASA and the National Academy of Sciences to college gatherings, including the commencement assembly at the University of Wisconsin. Paulos has appeared frequently on radio and television, including a four-part BBC adaptation of *A Mathematician Reads the Newspaper* and appearances on *NewsHour with Jim Lehrer*, *20/20*, *Larry King Live*, and the *Late Show with David Letterman*. In 2003 he received the American Association for the Advancement of Science award for promoting public understanding of science.

He's also been cited by cultural, business, and political commentators, has an extensive Web presence (including Twitter), and has even been the answer to a *Jeopardy* question. With these curious credentials, he served for two years on the editorial board of the *Philadelphia Daily News* where, as with his newspaper book, ABC columns, and stint at the Columbia School of Journalism, he tried to straddle the disparate realms of Pythagoras and Pulitzer.

Response from John Allen Paulos

I'm very honored to receive the JPBM Communications Award, especially given its previous recipients and the fact that communicating mathematics is a significant part of what I do. Like many of you, I was greatly influenced by popular communicators of mathematical ideas when I was young, particularly Martin Gardner and, a bit later, Ernest Nagel on Gödel's proof. They made clear that math wasn't just about algorithms, but said something about games, magic tricks, science, math itself (Gödel), and the world. Bertrand Russell was also an early influence although *Principia Mathematica* and his purely mathematical writings were anything but easily accessible. His philosophical and popular writings, however, primed me both to appreciate what he termed the "austere beauty" of mathematics and to realize that its study did not preclude one from commenting on topical issues and might even give one an oblique perspective on them. Nevertheless, at one time or another as an undergraduate at the University of Wisconsin in Madison I resolved to major in classics, English, philosophy, physics, and, of course, mathematics. Despite the brief separations and flings

with the above disciplines and other topics, I gradually became more deeply enthralled with the power of mathematics and came to see it as a sort of imperialist discipline capable of invading and occupying almost every other domain.

An opportunity to further the invasion came with *Innumeracy*, and I've been doing my best to advance the occupying forces for a long time, writing about the connections between mathematics and humor, philosophy, journalism and a variety of news stories, the stock market, story-telling, and other endeavors.

Much, perhaps too much, has been written about mathematical pedagogy and I certainly don't wish to add to it here, but there is one under-appreciated motivating factor I would like to mention. Show kids that with mathematics, some facts, and sometimes a bit of psychology they can vanquish blowhards' nonsense no matter their age or size. For some, at least, this may be a better initial selling point than mixture problems or factoring techniques.

My communicating the charm and relevance of mathematics to a large audience has been honor in itself, as is, I want to reiterate, recognition of my efforts by the JPBM and the mathematics community generally.

American Mathematical Society
Mathematical Association of America
Society for Industrial and Applied Mathematics

Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student

The Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student recognizes and encourages outstanding mathematical research by undergraduate students. It was endowed by Mrs. Frank Morgan of Allentown, Pennsylvania.

Citation

Fan Wei

Fan Wei is awarded the 2013 AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student for her wide range of scholarly contributions. As an undergraduate at the Massachusetts Institute of Technology, Wei authored or co-authored five papers in fields as diverse as number theory, combinatorics, statistics, and tropical geometry, and she is recognized, in particular, for her single-authored paper that solves a separable permutations problem posed by Dr. Richard Stanley. Her work has been described as "impressive and ingenious" and as "enthusiastically received by other mathematicians."

Wei has attended REUs at Williams College and the University of Minnesota-Twin Cities, and has participated in many research projects at MIT. She has presented her results at two conferences in 2010: the Young Mathematician's Conference and Permutation Patterns.

Wei was part of a Meritorious Winner Team for the 2010 Mathematical Contest in Modeling, a mentor of the Girl's Angle Math Club in Cambridge, and has served on the board of MIT's Society of Women Engineers. Additionally, Wei won the 2012 Alice T. Schafer Prize.

Biographical Note

Fan Wei is from Beijing, China, where she finished high school and became interested in mathematics. In 2012, Fan Wei received her bachelor's degree from the Massachusetts Institute of Technology, where she majored in mathematics and became more committed to the subject. Her interests in mathematics are in analysis and combinatorics. After a summer internship at Microsoft Research New England with Henry Cohn, she went to Cambridge University, where she is studying Part III mathematics for a master's degree. She plans to return to the United States to obtain a Ph.D.

Response from Fan Wei

I am very honored and grateful to receive the Frank and Brennie Morgan Prize. It is a great encouragement for me and I would like to thank AMS, MAA, and SIAM for selecting me for this award.

First and foremost, I want to thank my parents for their constant love, understanding, and tolerance. My home has always been, and will continue to be, my motivation. My gratitude goes to my research mentors, class lecturers, and nominators, Richard Dudley and Richard Stanley. Furthermore, I want to express my gratitude to Henry Cohn, my mentor at Microsoft Research; to the hosts of the UMN REU—Gregg Musiker, Victor Reiner, and Pavlo Pylyavskyy; and to the hosts of Williams College SMALL REU, especially Allison Pacelli, for providing me with two memorable summers. I am also grateful to the MIT mathematics department, and the many people including the staff members and professors, such as Michael Artin, Alan Edelman, Ju-Lee Kim, Gigliola Staffilani, Daniel Stroock, and other analysis and combinatorics professors for their great help, patience, and support. Lastly, I want to thank all my friends for giving me a second family. I am lucky to know you all.

Citation for Honorable Mention
Dhruv Ranganathan

Honorable mention goes to Dhruv Ranganathan for the 2013 AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student. Ranganathan is recognized for his research in Gromov–Witten theory and toric geometry, and, in particular, for his article "Toric Symmetry of CP^3". Letter writers remarked on his ability to "master the formidable prerequisite material" and commented on his "key insights" and "surprising" results.

Ranganathan has presented his results at the Algebra, Number Theory and Combinatorics Seminar of the Claremont Colleges, the 2011 Joint Mathematics Meetings, and the Western Algebraic Geometry Seminar. Ranganathan is a 2012 graduate of Harvey Mudd College.

Biographical Note

Dhruv Ranganathan grew up in Chennai, India, and Johannesburg, South Africa. Despite early aspirations to be a professional cricket player, his interest in mathematics and physics quickly took over. It was at the age of nine that he began learning advanced mathematics outside of school, under the private tutelage of A.V. Ramamoorthy in Chennai. At Harvey Mudd College, he worked closely with Dagan Karp for over two years, studying Gromov–Witten theory and toric geometry. This project shaped his current research interests, which include algebraic geometry, toric and tropical geometry, and high-energy physics. Ranganathan is a winner of the Giovanni Borrelli Fellowship and was awarded the Chavin Prize for his Harvey Mudd College senior thesis entitled "Gromov–Witten theory of blowups of toric threefolds." He is currently a first-year graduate student at Yale University. When not studying mathematics, Ranganathan can be found playing

the violin, finding innovative ways to cook for himself, or honing his flying trapeze skills.

Response from Dhruv Ranganathan

I am deeply humbled and honoured to be selected for Honourable Mention for the 2013 Morgan Prize. I thank the AMS, MAA, and SIAM for selecting me. I owe a debt of gratitude to my advisor Dagan Karp for his friendship, guidance, and patience. I also express my gratitude to my teachers, Alfonso Castro, Jon Jacobsen, Michael Orrison, and A. V. Ramamoorthy, all of whom have inspired me to study mathematics. Finally, I owe a massive *thank you* to my family and friends for their ever present belief, unquestioning support, and unbounded love.

Citation for Honorable Mention
Jonathan Schneider

Honorable mention goes to Jonathan Schneider for the 2013 AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student. Schneider is recognized for his solution to a problem posed by Dr. Richard Stanley concerning polynomial sequences of binomial type. One letter writer describes Schneider's "ingenious insights and arguments" as having "vast potential for applications and generalizations." Jon is currently a senior at the Massachusetts Institute of Technology.

Biographical Note

Jon Schneider was born in Montreal, Canada, and grew up in Toronto, Canada. His high school mathematics teachers at the University of Toronto Schools encouraged Jon's passion for math, and while at high school Jon represented Canada three times at the International Mathematics Olympiad.

Jon then enrolled at MIT, where he is currently concentrating in mathematics and theoretical computer science. During his freshman summer, Jon was introduced to the world of mathematics research through MIT's Summer Program in Undergraduate Research, where he studied the combinatorics of chip-firing and hyperplane arrangements. The next summer, Jon did research with Professor Richard Stanley, solving an open problem regarding the coefficients of chromatic polynomials of certain graphs. Jon presented his solution to this problem at the 2011 Joint Mathematics Meetings, for which he was recognized with an MAA Undergraduate Poster Prize. Next year Jon intends to attend graduate school in either mathematics or computer science.

Response from Jon Schneider

I would like to thank the AMS, MAA, and SIAM for selecting me for this honorable mention.

I am especially grateful to Professor Richard Stanley for introducing me to this problem and for advising me over the course of my research. I am further thankful to all of my math professors and classmates at MIT, from whom I have learned a great deal. Finally, I would like to thank my parents for their incredible love and support.

Chauvenet Prize

The Chauvenet Prize is awarded to the author of an outstanding expository article on a mathematical topic. First awarded in 1925, the Prize is named for William Chauvenet, a professor of mathematics at the United States Naval Academy. It was established through a gift in 1925 from J. L. Coolidge, then MAA President. Winners of the Chauvenet Prize are among the most distinguished of mathematical expositors.

Citation

Robert Ghrist

"Barcodes: The persistent topology of data," *Bulletin Amer. Math. Soc.* 45 (2008), no. 1, 61–75.

This article is an intriguing survey of some recent developments in computational algebraic topology that find application in the detection of patterns in large sets of high-dimensional data. The author uses attractive illustrations to introduce the reader to the mathematical concept of persistent homology and to its graphical representation through barcodes.

Although the human eye and brain are marvelously adept at recognizing features inherent in a pointillist painting, discovering structure in a cloud of points in three dimensions or in thirty dimensions presents a formidable challenge that demands effective computational tools. A promising idea is to fatten the points into balls and to seek topological information that is stable under variation of the radii of the balls. This idea underlies the new theory of persistent homology, which has been developed by various researchers over the past decade. Barcodes—parametrized versions of Betti numbers—provide a convenient picture of persistent homology.

The author's engaging exposition includes a discussion of how persistent homology has been exploited to tease out subtle regularities within a large set of nine-dimensional vectors derived from a database of digital photographs. This survey article reveals modern applied mathematics at its best: sophisticated, abstract mathematics in the service of real-world data analysis.

Biographical Notes

After earning an undergraduate degree in mechanical engineering from the University of Toledo, **Robert Ghrist** earned a Ph.D. in applied mathematics from Cornell University (1995), writing a thesis on knotted flowlines. In 2008,

Professor Ghrist was appointed as the Andrea Mitchell University Professor of Mathematics and Electrical & Systems Engineering at the University of Pennsylvania.

Ghrist is the recipient of NSF CAREER (2002) and PECASE (2004) awards for work focusing on topological methods in applied mathematics, with applications including robotics, sensor networks, fluid dynamics, and more. His joint work with Vin de Silva was honored by Scientific American (2007) as a "SciAm50 Top Research." He is the recipient of several teaching awards and enjoys teaching not only his Penn students, but his four children at home, as well as his tens of thousands of calculus students via *Coursera*, starting January 2013.

Response from Robert Ghrist

I am both grateful and humbled that the MAA has awarded the Chauvenet Prize to my article, "Barcodes: The persistent topology of data." This article is an exposition of the work of Gunnar Carlsson and his collaborators on applications of algebraic topology to data analysis. I therefore thank Professors Carlsson and de Silva especially for our many illuminating conversations on the research, as well as for making the subject so engaging and easy to exposit.

CERTIFICATES FOR MERITORIOUS SERVICE

Certificates for Meritorious Service are presented, on the recommendation of the Sections of the Association, for service at the national level or for service to a Section of the Association. The first such awards were made in 1984. At each January meeting of the Association, honorees from several Sections are recognized.

Citation

Jon L. Johnson, Illinois Section

For the last fifteen years Jon Johnson has served the Illinois Section of the MAA (ISMAA) as Secretary-Treasurer, and in this role he has kept the annual Section meeting on track as well as having recorded it with his pictures. During his term, ISMAA has maintained a solid financial balance, revised the Section bylaws, and embarked on several initiatives to promote student participation in the annual meeting and to enhance the professional development of members new to the Association. Jon earlier served on the ISMAA Board and High School Lecture Committee, which he chaired for two years. Jon received the ISMAA Distinguished Service Award in 2005.

Jon has organized special sessions at both MathFest and the Joint Mathematics Meetings and is in his second term on the committee on Curriculum Renewal Across the First Two Years. At Elmhurst, he has received the President's Excellence in Teaching Award. His devotion to teaching and to his students is evidenced by his supervision of undergraduate student research resulting in more than twenty student presentations at local, regional, and national conferences.

Jon has published articles on commutative algebra, technology in the mathematics classroom, and applications of differential equations. He was the Project Director for a National Science Foundation Teacher Enhancement Project for high school teachers and was a Co-Project Director for an NSF Instrumentation and Laboratory Improvement Project linking physics and mathematics courses, for National Conferences for Undergraduate Research, and for a Leslie E. Lancy Foundation Project "Issues related to the expansion of O'Hare International Airport".

Biographical Note

Jon L. Johnson received his B.S. from Harvey Mudd College and his M.S. and Ph.D. from the University of Kentucky in commutative algebra under the direction of Paul Eakin. Jon is a professor of mathematics at Elmhurst College in Elmhurst, Illinois, where he has taught for thirty-five years. While at Elmhurst, Jon has served as both department chair and division chair. He serves as faculty advisor for both Pi Mu Epsilon and the MAA Student Chapter.

In his away-from-college life, Jon enjoys being with his family, swimming, running, tennis, Saab automobiles, and Disney theme parks.

Response from Jon L. Johnson

I am very pleased and honored to represent the Illinois Section by receiving this Certificate for Meritorious Service. As the Secretary-Treasurer of the Section, I always enjoyed the interaction with those who attended the Section meetings. But, most of all, it was getting to know and work with the wonderful individuals who served as Section officers and board members during the last fifteen years that I'll most fondly remember. Thank you!

Citation
Dan Curtin, Kentucky Section

Dan came to Northern Kentucky University (NKU) in 1979 and immediately became active in the Kentucky Section of the MAA and has participated in all but three of the annual Section meetings since that time. Dan has presented talks at Section meetings, conducted a minicourse, "The History of Mathematics," and served as a panelist for an "Assessment Workshop." In addition, he was a member or chair of the Section's nominating committees several times, handled local arrangements when the Section meeting was held at NKU, served as Chair from 1989 to 1991, and then as Governor. Dan now serves as Historian of the Kentucky Section.

Dan is an active participant in the Joint Mathematics Meetings and MathFest, presenting talks at MathFest on several occasions. Dan has served on the MAA Notes Editorial Board, refereed chapters for an MAA book on the history of mathematics, and refereed articles for the *College Mathematics Journal*. Soon after arriving at NKU, Dan began explorations into the history of mathematics, becoming active, productive, and well known in the history of mathematics community. In addition to historical presentations at national and Section meetings, Dan had an article in the *College Mathematics Journal* as well as the MAA online journal on the history of mathematics. Dan authored three chapters in the MAA Notes volume *Mathematical Time Capsules*, published in 2011. Dan has been a leader in the MAA's history of mathematics community, including service as Chair of History of Mathematics Special Interest Group of the MAA (HOM SIGMAA) from 2006 to 2009.

Biographical Note

Dan Curtin was born in Buffalo, NY, and graduated from Canisius High School. His undergraduate degree is from the University of Notre Dame, and he completed a Ph.D. at the University of North Carolina at Chapel Hill. That fall he began his career at NKU and joined the Kentucky Section of the MAA. He has been active in both ever since. Trained as an algebraic geometer, he was intrigued by the history of mathematics and began investigating 16th-century algebra in Italy and the mathematics of the Dutch commentators on Descartes' *Géométrie*. At NKU he served in administrative positions for both the department and the

Dean's office as well as on countless committees. Outside of mathematics he is active with his church, family, fellow ham radio enthusiasts, and on stage and behind the scenes in support of Irish music and culture.

Response from Dan Curtin

The MAA and especially the Kentucky Section are an essential part of my life. It has been a great pleasure to work with colleagues from all over the Commonwealth and the nation and to count so many mathematicians as friends. They even made committee meetings enjoyable. Knowing the excellence of my colleagues and having seen those chosen before me to receive this award, I was astonished to learn of my nomination. Much credit must go to those who taught me the importance of serving the community—and how to serve others well. I am grateful to everyone who helped me along the way, from my Jesuit instructors in high school and my teachers in college and graduate school to my colleagues at NKU, KYMAA, HOM SIGMAA, and the MAA. My wife, Ellen, and my family deserve special thanks. I also thank my students, who every year give me hope and keep me humble.

Citation

Yungchen Cheng, Missouri Section

Yungchen has been a stalwart, hard-working member of the Section for over twenty years. He initiated the MAA Student Chapter at Missouri State in the late 1980s, one of the first chapters in the nation, and served as its sponsor for years. He served as Secretary-Treasurer of the Missouri Section from 1992 to 1998 and was principally involved in organizing the 1998 joint meeting with the Missouri Council of Teachers of Mathematics. He served as the Missouri State Departmental Liaison and as Chair and Governor of the Section. Yungchen initiated joint meetings of the Missouri Section with the Missouri Mathematical Association of Two Year Colleges, which occurred in 2011. During his twelve years of service on the executive committee, he provided timely advice to many Chairs in organizing their meetings. From 2007 to 2009, Yungchen served on the Missouri Department of Higher Education's Math Workgroup to develop college entry and exit competencies. During his tenure, he made a concerted effort to keep the Missouri Section members and institutions informed, making two presentations on the topic. Yungchen currently serves as the Section's liaisons coordinator.

Biographical Note

Yungchen Cheng grew up in Taiwan and did his undergraduate work at National Taiwan University and his master's at Tamkang University. He received his Ph.D. from Rutgers University and is currently Professor of Mathematics at Missouri State University (MSU) in Springfield, Missouri, where he served as department head for seventeen years. Yungchen became involved with campus service work at MSU soon after joining the faculty in 1984. He has directed a Regional undergraduate math research conference involving about a dozen colleges and universities in Missouri, Arkansas, and Kansas, which has been hosted at MSU since 2005 through MAA's Regional Undergraduate Mathematics Conference (RUMC) program.

Yungchen was an active collaborator with area high schools for years through sponsoring math contests, math clubs, summer math institutes, and dual credit math courses. He was greatly involved with a recent statewide (high school/college) math curriculum alignment initiative. He has been an advisor to the area math teachers association, continues directing a math enrichment program for area high/middle school students, and has stayed involved with American Regions Math League's activities.

In his spare time, Yungchen enjoys walking, and he participates in a local 10K walk annually.

Response from Yungchen Cheng

I am honored and humbled to be receiving this award. To many wonderful colleagues in the Missouri Section, I am grateful for having opportunities to work with them to help promote the great good of the MAA.

Citation
Jean Bee Chan and Peter Stanek, Golden Section

Jean Bee Chan and Peter Stanek have each served the MAA, but it is their joint work in managing the Golden Section Book Sales that is recognized with this certificate. They have done this service over a period now moving into its second decade, and this represents no minor contribution to the Section. The Golden Section Book Sales has ranked among the best sectional book sales across all MAA Sections.

Jean, a mathematics faculty member at Sonoma State University in California, won teaching awards on her campus and in Sonoma County, and she won a Martin Luther King, Jr., Humanitarian Award in Marin County. Peter's career has mainly been in industry. He has won several professional awards for innovative development of efficient processes, and he owns a patent in image processing technology.

Jean has served as an MAA Section Officer, Governor, and Second Vice President. She served on several MAA committees and spoke at Section meetings across the country, including the Golden Section meeting. Peter was elected MAA Governor-at-Large for Mathematicians in Business, Industry, and Government (BIG) in 2006. He served on several MAA committees, including the Editorial Board of *MAA FOCUS* and the BIG committee; he was a founding member of BIG SIGMAA.

Joint Biographical Note

Jean Bee Chan grew up in China and went to high school in Hong Kong. Her family came to Chicago to join her grandfather. She enrolled in the University of Chicago, where she met Peter, her future husband.

Peter Stanek is a native of Chicago. He skipped the last year of high school to enter the University of Chicago, skipped his B.S., and earned his M.S. and wrote his Ph.D. thesis under A. Adrian Albert. He followed a career in academia,

government operations research, and aerospace engineering until retirement in 2004. Since 2009, he has been the President of the Global Alliance for Preserving the History of WWII in Asia.

Jean spent almost her entire academic life at Sonoma State University where she founded the weekly Math Colloquium and the Mathematics Festival to celebrate National Mathematics Awareness Month. She was the founder of the Asian Scholarship Fund, which awards scholarships to qualified high school seniors in California.

Since 1973, Jean and Peter have attended nearly all of the national MAA summer and winter meetings, where they have learned innovative teaching and research methods and met many good friends. They regularly attend the meetings of the Golden Section. They are proud parents of two fine grown children, an actuary and an attorney, both of San Francisco.

Joint Response from Jean Bee Chan and Peter Stanek

We are most grateful to the MAA for representing the mathematical professions to the general public, and for challenging our community with the highest standards of teaching and research. We were very surprised and humbled to learn of this award. So many other Golden Section colleagues deserve the award much more than we do. It is our privilege to have the opportunity to work with the inspiring and dedicated individuals in the Golden Section.

Citation

Robert Rogers, Seaway Section

Robert Rogers is a distinguished Professor of Mathematics at State University of New York (SUNY) Fredonia and has been awarded both the SUNY Fredonia President's Award and the MAA Seaway Section Clarence Stephens Award for Excellence in Teaching. His research interests include analysis, history of mathematics, and mathematics education. He is the editor of the *New York State Mathematics Teachers' Journal* and is currently President-elect of the Association of Mathematics Teachers of New York State (AMTNYS). He is also a member of the NYS STEM (Science, Technology Education, and Math) Education Collaborative and NYS Educational Leadership Cadre, helping to examine and disseminate PARCC (Partnership on Assessment for Readiness for College and Career) materials.

Bob has been active and effective in Seaway Section leadership since agreeing to become the First Vice-Chair and Program Chair of the Section in 1998. As Chair-elect, Chairperson, and Past Chair (2000-2004), Bob coordinated and directed a Web-based process for Executive Committee business, promotion of Section meetings, and the *Seaway Current Newsletter*. During these years Bob continued to energize the work of the Seaway Section's Educational Policies Committee, hosting regular K–16 panel discussions among members of AMTNYS, NYSMATYC (New York State section of the Association of Mathematics Teachers at Two Year Colleges), and the MAA. The Section cohosted several meetings with NYSMATYC during Bob's leadership. Thanks to Bob's efforts, mathematics teachers across

upstate New York and into Canada have an ongoing dialogue about topics such as articulation agreements, what to emphasize in calculus, students understanding proofs, and incorporating history in the teaching of mathematics. As Student Program Chair of the Section, Bob worked with MAA staff to obtain grant money from Exxon for developing a comprehensive student program at Section meetings. Bob has served as Governor of the Section and most recently stepped back in for a year as Interim Chair, again keeping the Section business running while the Nominations Committee members arranged for a longer term transition.

Biographical Note

Robert Rogers grew up near Buffalo, NY, graduating from high school in 1975. He earned his B.S. in Mathematics with Certification for Secondary Education from Buffalo State College, his M.S. in Mathematics from Syracuse University, and his Ph.D. in Mathematics from SUNY Buffalo. A first generation college graduate, Bob intended to be a high school mathematics teacher. He was encouraged by the faculty at Buffalo State College to attend graduate school, ultimately leading to his Ph.D. in mathematics specializing in operator theory. He has taught at SUNY Fredonia since 1987 and is happy to be in a supportive department with excellent colleagues and friendly students. Bob's interest in teaching mathematics at all levels has extended to his editorship of the *New York State Mathematics Teachers' Journal*, where he has the opportunity to facilitate a dialogue among mathematics teachers from K–16. Using his interest in the history of mathematics, Bob tries to emphasize the evolution of mathematical ideas and applies this to how ideas evolve in students' minds.

Response from Robert Rogers

My receiving this honor would not have been possible without the help and support of a number of people. This award is as much theirs as it is mine. First I want to thank my immediate predecessors, H. Joseph Straight and Luise-Charlotte Kappe, for being the exemplars of service that they were. I next want to thank the members of the Executive Committee of the Seaway Section and especially Cheri Boyd for my nomination. There are many others so deserving that I was genuinely surprised that they chose me for this honor. I want to personally thank John Maceli, who is really an unsung hero of the Section. Often it is his behind-the-scenes work and counsel that keeps the Section running smoothly. My colleagues at SUNY Fredonia deserve credit for their unwavering support. They have always been there to cheerfully help on any endeavor that has come our way. Working with such people has been my privilege and pleasure. I want to thank my family and especially my wife, Cheryll. Without her love and support, none of this would have ever happened.

Citation

Jonathan Kane, Wisconsin Section

Jonathan Kane has served the Wisconsin Section as Chair and as Governor and has served on many MAA related committees. One of Jon's passions is student math contests. In 2003 he, Titu Andreescu, and Bennette Harris developed an

online mathematics competition in which middle school and high school students compete in teams. The contest, renamed the Purple Comet, has thrived since that first year and now attracts more than two thousand teams annually. The success of the Purple Comet is due in large part to Jon's unflagging dedication to it, as he writes contest problems and lines up funding. It is a stroke of good fortune for the MAA that Jon has shared his expertise on mathematics competitions by serving on the American Invitational Mathematics Exam committee, on committees for the AMC 10/12 and the USA Mathematics Olympiad, and on the Committee on the American Mathematics Competitions. Jon is currently serving a second term as a member of the MAA Minicourse Committee.

Jon has taught mathematics and computer programming at University of Wisconsin-Whitewater since the 1980s, and has taken a keen interest in the actuarial sciences part of the undergraduate program there. But his contributions are diverse. For example, in 2012 he published with Janet Mertz the paper "Debunking myths about gender and mathematics performance." This paper, which appeared in the *Notices of the American Mathematical Society* in December 2012 has been adopted by the mathematical community as its answer to those who claim, erroneously, it appears, that the female gender naturally shows less variability in mathematical talent than the male gender. Jon continues service to the Section in his new position as Secretary-Treasurer of the Section.

Biographical Note

Jonathan Kane received a B.A. in mathematics from the University of Minnesota-Duluth. From the University of Wisconsin-Madison, he received masters degrees in mathematics, statistics, and computer science, along with a Ph.D. in mathematics with a thesis in several complex variables. Jon also completed an associateship in the Society of Actuaries. He was a member of the faculty at the UW-Whitewater from 1980 through 2012 and is currently an Honorary Fellow at UW-Madison, where he is helping the department with outreach activities.

Jon enjoys mathematics competitions, ranging from coaching the Whitewater Putnam Team to writing problems to helping run competitions. He regularly teaches at the AwesomeMath Summer Program. Jon has published articles in several complex variables, probability, algorithms, and gender and mathematics performance, the latter written with his spouse, Janet Mertz. He created and markets the shareware programs GRADE GUIDE and Sudoku Studio. Jon also enjoys chess, bridge, playing the string bass in a community orchestra, photography, running, bicycling, science fiction, and mysteries.

Response from Jonathan Kane

I wish to thank the Wisconsin Section for recommending me for this Meritorious Service award. I have always enjoyed working with that great group of people, and look forward to serving as their new Secretary-Treasurer. I would also like to thank those who have been major influences in my mathematical career, including my teachers Charlie Nelson and Duane Anderson; my research advisors Jim Nelson, Joe Gallian, and Alex Nagel; and those who got me involved in mathematics competitions, especially Titu Andreescu and Steve Dunbar.

Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics

The Gung and Hu Award for Distinguished Service to Mathematics, first presented in 1990, is the endowed successor to the Association's Award for Distinguished Service to Mathematics, first presented in 1962. This award is intended to be the most prestigious award for service offered by the Association. It honors distinguished contributions to mathematics and mathematical education—in one particular aspect or many, and in a short period or over a career. The initial endowment was contributed by husband and wife, Dr. Charles Y. Hu and Yeuh-Gin Gung. It is worth noting that Dr. Hu and Yueh-Gin Gung were not mathematicians, but rather a professor of geography at the University of Maryland and a librarian at the University of Chicago, respectively. They contributed generously to our discipline because, as they wrote, "We always have high regard and great respect for the intellectual agility and high quality of mind of mathematicians and consider mathematics as the most vital field of study in the technological age we are living in."

Citation

William A. Hawkins, Jr.

The Mathematical Association of America awards the 2013 Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics to William A. Hawkins, Jr. (Bill) for his work to improve the mathematical education of underrepresented minorities and to increase their representation in the mathematical community. Since 1990, Bill has directed the MAA program Strengthening Underrepresented Minority Mathematics Achievement (SUMMA). In this capacity, he has been a leader in analyzing and interpreting the current status of minorities in mathematics and in calling attention to the need for action. He has also been active in raising funds and organizing programs to bring about change.

Bill Hawkins was one of the cochairs when the MAA Committee on Minority Participation in Mathematics was first established in the late 1980s. In 1990, he resigned from that position and took a leave from the University of the District of Columbia to become director of the then-new MAA program, SUMMA. At first, the MAA position was salaried through a grant from the Carnegie Corporation, but that funding ran out in the mid-1990s. Bill has continued to work, without pay, approximately half-time, directing the SUMMA program while working full-time at the University of the District of Columbia. So although Bill is listed on the MAA staff page and works in the MAA office, he has been an unpaid volunteer for many years.

Under his leadership, SUMMA has been responsible for bringing more African Americans, Chicanos, Latino Americans, and Native Americans into mathematics at all levels and has provided sustained efforts to keep them there; from the precollege students who participated in SUMMA-supported intervention projects, through the undergraduates who are learning the excitement of research experiences in the National Research Experiences for Undergraduates Program (NREUP), to underrepresented minority Ph.D.s in mathematics and mathematics education whose success stories are told in Bill's archival record, on up to the chairs of the nation's minority-serving mathematics departments. For these chairs, the annual Minority Chairs Breakfast and Meeting organized by Bill at the Joint Mathematics Meetings has become a primary networking event.

Since 1990, SUMMA has raised more than $4M in grants for programs and publications to increase minority participation in mathematics. Receiving a grant is just the first step. Bill has followed through, leading one successful project after another with the support of the MAA staff. Under Bill's guidance, in 1991 SUMMA obtained funding to carry out Middle and High School Intervention Projects. The SUMMA Intervention Projects ultimately provided seed funding, professional support, and a consortium network (SUMMAC) for over one hundred precollege mathematics enhancement programs for underrepresented minority students in forty-two states, Puerto Rico, the District of Columbia, and Canada.

SUMMA's National Research Experiences for Undergraduates Program (NREUP) provides an example of Bill's service and leadership in the mathematical community. With a small amount of start-up funding from the National Security Agency (NSA), Bill designed a project to support underrepresented minority students. Bill used that funding to give small grants to multiple sites each having a few underrepresented minority students working together on mathematics-based research projects. In the first year, there were three sites with a total of eight students; of those eight, three have entered or completed doctoral programs in the mathematical sciences and two more have done the same with masters programs in mathematics. The program has been expanded with enhanced funding from the NSA, the NSF, and other sources; to date, NREUP has hosted 386 students in eighty-six summer REU projects. Almost as important as the student success stories from these REU projects are the large cadre of project directors who now network at SUMMA panels and activities at the Joint Mathematics Meetings. Some directors have moved from NREUP support to continue their projects with funding from other sources.

Bill continues to provide extensive support to the Committee on Minority Participation in Mathematics. He finds topics that need to be discussed, does much of the work in putting together the agenda and gets the special guests there, and follows up on the decisions the committee has made; in brief, he acts as at least a full cochair without that title. He assumes most responsibility for the arrangements, agenda, invitations, and rounding up of speakers for the annual Minority Chairs Breakfast and Meeting. Bill also organizes panels, workshops, and other networking activities related to SUMMA efforts at the Joint Mathematics Meetings.

Leveraging collaborations with the Tensor Foundation, the Benjamin Banneker Association, Texas Instruments, and the Sloan Foundation, Bill promotes access, equity, and encouragement for traditionally underrepresented mathematicians at all levels. Whether it be supporting precollege intervention projects, providing otherwise unaffordable technology, or making available other resources for success, he has done wonderful work throughout the years and is not bothered by the fact that his efforts often are taken for granted. He works to address issues and needs in the mathematics community without regard to compensation, recognition, or expressions of appreciation. The Association is pleased to have this opportunity to express its appreciation by recognizing Bill Hawkins with its most prestigious award for service.

Biographical Note

William A. Hawkins, Jr., earned his B.S. in mathematics and M.S. in physics from Howard University before earning an M.A. and Ph.D. in mathematics from the University of Michigan. He joined the faculty of what became the University of the District of Columbia (UDC) in 1970 and served as department chair for five years. Taking leave, he worked as the director of the MAA Strengthening Underrepresented Minority Mathematics Achievement (SUMMA) from 1990 through 1996, when he returned to UDC. He continues to direct SUMMA.

Response from William A. Hawkins, Jr.

I am grateful for and humbled by this award. It goes without saying that many others more deserving could have been chosen. I am honored to be included in the illustrious company of those who have been previous recipients. It would have been impossible for me to accomplish anything without the unqualified support of the three MAA Executive Directors under whom I have served—the late Marcia Sward, Tina Straley, and Michael Pearson. Florence Fasanelli and I worked side-by-side for many years at SUMMA. John Kenelly and I worked on projects at minority institutions. Minority mathematicians, such as Sylvia Bozeman, the late Joaquin Bustoz, Wade Ellis, Jr., Genevieve Knight, Bob Megginson, and Abdulalim Shabazz, have been constant in their encouragement of my efforts. Finally, I want to thank my wife and my children for all their love and affection.

E. H. Moore Research Article Prize

This prize was established in 2002 in honor of E. H. Moore. Among other activities, Moore founded the Chicago branch of the American Mathematical Society, served as the Society's sixth president (1901–02), delivered the Colloquium Lectures in 1906, and founded and nurtured the *Transactions of the AMS*. The prize is awarded every three years for an outstanding research article to have appeared in one of the AMS primary research journals (namely, *Journal of the AMS*, *Proceedings of the AMS*, *Transactions of the AMS*, *Memoirs of the AMS*, *Mathematics of Computation*, *Electronic Journal of Conformal Geometry and Dynamics*, and *Electronic Journal of Representation Theory*) during the six calendar years ending a full year before the meeting at which the prize is awarded.

Citation

Michael J. Larsen and Richard Pink

The 2013 E. H. Moore Research Prize is awarded to Michael J. Larsen and Richard Pink for their article "Finite subgroups of algebraic groups" (*J. Amer. Math. Soc.* 24 (2011), no. 4, 1105–1158). The article provides a conceptual proof of an approximation to the classification of finite simple groups, using methods that are independent of the classification. Specifically, the article generalizes a fundamental result of Camille Jordan (1878) that concerns finite subgroups of GL_n over a field of characteristic 0; Jordan's theorem states that each such subgroup has a normal abelian subgroup of index bounded by a constant that depends only on n. Larsen and Pink work with arbitrary fields; they allow positive characteristic. Their situation is visibly more complicated than that studied by Jordan: consider, for example, what happens over a finite field, where the ambient group GL_n is finite and close to being simple. The authors prove, in particular, that finite simple subgroups of GL_n are either small (in terms of n) or are of Lie type.

Experts spoke of the impact of this article, praising the methods of the article as well as its conclusions. One report ended, "This was a *tour de force*, and I cannot think of a better choice for the E. H. Moore Prize."

Biographical Notes

Michael Larsen graduated from Harvard College in 1984 and received a Ph.D. in mathematics from Princeton University in 1988. He has worked at the Institute for Advanced Study (1988–90), the University of Pennsylvania (1990–97), and the University of Missouri (1997–98) before coming to Indiana University, where he is now Distinguished Professor of Mathematics.

Richard Pink received his Ph.D. in mathematics from Bonn University in 1989 under the supervision of Professor Dr. G. Harder. An invited lecturer to the 2002 ICM in Beijing, China, Richard has taught at Bonn University, Harvard University, the Max-Planck-Institut für Mathematik, and Mannheim University. Currently, he is teaching at ETH Zürich, where he served as chairman of the Department of Mathematics from 2004–06. His research interests include number theory and arithmetic geometry, specifically the arithmetic of Shimura varieties, the topological-geometric nature of the Lefschetz trace formula, Drinfeld modules and their generalizations, and motives over function fields, including the arithmetic of the associated Galois representations. In 1996, after some preliminary sketches, Richard commissioned a master carpenter to design and build a fancy modular cabinet for his house (http://www.math.ethz.ch/~pink/ModularCabinet/cabinet.html); the design is based upon the action of the modular group on the Poincaré half-plane, an important idea that underlies much of his work.

Joint Response from Michael J. Larsen and Richard Pink

We would like to express our deep appreciation to the American Mathematical Society for this unexpected honor. At the time that we wrote the original draft of our paper (1998), the quasithin case of the classification of finite simple groups remained open. We wanted a weak version of the classification theorem that could be used for subgroups of GL_n, for instance for Galois representations associated to Drinfeld modules or for strong approximation in the spirit of Boris Weisfeiler's work. We were inspired by the beautiful paper of Madhav Nori on subgroups of $\mathrm{GL}_n(\mathbb{F}_p)$ and were very glad to succeed using only the comparatively soft methods of algebraic geometry.

Ruth Lyttle Satter Prize in Mathematics

The Satter Prize was established in 1990 using funds donated by Joan S. Birman in memory of her sister, Ruth Lyttle Satter, to honor Satter's commitment to research and to encourage women in science. The prize is awarded every two years to recognize an outstanding contribution to mathematics research by a woman in the previous six years.

Citation

Maryam Mirzakhani

The 2013 Ruth Lyttle Satter Prize in Mathematics is awarded to Maryam Mirzakhani for her deep contributions to the theory of moduli spaces of Riemann surfaces.

Her earliest work, the topic of her thesis, was a volume formula for the moduli space of bordered Riemann surfaces of genus g with n geodesic boundary components, a formula that expresses this volume as a polynomial in the lengths of the boundary components. That there exists a formula of this nature was itself surprising, but more surprising were the results she was able to extract from it: a new proof of the celebrated conjecture of Witten on the intersection numbers of tautology classes on moduli space and, in a completely different direction, an asymptotic formula for the lengths of simple closed geodesics on a compact hyperbolic surface.

Much of her work subsequent to this has focused on the Teichmüller dynamics of moduli space. In particular, she was able to construct a measure-preserving conjugacy between Thurston's earthquake flow on Teichmüller space and horocycle flow on the associated space of quadratic differentials and as an immediate and long sought-after consequence of this to prove that earthquake flow is ergodic. In another vein, her recent work with Eskin establishes striking analogues for the Teichmüller flow and the mapping class group of Selberg's classical "Prime Geodesic Theorem" for the modular surface and the modular group. Moreover, in a work in progress, they have unearthed some unexpected and intriguing analogues, in this Teichmüller setting, of the Ratner unipotent rigidity theorems in homogeneous dynamics.

Biographical Note

Maryam Mirzakhani grew up in Tehran, Iran. She obtained her B.Sc. in mathematics (1999) from the Sharif University of Technology. She holds a Ph.D. from Harvard University (2004), where her advisor was Curtis McMullen. From 2004 to 2008 she was a Clay Mathematics Institute Research Fellow and an assistant

professor at Princeton University. She is a professor at Stanford University. Her research interests include Teichmüller theory, hyperbolic geometry, and ergodic theory.

Response from Maryam Mirzakhani

I am deeply honored to receive the Ruth Lyttle Satter Prize. This would not have been possible without many people who helped me along. I am grateful to my collaborators and colleagues who helped me all these years. I would like to thank my great teachers in Iran, both in high school and at Sharif University, for providing a stimulating environment for their students. All these opportunities and the people who made them possible, regardless of the difficulties of the times, deserve my sincere gratitude. I am also grateful to my Ph.D. advisor, Curt McMullen, for his unceasing support and for introducing me to fascinating areas of mathematics.

I have enjoyed a pleasant and supportive environment during my time at Harvard, Princeton, and Stanford. Still, in my opinion, the situation of women in math is far from ideal. The social barriers for girls who are interested in mathematical sciences might not be lower now than they were when I grew up. And balancing career and family remains a big challenge. It makes most women face difficult decisions which usually compromise their work. However, there has been a lot of progress over the years, and I am sure this trend will continue.

Finally, I would like to thank my friends who have been like my family away from home. I am grateful to my husband, Jan, for being my best friend and companion, and for encouraging me when I need it the most. I would like to thank my parents who always believed in me and let me be who I am. They have been my inspiration throughout my life.

Leroy P. Steele Prize for Seminal Contribution to Research

The Leroy P. Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein and are endowed under the terms of a bequest from Leroy P. Steele. Prizes are awarded in up to three categories and each is awarded annually. The following citation describes the award for Seminal Contribution to Research.

Citation
Saharon Shelah

The 2013 Leroy P. Steele Prize for Seminal Contribution to Research is awarded to Saharon Shelah for his book, *Classification Theory and the Number of Non-isomorphic Models* (Studies in Logic and the Foundations of Mathematics, 92, North-Holland Publishing Co., Amsterdam–New York, 1978; 2nd edition, 1990).

Before Shelah's work, the great theorem of pure model theory was Morley's theorem on categoricity. It concerned a class of theories, whose uncountable models are completely determined by their cardinality. Shelah visualized a vast extension of the problem to a classification of arbitrary first-order theories, based on the number of models they may have of a given uncountable size. Solving this problem required some twenty years that made model theory into a mature field, completely transforming its aims, methods, and ability to connect to algebra and geometry.

Shelah isolated the class of *stable theories*, where finitely generated extensions admit, in a certain local sense, finitary descriptions. He was able to show, on the other hand, that any unstable theory has the maximum set-theoretically permissible number of models. All theories of modules are stable. Among the stable theories, he isolated the *superstable theories*, analogous to Noetherian rings, and again found many models if this condition fails. These were the first two of a series of *dividing lines*, characterized by a deep theorem on either side. On the stable side, he was able to define a canonical tensor product of extensions of structures, and made it into an incisive tool for the decomposition of structures. An arsenal of notions became available to the previously bare-handed model theorist: algebraic closure, canonical bases, imaginary sorts, domination, forking, regular types. These concepts proved useful beyond the stable framework and led to substantial applications when investigated in algebraic settings. The problem of the number of models was solved in the second edition of his monograph, but the

ideas of the solution remained central and proved critical for many others. It would be impossible to imagine model theory today without them.

Biographical Note

Saharon Shelah had earned his B.Sc. from Tel Aviv University, his M.Sc. from the Hebrew University under the supervision of Professor H. Gaifman, and his Ph.D. from the Hebrew University under the supervision of Professor M. Rabin. He has taught at the Hebrew University and Rutgers University (and others). He is member of the Israel Academy of Sciences and Humanities and the American Academy of Arts and Sciences.

Response

I am grateful for this great honour.

While it is great to find full understanding of that for which we have considerable knowledge, I have been attracted to trying to find some order in the darkness, more specifically, finding meaningful dividing lines among general families of structures. This means that there are meaningful things to be said on both sides of the divide: characteristically, understanding the tame ones and giving evidence of being complicated for the chaotic ones. It is expected that this will eventually help in understanding even specific classes and even specific structures. Some others see this as the aim of model theory, not so for me. Still I expect and welcome such applications and interactions. It is a happy day for me that this line of thought has received such honourable recognition. Thank you.

Leroy P. Steele Prize for Mathematical Exposition

The Leroy P. Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein, and are endowed under the terms of a bequest from Leroy P. Steele. Prizes are awarded in up to three categories and each is awarded annually. The following citation describes the award for Mathematical Exposition.

Citation

John Guckenheimer and Philip Holmes

The 2013 Leroy P. Steele Prize for Mathematical Exposition is awarded to John Guckenheimer and Philip Holmes in recognition of their book, *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields* (Applied Mathematical Sciences, 42, Springer-Verlag, New York, 1983; reprinted with revisions and corrections, 1990).

Dynamical systems underwent a rebirth in the 1960s and 1970s with the work of mathematicians such as (in alphabetical order) Anosov, Arnold, Kolmogorov, Moser, Smale, Ruelle, Sinai, Takens, Thom, and many others on the theoretical side, and engineers and experimental physicists such as Lorenz, Swinney, Gollub, and many others on the applied side. Not surprisingly, it was difficult for the two communities to know about each other's work until the publication of the now-classic text by Guckenheimer and Holmes. Thirty years later this book remains in wide use as a standard text for graduate level courses in mathematics departments and throughout the sciences and engineering, and Chinese and Russian translations have appeared.

In the late 1970s dynamical systems theory was still largely the preserve of mathematicians, at least in Europe and the Americas (the Soviet Union had maintained somewhat stronger links among mathematical scientists and physicists, chemists, and engineers). Excitement was growing over chaos and sensitive dependence (the butterfly effect) and bifurcation and unfolding theories. Physicists such as Swinney and Gollub were generating experimental data on constrained fluid systems, but the fundamental work of Smale and his students was appearing in journals unknown to many researchers who could most benefit from them, beyond and even within the mathematics community.

Research monographs were beginning to appear: Abraham and Marsden's *Foundations of Mechanics* (1967) focused on Hamiltonian systems and classical mechanics; Marsden and McCracken edited a collection of papers on Hopf bifurcation (1976). A few research groups were applying center manifold reduction

to physical problems, computing normal forms, and unfolding bifurcations, but the Guckenheimer and Holmes work was the first textbook to lay out clearly the theory for dissipative dynamical systems, to separate rigorous results from speculation, to begin to reunite perturbation methods with the geometric and topological ideas of global analysis, and to provide analyses of practical problems.

Both theoretical and applied dynamical systems remain strong research areas, with theoretical research appearing in physics, engineering, and applied mathematics departments and applied work being produced by researchers in mathematics departments—a healthy trend that was given substantial help by the publication of *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields*.

Biographical Notes

John Guckenheimer was born in Baton Rouge, LA, in 1945. He received his undergraduate degree from Harvard in 1966 and his Ph.D. from the University of California, Berkeley, in 1970 under the direction of Stephen Smale. He held positions at IMPA (1969), the University of Warwick (1969–70), the Institute for Advanced Study (1970–72), and MIT (1972–73) before joining the faculty of hte University of California, Santa Cruz (1973–85). Since 1985 he has been on the faculty of Cornell University, where he is now as the A. R. Bullis Professor of Mathematics.

During the past fifteen years, his research has investigated dynamical systems with multiple time scales and associated numerical methods. He has also continued to investigate the use of dynamical systems theory in diverse areas, notably in neuroscience and animal locomotion. He was a 1984 Guggenheim Fellow and is a Fellow of the American Academy of Arts and Sciences, the American Association for Advancement of Science, the American Mathematical Society, and the Society for Industrial and Applied Mathematics (SIAM). He served as President of SIAM in 1997–98.

Philip Holmes was born in Lincolnshire, England, in 1945 and was educated in Engineering Science at the Universities of Oxford and Southampton. He taught in the departments of theoretical and applied mechanics and mathematics at Cornell from 1977–94. In 1994 he moved to Princeton, where he is Eugene Higgins Professor of Mechanical and Aerospace Engineering, professor of Applied and Computational Mathematics, associated faculty in the Department of Mathematics, and a member of Princeton's Neuroscience Institute. Much of his research has been in dynamical systems and their applications in engineering and the physical sciences, but in the past fifteen years he has increasingly turned to biology. He currently works on the neuro-mechanics of animal locomotion and neuro-dynamics of decision making. He is a member of the American Academy of Arts and Sciences, an honorary member of the Hungarian Academy of Sciences, and a Fellow of the American Mathematical Society, of the American Physical Society, and of the Society for Industrial and Applied Mathematics. He has also published four collections of poems (Anvil Press, London).

Joint Response from John Guckenheimer and Philip Holmes

We are honored and delighted to receive the Steele Prize for Mathematical Exposition. We come from very different places (Baton Rouge, LA, and Brigg, Lincolnshire, UK) and very different training: John from Ph.D. studies with Steve Smale, and Phil from applied mechanics. We first met in 1976 at a dynamical systems conference in Southampton co-organized by David Rand. At that time rapid advances in dynamical systems theory were stimulating experimental work that demonstrated the usefulness of the theory in explaining empirical phenomena across the sciences and engineering. We saw a real need for a book that made the new mathematics accessible to a broad audience, including mature scientists and students. The excitement of the period was captured vividly by James Gleick in his book, *Chaos*: *Making a New Science* (Penguin Books, New York, 1987), which received the first JPBM Communications Award in 1988.

In the late 1970s Phil and David Rand, after working together on nonlinear oscillators, began teaching courses in dynamical systems and assembling notes toward a book. Independently, John also began planning a book. In spring 1981 Phil visited UC Berkeley and David visited UC Santa Cruz. We discussed continuing the writing as a three-author team, but ultimately David decided to withdraw while the two of us proceeded. We completed the first draft in approximately nine months, starting with notes for applied dynamical systems courses that we taught at UC Santa Cruz and Cornell and spending an hour or two discussing our differences on the phone every Friday. We received enthusiastic support from Jerry Marsden and others. Walter Kaufmann-Buehler at Springer-Verlag was willing to take a risk in pricing the book at a level that would encourage individuals to buy it. Our handwritten manuscript was painstakingly typed by Dolores Pendell at Cornell's Center for Applied Mathematics and the diagrams were produced by Barbara Boettcher.

The book's success has been extraordinarily gratifying, especially when younger (than us!) scientists tell us that they studied it carefully and keep returning to take it from their bookshelves. We tried hard to explain mathematical concepts and arguments in their simplest manifestations while relying on as little formal training as seemed feasible. It helped that we came to the interface between mathematics and the physical sciences from opposite sides. With our different backgrounds, we sought to bring alive how dynamical systems theory has been enriched repeatedly by questions from the "real world," while, at the same time, demonstrating the power of mathematical thinking and abstraction to unify the sciences. We thank the Committee for recognizing our efforts to present significant results to a broad scientific audience that stretches far beyond the boundaries of mathematics.

Leroy P. Steele Prize for Lifetime Achievement

The Leroy P. Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein and are endowed under the terms of a bequest from Leroy P. Steele. Prizes are awarded in up to three categories and each is awarded annually. The following citation describes the award for Lifetime Achievement.

Citation

Yakov Sinai

The 2013 Steele Prize for Lifetime Achievement is awarded to Yakov Sinai for his pivotal role in shaping the theory of dynamical systems and for his groundbreaking contributions to ergodic theory, probability theory, statistical mechanics, and mathematical physics.

Sinai's research exhibits a unique combination of brilliant analytic technique, outstanding geometric intuition, and profound understanding of underlying physical phenomena. His work highlights deep and unexpected connections between dynamical systems and statistical mechanics. Sinai has opened up new directions, including Kolmogorov–Sinai entropy, Markov partitions, and Sinai–Ruelle–Bowen measures in the hyperbolic theory of dynamical systems; dispersing billiards, a rigorous theory of phase transitions in statistical mechanics and space-time chaos. In addition, Sinai has made seminal contributions in the theory of Schrödinger operators with quasi-periodic potentials, random walks in random environments, renormalization theory, and statistical hydrodynamics for Burgers and Navier–Stokes equations.

Sinai pioneered the study of dispersing billiards: dynamical systems which model the motion of molecules in a gas. The simplest example of such a billiard table, a square with a disk removed from its center, is called "Sinai's billiard." Studying billiard motions within the framework of hyperbolic theory, Sinai discovered that they exhibit deep ergodic and statistical properties (such as the central limit theorem). Owing to Sinai's work, some key laws of statistical mechanics for the Lorentz gas can be established with mathematical rigor. In particular, Sinai made the first steps towards justification of Boltzmann's famous ergodic hypothesis, proposed in the end of the nineteenth century: "For large systems of interacting particles in equilibrium, time averages are close to the ensemble average." Sinai returned to this subject several times in the period 1970–90 with various co-authors, including his students Bunimovich and Chernov.

Together with his student Pirogov, Sinai created a general theory of low-temperature phase transitions for statistical mechanics systems with a finite number of ground states. Pirogov–Sinai theory forms essentially the basis for modern equilibrium statistical mechanics in a low-temperature regime.

Sinai made seminal contributions to the theory of random walks in a random environment. With his model, known nowadays as "Sinai's random walk," he obtained remarkable results about its asymptotic behavior. With his student Khanin, Sinai pioneered applications of the renormalization group method to multi-fractal analysis of the Feigenbaum attractor, and to the Kolmogorov–Arnold–Moser theory on invariant tori of Hamiltonian systems.

In the past fifteen years Sinai has brought novel tools and insights from dynamical systems and mathematical physics to statistical hydrodynamics, obtaining new results for the Navier–Stokes systems. Specifically, along with D. Li, Sinai devised a new renormalization scheme which allows the proof of existence of finite time singularities for complex solutions of the Navier–Stokes system in dimension three.

Sinai's mathematical influence is overwhelming. During the past half-century he has written more than 250 research papers and a number of books. Sinai's famous monograph, *Ergodic Theory* (with Cornfeld and Fomin), has been an introduction to the subject for several generations, and it remains a classic.

Sinai supervised more than fifty Ph.D. students, many of whom have become leaders in their own right. Sinai's work is impressive for its breadth. In addition to its long-lasting impact on pure mathematics, it has played a crucial role in the creation of a concept of dynamical chaos which has been extremely important for the development of physics and nonlinear science over the past thirty-five years. The Steele Prize for Lifetime Achievement is awarded to Sinai in recognition of all these achievements.

Biographical Note

Yakov G. Sinai was born in 1935 in Moscow, Soviet Union, now Russia.

He received his Ph.D. degree (called a Candidate of Science in Russia) and then his doctorate degree (Doctor of Science) from Moscow State University. For several years, he combined his position at Moscow State University and the Landau Institute of Theoretical Physics of the Russian Academy of Sciences. Since 1993, he has been a professor in the mathematics department of Princeton University.

Ya. Sinai received various honors recognizing his contributions. He was elected as a foreign associate of the National Academy of Sciences and a foreign member of the Academy of Arts and Sciences. He is a full member of the Russian Academy of Sciences, and he was recently elected as a foreign member of the Royal Society in London. He is also a member of the Brazilian Academy of Science, the Hungarian Academy of Science, the Polish Academy of Science, and Academia Europea.

Among his other recognitions are the Wolf Prize in Mathematics, the Nemmers Prize, the Lagrange Prize, the Boltzmann Medal, the Dirac Medal, and the Poincaré Prize.

Response from Yakov Sinai

It is a great honor to be awarded the Steele Prize for Lifetime Achievement from the American Mathematical Society. I worked in several directions in mathematics, including the theory of dynamical systems, statistical and mathematical physics, and probability theory.

My mentors who had a big influence on me were A. N. Kolmogorov, V. A. Rokhlin, and E. B. Dynkin. I also benefitted a lot from many contacts with my colleagues. I was very fortunate to have talented students, many of whom became strong and famous mathematicians. Unfortunately, it is not possible to list the names of all of them here. I thank my family and friends for their encouragement and support. Finally, I thank the selection committee for its work.

Summary of Awards

For AMS

Levi L. Conant Prize: John Baez, John Huerta

E. H. Moore Research Article Prize: Michael Larsen, Richard Pink

David P. Robbins Prize: Alexander Razborov

Ruth Lyttle Satter Prize in Mathematics: Maryam Mirzakhani

Leroy P. Steele Prize for Lifetime Achievement: Yakov Sinai

Leroy P. Steele Prize for Mathematical Exposition: John Guckenheimer, Philip Holmes

Leroy P. Steele Prize for Seminal Contribution to Research: Saharon Shelah

Oswald Veblen Prize in Geometry: Ian Agol, Daniel Wise

For AMS-SIAM

Norbert Wiener Prize in Applied Mathematics: Andrew J. Majda

For AMS-MAA-SIAM

Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student: Fan Wei

For AWM

Louise Hay Award for Contributions to Mathematics Education: Amy Cohen

M. Gweneth Humphreys Award for Mentorship of Undergraduate Women in Mathematics: James Morrow

Alice T. Schafer Prize for Excellence in Mathematics by an Undergraduate Woman: MurphyKate Montee

For JPBM

Communications Award: John Allen Paulos

For MAA

Certificates for Meritorious Service: Jon L. Johnson, Dan Curtin, Yungchen Cheng, Jean Bee Chan, Peter Stanek, Robert Rogers, Jonathan Kane

Chauvenet Prize: Robert Ghrist

Euler Book Prize: Persi Diaconis, Ron Graham

Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics: William A. Hawkins, Jr.

Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics: Matthias Beck, Margaret Robinson, Francis Su

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