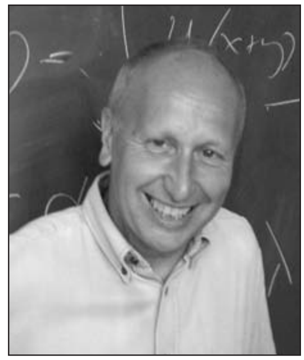
2009 Steele Prizes

I. G. Macdonald

Richard Hamilton



Luis Caffarelli

The 2009 AMS Leroy P. Steele Prizes were presented at the 115th Annual Meeting of the AMS in Washington, DC, in January 2009. The Steele Prizes were awarded to I. G. MACDONALD for Mathematical Exposition, to RICHARD HAMILTON for a Seminal Contribution to Research, and to LUIS CAFFARELLI for Lifetime Achievement.

Mathematical Exposition: I. G. Macdonald

Citation

Symmetric Functions and Hall Polynomials, Second edition. The Clarendon Press, Oxford University Press, New York, 1995.

I. G. Macdonald's book gathers a wealth of material related to symmetric functions into a beautifully organized exposition. Pioneering work of Frobenius, Schur, and others established important connections between symmetric functions and the representation theory of the symmetric group and complex general linear group. Since their work, many further connections were developed with representation theory, algebraic geometry, intersection theory, enumerative combinatorics, special functions, random matrix theory, and other areas. Until the first edition of Macdonald's book appeared in 1979, the theory of symmetric functions was scattered throughout the literature and very difficult to learn. This first edition collected, unified, and expanded such material as Schur functions, Hall polynomials, Hall-Littlewood symmetric functions, the characters of $\mathrm{GL}_n(q)$, and the Hecke ring of GL_n over a local field, none of which had previously received an adequate exposition. The second edition of 1995 added a huge amount of new material, including Jack polynomials and the two-parameter Macdonald polynomials, which have subsequently arisen in many unexpected areas, such as in the Hilbert scheme of n points in the plane and in the representation theory of affine Hecke algebras and quantum affine algebras. An especially notable feature of Macdonald's book is the "examples" (really exercises with solutions) which include a vast variety of additional results, many of them original. The importance and popularity of Macdonald's book is evidenced by the more than 3,600 citations on Google Scholar. Macdonald's book has been and continues to be an invaluable resource to researchers throughout mathematics.

Biographical Sketch

Ian Macdonald was born in Middlesex, England, in 1928. After army service he went to Cambridge University in 1949 and graduated in 1952. He spent the next five years in the British Civil Service (government administration). Subsequently, he held teaching positions successively at the universities of Manchester, Exeter, Oxford, Manchester (again), and London. He was elected a Fellow of the Royal Society of London in 1979 and was awarded the Pólya Prize by the London Mathematical Society in 1991.

His research since the 1960s has been mainly in the general area of Lie theory, in particular the combinatorial infrastructure (root systems, Weyl groups) and associated objects such as orthogonal polynomials and power series identities.

Response

I am both honoured and delighted to be awarded a Steele Prize for Mathematical Exposition for my book, *Symmetric Functions and Hall Polynomials*.

The origins of that book go back to the beginning of my mathematical career at Manchester in the late 1950s. Whilst there, I learned about

Hall polynomials and what are now called Hall-Littlewood symmetric functions from Sandy Green, who had recently made crucial use of them in his determination of the character tables of the finite general linear groups. Some years later I was invited to write a survey article on Hall polynomials for the *Jahresbericht der DMV*. That article never got written, partly for the usual reasons but also partly because it became clear to me that such a survey would for the sake of clarity need to be prefaced by a self-contained account of the algebra of symmetric functions, which at that time was lacking in the mathematical literature. I hope my book may have been of service to students and others who need to know the basic facts about symmetric functions, even if their interest in Hall polynomials is minimal.

Seminal Contribution to Research: Richard Hamilton

Citation

The 2009 Leroy P. Steele Prize for Seminal Contribution to Research is awarded to Richard Hamilton for his paper "Three-manifolds with positive Ricci curvature", *J. Differential Geom.* **17** (1982), 255–306.

Differential geometry includes the study of Riemannian metrics and their associated geometric entities. These include the curvature tensor, geodesic distance function, natural differential operators on functions, forms, and tensors as well as many others. A given smooth manifold has an infinite-dimensional space of Riemannian metrics whose geometric behavior may vary dramatically. By its very nature geometry must be coordinate invariant, so two Riemannian metrics which are related by a diffeomorphism of the manifold must be considered equivalent. The question of choosing a natural metric from the infinite-dimensional family is nicely illustrated by the case of compact oriented two-dimensional surfaces. For surfaces of genus 0 there is a unique choice of equivalence class of metrics with curvature 1, while for genus 1 (respectively genus greater than 1) there is a finite-dimensional moduli space of inequivalent metrics with curvature 0 (respectively curvature -1).

The cited paper of Richard Hamilton introduced a profoundly original approach to the construction of natural metrics on manifolds. This approach is the Ricci flow, which is an evolution equation in the space of Riemannian metrics on a manifold. The stationary points (for the normalized flow) are the Einstein metrics (constant curvature in dimensions 2 and 3). The Ricci flow is a nonlinear diffusion equation which may be used to deform any chosen initial metric for a short time interval. In the cited paper Hamilton showed that, in dimension 3, if the initial metric has positive Ricci curvature, then the flow exists for all time and converges to a constant curvature metric. This implies the remarkable result that a three manifold of positive Ricci curvature is a spherical space form (a space of constant curvature). Over the next twenty years Hamilton laid the groundwork for understanding the long time evolution for an arbitrary initial metric on a three-manifold with an eye toward the topological classification problem. For this purpose he developed the idea of the Ricci flow with singularities in which the flow would be continued past singular times by performing surgeries in a controlled way. Finally, through the spectacular work of Grisha Perelman in 2002, the difficult issues remaining in the construction were resolved, and the program became successful.

In addition to the applications to the topology of three-manifolds, the Ricci flow has had, and continues to have, a wide range of applications to Riemannian and Kähler geometry. The cited paper truly fits the definition of a seminal contribution; that is, "containing or contributing the seeds of later development".

Biographical Sketch

Richard Streit Hamilton was born in Cincinnati, Ohio, in 1943. He graduated from Yale summa cum laude in 1963, and received his Ph.D. from Princeton in 1966, writing his thesis under Robert Gunning. He has taught at Cornell University, the University of California at San Diego, and UC Irvine, where he held a Bren Chair. He is currently Davies Professor of Mathematics at Columbia University in New York City, where he does research on geometric flows. In 1996 Richard Hamilton was awarded the Oswald Veblen Prize of the American Mathematical Society, and he is a Member of the American Academy of Arts and Sciences and the National Academy of Sciences.

Response

It is a great honor to receive the Steele Prize acknowledging the role of my 1982 paper in launching the Ricci flow, which has now succeeded even beyond my dreams. I am deeply grateful to the prize committee and the AMS.

When I first arrived at Cornell in 1966, James Eells Jr. introduced me to the idea of using a nonlinear parabolic partial differential equation to construct an ideal geometric object, lecturing on his brilliant 1964 paper with Joseph Sampson on harmonic maps, which was the origin of the field of geometric flows. This now encompasses the harmonic map flow, the mean curvature flow (used in physics to describe the motion of an interface, and also in image processing as well as isoperimetric estimates), the Gauss curvature flow (describing wear under random impact), the inverse mean curvature flow (used by Huisken and Ilmanen to prove the Penrose conjecture in relativity), and many others, including Ricci flow.

James Eells Jr. also first suggested I use analysis rather than topology to prove the Poincaré conjecture on the grounds that it is difficult for topologists to solve a problem where the hypothesis is the absence of topological invariants. And indeed as Lysander said, “Where the lion’s skin will not reach, we must patch it out with the fox’s.” So I started thinking in the 1970s about how to use a parabolic flow to round out a general Riemannian metric to an Einstein metric by spreading the curvature evenly over the manifold. Now the Ricci curvature tensor is in a certain sense the Laplacian of the metric, so that zero Ricci curvature in the Riemannian case is really the elliptic equation for a harmonic metric, while in the Lorentzian case it is the hyperbolic wave equation for a metric, which is Einstein’s theory of relativity. So it is only natural to guess that the parabolic heat equation for a metric is to evolve it by its Ricci curvature, which is the Ricci flow.

It is often the case that the credit for a discovery goes not to the first person to stumble upon a thing, but to the first who sees how to use it. So the significance of my 1982 paper was that it proves a very nice result in geometry, that a three-dimensional manifold with a metric of positive Ricci curvature is always a quotient of the sphere. To prove this I developed a number of new techniques and estimates that opened up the field, in particular using the maximum principle on systems to obtain pinching estimates on curvature. Right afterward Shing-Tung Yau pointed out to me that the Ricci flow would pinch necks, performing a connected sum decomposition. I was very fortunate that shortly after I moved to UCSD where I could collaborate with Shing-Tung Yau, Richard Schoen, and Gerhard Huisken, who coached me in the use of blow-ups to analyze singularities, making it possible to handle surgeries. It was also very important that Peter Li and Yau pointed out the fundamental importance of their seminal 1986 paper on Harnack inequalities, leading to my Harnack estimate for the Ricci flow, which is fundamental to the classification of singularities. And in 1997 I proved a surgical decomposition on four-manifolds with positive isotropic curvature. In 1999 I published a paper outlining a program for proving geometrization of three-manifolds by performing surgeries on singularities and identifying incompressible hyperbolic pieces as time goes to infinity, only as I was still lacking control of the injectivity radius, I had to assume a curvature bound. This was supplied four years later in 2003 by the brilliant work of Grigory Perelman in his noncollapsing estimate, which led to his remarkable pointwise derivative estimates, allowing him to complete the program.

But the importance of Ricci flow is not confined to three dimensions. For example, we can hope to prove results on four-manifold topology, which are far more difficult. The Ricci flow on canonical Kähler manifolds is well advanced, based on the work of Huai-Dong Cao and Grigory Perelman, which might lead to a theorem in algebra. Ricci flow also is closely connected to the renormalization group in string theory, and might be used to find stationary Lorentzian Einstein metrics in higher dimensions, giving applications to physics. And just recently we have the very lovely result of Richard Schoen and Simon Brendle using Ricci flow to prove the much stronger result in differential geometry of diffeomorphism rather than homeomorphism in the quarter-pinching theorem using the much weaker assumption of pointwise rather than global pinching. Now that many outstanding mathematicians are working on it, the story of the Ricci flow is just beginning.

Lifetime Achievement: Luis Caffarelli

Citation

Luis Caffarelli is one of the world’s greatest mathematicians studying nonlinear partial differential equations (PDE). This is a difficult field: there are rarely exact formulas for solutions of nonlinear PDEs, and rarely will exact algebraic calculations yield useful expressions.

Instead researchers must typically invoke functional analysis to build “generalized” solutions for many important equations. What remains is the profound and profoundly technical problem of proving regularity for these weak solutions and, by universal acclaim, the greatest authority on regularity theory is Luis Caffarelli.

His breakthroughs are so many, and yet so technical, that they defy any simple recounting here. But it was certainly Caffarelli’s work on “free boundary” problems that first showed his deep insights. Free boundary problems entail finding not only the solution of some PDEs, but also the very region within which the equation holds. Luis Caffarelli’s vast work totally dominates this field, starting with his early papers on the obstacle problem. In estimate after estimate, lemma after lemma, he shows that the generalized solution and the free boundary have a bit more regularity than is obvious, then a bit more, and then more; until finally he proves under a mild geometric condition that the solution is smooth and the free boundary is a smooth hypersurface. The arguments are intricate, but completely elementary.

Later papers introduce countless technical innovations that broaden the analysis to PDE free boundary problems of all sorts. Caffarelli has likewise revolutionized the study of fully nonlinear elliptic PDEs, and particularly the Monge-Ampère equation. His breakthroughs here include boundary second derivative estimates, classifications of possible degeneracies for solutions, regularity theory for optimal mass transfer schemes, etc. In all this work Caffarelli is an endlessly inventive technical magician, for instance using the maximum principle in one paper to derive L_p estimates for second derivatives of solutions.

During his years at the University of Minnesota, the University of Chicago, New York University, the Institute for Advanced Study, and now the University of Texas, Luis Caffarelli has collaborated widely and directed many Ph.D. students. He is extraordinarily generous, in both his personal and professional lives. One of his coauthors at a conference once described extending to a fully nonlinear equation some previous research on a linear PDE. He reported that the earlier workers on the linear equation used a formula for the solution, but that "we had something better than an exact formula. We had Luis."

Biographical Sketch

Luis A. Caffarelli was born in Buenos Aires, Argentina, in December of 1948. He completed his Ph.D. in mathematics at the Universidad de Buenos Aires in 1972 under the direction of Calixto Calderón. In 1973, he came to the United States with a postdoctoral fellowship to the University of Minnesota, where by 1979 he attained a professorship.

He has been a professor at the University of Chicago (1983–1986), the Courant Institute (1980–1982 and 1994–1997), and the Institute for Advanced Study (1986–1996).

Since 1997, Luis Caffarelli has been a professor in the Department of Mathematics and the Institute for Computational Engineering and Science at the University of Texas at Austin, holding the Sid Richardson Chair 1.

He is a member of several academies, including the National Academy of Sciences, holds several honorary degrees and professorships, and has been awarded several distinguished prizes, including the Bôcher Prize of the AMS and the Rolf Schock Prize of the Royal Swedish Academy of Sciences. Finally, he has delivered the AMS Colloquium Lectures; AMS Invited Addresses; and a plenary lecture at the International Congress of Mathematics in Beijing, 2002; and the International Congress of Industrial and Applied Mathematics in Zurich, 2007.

His main mathematical interests are in nonlinear analysis and partial differential equations. He has made contributions in areas concerning phase transitions, free boundary problems, the Landau-Ginzburg equation; fluid dynamics, Navier-Stokes and quasi-geostrophic flows; fully nonlinear equations from optimal control, the Monge-Ampère equation and optimal transportation; and more recently nonlinear homogenization in periodic and random media and nonlinear problems involving nonlocal diffusion processes.

Response

On this very happy occasion, I would like to thank the Selection Committee for having awarded me this great distinction.

I would also like to thank my parents, my wife Irene, and my children Alejandro, Nicolas, and Mauro, for accompanying me through the years and sharing with me their love and their encouragement.

I came to the United States to the University of Minnesota in January of 1973. There was no email, no fax, and even the telephone was very expensive. But I found at Minnesota and in the midwest an extraordinary group of people. My colleagues were extremely generous, dedicated, and friendly, and they taught me much of what I know. They shared their ideas and gave me guidance as I began my research program.

Through the years, I have had the opportunity to belong to wonderful institutions and to befriend and collaborate with extraordinary scientists all over the world. This led to further opportunities to mentor very talented young people who have invigorated my research with new ideas.

The Steele Prize, which so much honors me, should also serve to recognize the many mathematicians who have contributed in so many ways to make nonlinear analysis and applied mathematics a central part of science today.

About the Prize

The Steele Prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein. Osgood was president of the AMS during 1905–1906, and Birkhoff served in that capacity during 1925–1926. The prizes are endowed under the terms of a bequest from Leroy P. Steele. Up to three prizes are awarded each year in the following categories: (1) Lifetime Achievement: for the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students; (2) Mathematical Exposition: for a book or substantial survey or expository-research paper; (3) Seminal Contribution to Research: for a paper, whether recent or not, that has proved to be of fundamental or lasting importance in its field, or a model of important research. Each Steele Prize carries a cash award of US$5,000.

The Steele Prizes are awarded by the AMS Council acting on the recommendation of a selection committee. For the 2009 prizes, the members of the selection committee were: Enrico Bombieri, Russel Caflisch, Lawrence C. Evans, Lisa C. Jeffrey, Nicholas M. Katz, Gregory F. Lawler, Richard M. Schoen, Julius L. Shaneson (chair), and Richard P. Stanley.

The list of previous recipients of the Steele Prize may be found on the AMS website at `http://www.ams.org/prizes-awards`.

2009 AMS-SIAM Birkhoff Prize

Joel Smoller received the 2009 AMS-SIAM George David Birkhoff Prize in Applied Mathematics at the Joint Mathematics Meetings in Washington, DC, in January 2009.

Citation

The 2009 George David Birkhoff Prize in Applied Mathematics is awarded to Joel Smoller for his leadership, originality, depth, and breadth of work in dynamical systems, differential equations, mathematical biology, shock wave theory, and general relativity. His classic text on shock waves has had far-reaching impact on the field. His work with Charles Conley led to many results on reaction-diffusion equations, with diverse applications to biology, physiology, and chemistry. His work with Arthur Wasserman on bifurcation theory, which introduced an equivariant version of the Conley index, was a tour de force of original methods, providing a rigorous analysis and characterization of radial stationary solutions of the Einstein Yang-Mills equations. He and Blake Temple developed a theory of shock wave propagation in general relativity and gave the first exact solution of the Einstein equations. Overall, his powerful intuition for innovative new directions and his forcefulness in cementing powerful collaborations have been emblematic of a career worthy of emulation.

Joel Smoller

Biographical Sketch

Joel Smoller was born in New York City and was an undergraduate at Brooklyn College. He obtained his Ph.D. at Purdue University in 1963, writing a thesis in abstract functional analysis. He has spent his entire academic career at the University of Michigan and was promoted to full professor in 1969. Shortly after arriving at Michigan, his research interests changed to partial differential equations. He has supervised 27 Ph.D. students, including Tai-Ping Liu (Stanford), David Hoff (Indiana), Robert Gardner (University of Massachusetts), Blake Temple (University of California, Davis), and Zhouping Xin (Chinese University of Hong Kong). Smoller has held the Lamberto Cesari Chair of Mathematics at the University of Michigan since 1998. His awards include a senior Humboldt Fellowship, 2005–2008; Morningside Lecturer, International Congress of Chinese Mathematicians, 2001 and 2004; Rothschild Professor and Rothschild Lecture, University of Cambridge (UK), 2003; Patton Lecturer, Indiana University, 2001; Distinguished Alumnus Award, Purdue University, 2000; Excellence in Research Award, University of Michigan, 1996; Plenary Address, Marcel Grossman Conference in Physics (Stanford University), 1994; joint Harvard-MIT-Brandeis lecture, 1994; Margaret and Herman Sokol Award, University of Michigan, 1992; Ordway Lecturer, University of Minnesota, 1985; Guggenheim Fellowship, 1980–1981. Three issues of the journal *Methods and Applications of Analysis* **12**, nos. 2, 3, 4, displaying his picture on the covers, were dedicated to him in 2005. Smoller has been the editor for five journals (*Michigan Mathematics Journal, Applicable Analysis, Journal of Hyperbolic Differential Equations, Nonlinearity*), and he was the PDE editor for the *Transactions of the American Mathematical Society*, 1982–1986. National meetings were dedicated to his 60th and 70th birthdays at UC Davis and Stanford University, respectively.

Response

It is a great honor to be chosen as the recipient of the 2009 George David Birkhoff Prize in Applied Mathematics. I am appreciative of the American Mathematical Society and to the Society for Industrial and Applied Mathematics for their recognition of my research accomplishments. Above all, I would like to thank my many collaborators for their generosity, their encouragement, and for patiently introducing me to a wealth of new ideas. Special thanks are due to Blake Temple, who has been a longtime collaborator and has shared many of his beautiful new ideas with me.

Many outstanding mathematicians have influenced me and affected the trajectory of my research career. In particular, I owe many thanks to Edward Conway, who taught me the mathematics of shock waves, and to Charles Conley, who was my friend, mentor, and collaborator for many years. Both Conway and Conley passed away unexpectedly more than twenty years ago, but I still miss them. James Glimm, Peter Lax, and Shing-Tung Yau have always supported and encouraged me, and for this I owe them many thanks. My younger collaborator Felix Finster, has greatly influenced my work by taking me into new and exciting directions. Finally, my many excellent students, including Blake Temple, David Hoff, Tai-Ping Liu, Zhouping Xin, and Robert Gardner, have had an impact on my career by being both my teachers and collaborators.

I have always been attracted to special problems whose analysis uncovers new phenomena in physical settings. I have tended to start in new directions, rather than work on more technical problems that finish up fields. Like most, I learn best through collaboration, and I have been extremely lucky to find brilliant colleagues who have led me into so many rewarding experiences.

About the Prize

The Birkhoff Prize recognizes outstanding contributions to applied mathematics in the highest and broadest sense and is awarded every three years (until 2001, it was awarded usually every five years). Established in 1967, the prize was endowed by the family of George David Birkhoff (1884–1944), who served as AMS president during 1925–1926. The prize is given jointly by the AMS and the Society for Industrial and Applied Mathematics (SIAM). The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico. The prize carries a cash award of US$5,000.

The recipient of the Birkhoff Prize is chosen by a joint AMS-SIAM selection committee. For the 2009 prize, the members of the selection committee were: Peter W. Jones (chair), George C. Papanicolaou, and Terence C. Tao.

Previous recipients of the Birkhoff Prize are Jürgen K. Moser (1968), Fritz John (1973), James B. Serrin (1973), Garrett Birkhoff (1978), Mark Kac (1978), Clifford A. Truesdell (1978), Paul R. Garabedian (1983), Elliott H. Lieb (1988), Ivo Babuška (1994), S. R. S. Varadhan (1994), Paul H. Rabinowitz (1998), John N. Mather (2003), Charles S. Peskin (2003), and Cathleen S. Morawetz (2006).

2009 Cole Prize in Algebra

Christopher Hacon and James M^{c}Kernan received the 2009 AMS Frank Nelson Cole Prize in Algebra at the 115th Annual Meeting of the AMS in Washington, DC, in January 2009.

Citation

The 2009 Frank Nelson Cole Prize in Algebra is awarded to Christopher Hacon and James M^{c}Kernan for their groundbreaking joint work on higher-dimensional birational algebraic geometry. This work concerns the minimal model program, by which S. Mori and other researchers made great progress in understanding the geometry of three-dimensional projective algebraic varieties in recent decades. The case of dimension greater than three, however, remained largely open. The work of Hacon and M^{c}Kernan has transformed the study of the minimal model program in higher dimensions, in particular regarding the existence and termination of flips and the finite generation of the canonical ring. Specifically, the prize is awarded for two joint papers of theirs: "Boundedness of pluricanonical maps of varieties of general type", *Invent. Math.* **166** (2006), 1–25, and "Extension theorems and the existence of flips" (in *Flips for 3-folds and 4-folds*, 76–110, Oxford Lecture Ser. Math. Appl., 35, Oxford Univ. Press, Oxford, 2007). The former paper, in addition to proving the result referred to in the title, also established their key lifting lemma for sections. The latter manuscript, which drew on their earlier paper, proved the inductive step on the existence of flips.

Biographical Sketch: Christopher Hacon

Christopher Hacon was born in Manchester, England, in 1970. He received his undergraduate degree in mathematics from the Università di Pisa and the Scuola Normale Superiore di Pisa in 1992, and he received his Ph.D. in mathematics from UCLA in 1998. His advisor was Robert Lazarsfeld. He was a postdoc at the University of Utah (1998–2000) and an assistant professor at the University of California, Riverside (2000–2002), and he has been a professor at the University of Utah since 2002. He received a Sloan Fellowship in 2003, an AMS Centennial Fellowship in 2006, and the Clay Research Award in 2007. His research interests are in algebraic geometry and, in particular, in the classification of higher-dimensional algebraic varieties.

Biographical Sketch: James M^{c}Kernan

James M^{c}Kernan was born in London, England, in 1964. He received his B.A. in mathematics from the University of Cambridge in 1985, while attending Trinity College, and his Ph.D. in mathematics from Harvard University under the supervision of Joseph Harris in 1991. He then held temporary positions at the University of Utah (1991–1993), the University of Texas at Austin (1993–1994), and Oklahoma State University, Stillwater (1994–1995). He joined the faculty at the University of California, Santa Barbara, in 1995 and the faculty at the Massachusetts Institute of Technology in 2007. In 2007 he received the Clay Research Award. His research interests are in algebraic geometry, especially birational geometry and the classification of algebraic varieties.

Response: Christopher Hacon and James M^{c}Kernan

The minimal model program is an attempt to extend the classification of complex projective surfaces achieved by the Italian school of algebraic geometry at the beginning of the twentieth century to higher-dimensional complex projective varieties. The main idea is to produce an optimal representative of any smooth projective variety via a finite sequence of well understood birational maps called flips and divisorial contractions. This representative is called a minimal model. In dimension three this program was completed by S. Mori with his work on the existence of 3-dimensional flips.

In higher dimensions the main problem is to show that flips always exist and that there is no infinite sequence of flips.

Christopher Hacon

It had always been our hope to say something significant about this problem. This dream became a reality when, by combining ideas of V. Shokurov and Y.-T. Siu, we were able to prove that flips exist in any dimension and that (under mild technical assumptions) carefully chosen sequences of divisorial contractions and flips always give a birational map to a minimal model.

We are very happy that the Selection Committee decided to recognize this field of research. We would like to stress that our accomplishments are based on a long series of beautiful results obtained by Y. Kawamata, J. Kollár, S. Mori, M. Reid, V. Shokurov, Y.-T. Siu, and many others. We are also in debt to our co-authors C. Birkar and P. Cascini, who were instrumental in the completion of a significant part of this program, and to A. Corti for many useful conversations on the minimal model program.

One of the nicest things about receiving this award is that it gives us an opportunity to publicly acknowledge the invaluable aid we have received from others. Christopher Hacon would like to thank Aleksandra, Stefan, Ana, Sasha, and Kristina Jovanovic-Hacon, D. Hacon, C. Peters, and G. Gianelli for their support, love and encouragement; F. Catanese, R. Lazarsfeld, and J. Kollár for inspiring him to work in the field of higher-dimensional birational geometry; the mathematics department at the University of Utah (in particular A. Bertram, H. Clemens, and J. Carlson) for hiring him (twice!) and providing a wonderful research environment; and the NSF [National Science Foundation], NSA [National Security Agency], AMS, and the Clay and Sloan Foundations for their generous financial support. James M^cKernan would like to thank his family for their support. He would also like to thank his advisor J. Harris, for inspiring him with so much beautiful projective geometry; J. Kollár and S. Mori for their support and encouragement over the whole of his career; V. Shokurov, who is always so generous with his ideas; and Y. Kawamata and M. Reid for their help. He would like to thank the mathematics department at the University of California, Santa Barbara—where a considerable amount of this work was done—for providing such a great environment to do research; and the mathematics department at the Massachusetts Institute of Technology. He is also very grateful to the NSF, NSA, and the Clay Foundation for their generous financial support.

James M^cKernan

About the Prize

The Cole Prize in Algebra is awarded every three years for a notable research memoir in algebra that has appeared during the previous six years. The awarding of this prize alternates with the awarding of the Cole Prize in Number Theory, also given every three years. These prizes were established in 1928 to honor Frank Nelson Cole on the occasion of his retirement as secretary of the AMS after twenty-five years of service. He also served as editor-in-chief of the *Bulletin* for twenty-one years. The Cole Prize carries a cash award of US$5,000.

The Cole Prize in Algebra is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2009 prize, the members of the selection committee were: Alexander Beilinson, David Harbater (chair), and Victor Kac.

Previous recipients of the Cole Prize in Algebra are: L. E. Dickson (1928), A. Adrian Albert (1939), Oscar Zariski (1944), Richard Brauer (1949), Harish-Chandra (1954), Serge Lang (1960), Maxwell A. Rosenlicht (1960), Walter Feit and John G. Thompson (1965), John R. Stallings (1970), Richard G. Swan (1970), Hyman Bass (1975), Daniel G. Quillen (1975), Michael Aschbacher (1980), Melvin Hochster (1980), George Lusztig (1985), Shigefumi Mori (1990), Michel Raynaud and David Harbater (1995), Andrei Suslin (2000), Aise Johan de Jong (2000), Hiraku Nakajima (2003), and János Kollár (2006).

2009 Satter Prize

LAURE SAINT-RAYMOND received the 2009 AMS Ruth Lyttle Satter Prize in Mathematics at the 115th Annual Meeting of the AMS in Washington, DC, in January 2009.

Citation

The Ruth Lyttle Satter Prize in mathematics is awarded to Laure Saint-Raymond for her fundamental work on the hydrodynamic limits of the Boltzmann equation in the kinetic theory of gases.

Laure Saint-Raymond

Saint-Raymond and François Golse established the definitive connection between weak solutions of the Boltzmann and the Leray solution of the incompressible Navier-Stokes equation for an important set of collision kernels in their paper, "The Navier-Stokes limit of the Boltzmann equation for bounded collision kernels", *Invent. Math.* **155** (2004), no. 1, 81–161.

Saint-Raymond also established the convergence of weak solutions of the Boltzmann equation to the dissipative solutions of the incompressible Euler equation in the most general setting in "Convergence of solutions to the Boltzmann equation in the incompressible Euler limit", *Arch. Ration. Mech. Anal.* **166** (2003), no. 1, 47–80.

The study of hydrodynamic limit theorems dates back to the work of Maxwell, Boltzmann, and Hilbert and has been extensively investigated by mathematicians and physicists. The results of Laure Saint-Raymond are a landmark in the subject.

Biographical Sketch

Laure Saint-Raymond received her Ph.D. in applied mathematics from the Université Paris VII in 2000. She joined the Centre National de la Recherche Scientifique (CNRS) as a research scientist in the Laboratoire d'Analyse Numérique, Université Paris VI. In 2002, she became a professor in the Laboratoire J.-L. Lions, Université Paris VI. In 2007, she joined the École Normale Supérieure.

She has received several awards, including the Louis Armand Prize from the French Academy of Sciences, the Claude-Antoine Peccot Award from the Collège de France, and the Pius XI Gold Medal from the Pontificia Academia Scientiarum. In 2006, she was awarded, together with François Golse, the first SIAG/APDE Prize on behalf of the paper, "The Navier-Stokes limit of the Boltzmann equation for bounded collision kernels" published in *Inventiones Mathematicae*. In 2008 she received the European Mathematical Society Prize in Amsterdam.

Her research has focused on the study of problems in mathematical physics, including the Boltzmann equation and its fluid dynamic limits, the Vlasov-Poisson system and its gyrokinetic limit, and problems of rotating fluids coming from geophysics. Her most striking work concerns the study of the hydrodynamic limits of the Boltzmann equation in the kinetic theory of gases, where she answered part of a question posed by Hilbert within the framework of his sixth problem.

Response

I am very grateful to the AMS and the Satter Prize Committee for awarding me this prize; it is truly encouraging to be recognized in this way. I am deeply indebted to my former adviser and collaborator François Golse, with whom part of the above cited work has been done.

I would like to use this opportunity to also thank all my American colleagues for their many kind invitations that I am too rarely able to honour. I thank especially mathematicians at Brown University, UCLA, MIT, Minnesota, and Harvard. I hope to have occasions in the future to develop more collaborations with them.

Finally, special thanks go to my family for their patience and their support.

About the Prize

The Satter Prize is awarded every two years to recognize an outstanding contribution to mathematics research by a woman in the previous six years. Established in 1990 with funds donated by Joan S. Birman, the prize honors the memory of Birman's sister, Ruth Lyttle Satter. Satter earned a bachelor's degree in mathematics and then joined the research staff at AT&T Bell Laboratories during World War II. After raising a family she received a Ph.D. in botany at the age of forty-three from the University of Connecticut at Storrs, where she later became a faculty member. Her research on the biological clocks in plants earned her recognition in the U.S. and abroad. Birman requested that the prize be established to honor her sister's commitment to research and to encouraging women in science. The prize carries a cash award of US$5,000.

The Satter Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2009 prize, the members of the selection committee were: Benedict H. Gross (chair), Jane M. Hawkins, and Sijue Wu.

Previous recipients of the Satter Prize are: Dusa McDuff (1991), Lai-Sang Young (1993), Sun-Yung Alice Chang (1995), Ingrid Daubechies (1997), Bernadette Perrin-Riou (1999), Karen E. Smith (2001), Sijue Wu (2001), Abigail Thompson (2003), Svetlana Jitomirskaya (2005), and Claire Voisin (2007).

2009 Whiteman Prize

Jeremy J. Gray received the 2009 AMS Albert Leon Whiteman Memorial Prize at the 115th Annual Meeting of the AMS in Washington, DC, in January 2009.

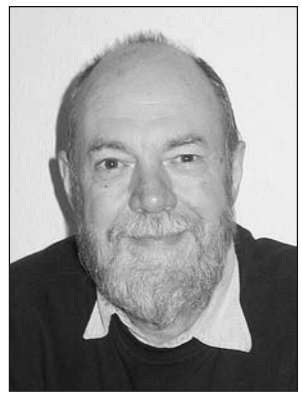
Citation

In awarding the Albert Leon Whiteman Prize to Jeremy J. Gray of the Open University and the University of Warwick, the American Mathematical Society recognizes the value of his many historical works, which have not only shed great light on the history of modern mathematics but also have given an example of the ways in which historical scholarship can contribute to the understanding of mathematics and its philosophy. In addition, Gray's work as an editor, teacher, translator, and organizer of forums for historical work has helped invigorate the study of the history of modern mathematics internationally.

Gray's book *Ideas of Space* (1979) deals with geometrical studies through history, from the Babylonians to Einstein. His fascination with non-Euclidean geometry is evident in much of his work, and in this book he imparts to the reader a sense of the importance of the topic to mathematics and its history.

His book *Linear Differential Equations and Group Theory from Riemann to Poincaré* (1986) is outstanding for the broad spectrum of topics it covers, for the depth in which it covers them, and for the skill with which they are woven together. In addition, the lively style of the narrative passages and of the philosophical discussions makes reading it as entertaining as it is enlightening, although, inevitably, full understanding of the mathematical content demands concentrated work on the part of the reader.

The Hilbert Challenge (2000) is a worthy successor to the earlier works, again weaving together many strands of a story—this time the story of the Hilbert problems—to give the reader an appealing introduction to wide areas of modern mathematics.



Jeremy J. Gray

His publications have taken a great many forms and have covered very wide areas. He has edited and written introductions to works of Janos Bolyai and Julian Coolidge. He has produced, with John Fauvel, a compendious book of readings in the history of mathematics, originally for the Open University but since published by Macmillan. In addition to his undergraduate textbook on the history of geometry in the nineteenth century, *Worlds Out of Nothing* (2007), he has been co-editor of two volumes of scholarly contributions to the study of history of mathematics, *Episodes in the History of Modern Algebra* (1800–1950) with Karen Parshall, and *The Architecture of Modern Mathematics* with José Ferreirós. Among his many scholarly publications in journals, his translation and annotation of Gauss's Tagebuch in *Expositiones Mathematicae*, volume 4 (1984), is a particularly valuable contribution.

Jeremy Gray's spirited presentations of a wide range of subjects of nineteenth and twentieth century mathematics have earned the respect of his colleagues for the quality of both their historical scholarship and their mathematical accuracy and insight, exactly the traits that the Whiteman Prize is meant to recognize.

Biographical Sketch

Jeremy Gray studied mathematics at the University of Oxford and obtained his Ph.D. at University of Warwick in 1980. He has taught at the Open University since 1974, where he became a professor of the history of mathematics in 2002, and he is an honorary professor at the University of Warwick, where he lectures on the history of mathematics. In 1996 he was a resident fellow at the Dibner Institute for the History of Science and Technology at the Massachusetts Institute of Technology, and in 1998 he gave an invited lecture at the International Congress of Mathematicians in Berlin. He lives in London with his wife, Sue Laurence, and their daughters, Martha and Eleanor.

Response

I am honoured to receive the Albert Leon Whiteman Memorial Prize of the American Mathematical Society. Mathematicians work in an exciting and important profession. Their research, the quality of their ideas, the applications they develop, and their teaching all make vital contributions to the society around them, and many people from every country in the world can be drawn in to this endeavour. Historians of mathematics have the opportunity to describe this enterprise as it occurred in all its different cultural settings from 6,000 years ago to yesterday, and in this way enrich everyone's appreciation of mathematics. In the last fifty years much has been done by my colleagues around the world in the history of mathematics; their work has been an inspiration to me. When I began to work on the nineteenth century, that century was not so long ago. Now large periods of the twentieth century are open to historical analysis. This will be a particularly rich topic for anyone interested in modern mathematics, and the American Mathematical Society is to be congratulated on its support for the history of our subject. I wish to thank my colleagues at the Open University and the University of Warwick who have helped me so much and whose support for the history of mathematics has been very important to me. Especially I wish to thank my co-authors and co-editors who have contributed so much. Above all I thank my wife and children for the love and joy they have brought to my life and for all that that has made possible.

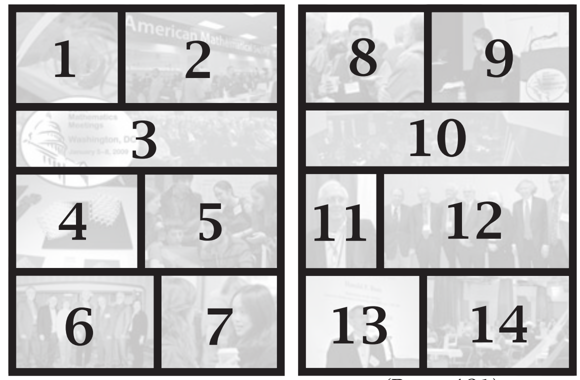
About the Prize

The Whiteman Prize is awarded every three years (every four years until 2009) to recognize notable exposition and exceptional scholarship in the history of mathematics. The prize was established in 1998 using funds donated by Mrs. Sally Whiteman, in memory of her husband, the late Albert Leon Whiteman. The prize carries a cash award of US$5,000.

The Whiteman Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2009 prize, the members of the selection committee were: Bruce C. Berndt, Keith J. Devlin, and Harold M. Edwards (chair).

Previous recipients of the Whiteman Prize are Thomas Hawkins (2001) and Harold M. Edwards (2005).

2009 Washington, DC, Joint Mathematics Meetings Photo Key



(Page 480) (Page 481)

1. Glass art from the Mathematical Art Exhibit.

2. AMS booth in the Exhibits area.

3. Audience at a talk.

4. 3-D art from the Mathematical Art Exhibit.

5. Students around a computer.

6. Opening Ceremony for the Exhibits. Left to right: Robert Daverman (AMS), James Tattersall (MAA), Tina Straley (MAA), James Glimm (AMS), Joseph Gallian (MAA), John Ewing (AMS), Martha Siegel (MAA).

7. Participants conversing.

8. Networking.

9. MAA invited address speaker Maria Chudnovsky.

10. Networking Center.

11. John W. Neuberger, University of North Texas. Neuberger has attended 50 annual meetings.

12. Present and former AMS presidents and former Executive Director John Ewing. Left to right: George Andrews (2009–2010), James Arthur (2005–2006), James Glimm (2007–2008), Ewing, Cathleen Morawetz (1995–1996), Arthur Jaffe (1997–1998), David Eisenbud (2003–2004).

13. Harold A. Boas, of Texas A&M University, accepting the Chauvenet Prize. Boas was editor of the *Notices*, 2000–2003.

14. Employment Center.

2009 Conant Prize

John W. Morgan received the 2009 AMS Levi L. Conant Prize at the 115th Annual Meeting of the AMS in Washington, DC, in January 2009.

Citation

The Levi L. Conant Prize for 2009 is awarded to John Morgan for his article, "Recent progress on the Poincaré Conjecture and the classification of 3-manifolds", *Bull. Amer. Math. Soc.* **42** (2005), 57–78.

John W. Morgan

The celebrated Poincaré Conjecture, formulated in modern terms, asks, "Is a closed 3-manifold having trivial fundamental group diffeomorphic to the 3-dimensional sphere?" This conjecture evolved from Poincaré's 1904 paper and inspired an enormous amount of work in 3-dimensional topology in the ensuing century. Thurston's Geometrization Conjecture subsumes the Poincaré Conjecture as a special case and speculates which 3-manifolds admit a Riemannian metric of constant negative curvature 1.

By proposing the existence of nice metrics on 3-manifolds, Thurston's far-reaching conjecture links together in an essential way the relevant topology and geometry and suggests a more analytic approach to classifying 3-manifolds. Hamilton's remarkable series of papers develops one such geometric-analytic approach using the Ricci flow and establishes crucial analytic estimates for evolving metrics and curvature. This set the stage for Perelman's much acclaimed work and the ultimate proof of these conjectures.

Morgan's paper was written in 2004 at a critical juncture in this story, just after the appearance of Perelman's papers and while they were still undergoing scrutiny by experts. It made the momentous developments surrounding the conjectures of Poincaré and Thurston accessible to a wide mathematical audience. The article captured key concepts and results from topology and differential geometry and conveyed to the reader the significance of the advances.

Morgan's exposition is elegant and mathematically precise. The paper transmits a great amount of information in a seemingly effortless flow of mathematical ideas from across a broad spectrum of topics. It was a valuable survey when it appeared and remains so today.

Biographical Sketch

Morgan received his Ph.D. in mathematics from Rice University in 1969. From 1969 to 1972 he was an instructor at Princeton University, and from 1972 to 1974 an assistant professor at the Massachusetts Institute of Technology. From 1974 to 1976 he was member of Institut des Hautes Etudes Scientifiques in Paris. Since becoming a professor of mathematics at Columbia University in 1976, he has also been a visiting professor at Stanford, Harvard, the Institute for Advanced Study, the Mathematical Sciences Research Institute in Berkeley, Université Paris-Sud, and IHES. He will become the founding director of the Simons Center for Geometry and Physics in Stony Brook in September 2009.

Morgan's mathematical speciality is topology and geometry, and he has worked on high-dimensional surgery, the topology of Kähler manifolds, and the topology and geometry of manifolds of dimensions 3 and 4. He is an editor of the *Journal of the American Mathematical Society*.

Morgan lives in New York City with his wife. They have two children—Jake, who lives in London, and Brianna, who is an undergraduate at Columbia University.

Response

I am honored to be awarded the 2009 Levi L. Conant Prize for my article, "Recent Progress on the Poincaré Conjecture and the Classification of 3-manifolds".

This is one of the most amazing developments in mathematics, representing as it does the solution of a 100-year-old problem. The advance is even more interesting because it uses a beautiful combination of analytic and geometric tools to solve a topological problem. It was a great pleasure to decipher these arguments and to understand their beauty and power—and the pleasure was only increased in the telling of the story. In working through the arguments behind these results, I benefited from the insights of various people, and it is a pleasure to thank them. First and foremost is Gang Tian with whom I have had a collaboration spanning several years as we sorted out in great detail the arguments. I had many fruitful discussions with Bruce Kleiner, John Lott, and Tom Mrowka. Finally, my greatest gratitude goes to Richard Hamilton, who developed the theory of Ricci flow and suggested the program to use this method to solve the 3-dimensional problems, and above all to Grigory Perelman whose mathematical power and insight led to the resolution of the conjectures.

About the Prize

The Conant Prize is awarded annually to recognize an outstanding expository paper published in either the *Notices of the AMS* or the *Bulletin of the AMS* in the preceding five years. Established in 2000, the prize honors the memory of Levi L. Conant (1857–1916), who was a mathematician at Worcester Polytechnic University. The prize carries a cash award of US$1,000.

The Conant Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2009 prize, the members of the selection committee were: Georgia Benkart, Stephen J. Greenfield, and Carl R. Riehm (chair).

Previous recipients of the Conant Prize are: Carl Pomerance (2001); Elliott Lieb and Jakob Yngvason (2002); Nicholas Katz and Peter Sarnak (2003); Noam D. Elkies (2004); Allen Knutson and Terence Tao (2005); Ronald M. Solomon (2006); Jeffrey Weeks (2007); and J. Brian Conrey, Shlomo Hoory, Nathan Linial, and Avi Wigderson (2008).

2009 Morgan Prize

AARON PIXTON received the 2009 AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student at the Joint Mathematics Meetings in Washington, DC, in January 2009. Receiving an honorable mention was ANDREI NEGUT.

Citation: Aaron Pixton

Aaron Pixton is the winner of the 2009 Morgan Prize for Outstanding Research by an Undergraduate Student. The award is based on five impressive papers in addition to his Princeton senior thesis. One of Pixton's papers has already appeared in the *Proceedings of the American Mathematical Society*, two others have been accepted by *Forum Mathematicum* and the *International Journal of Number Theory*, and two others have been submitted. In addition to being creative, Pixton's work spans a remarkable range of topics, including combinatorial number theory, modular forms, algebraic topology, and Gromov-Witten invariants.

Aaron Pixton

Pixton participated in Research Experience for Undergraduates (REU) programs at Cornell University, the University of Wisconsin-Madison, and the University of Minnesota Duluth, and wrote interesting papers at all three. One of his mentors described his "ability to digest current research papers, to formulate interesting questions…, and within a week's time, to start solving [them]" as "simply astonishing" and considers his work as "probably stronger than many Ph.D. dissertations". Another mentor describes the "depth and breadth" of his papers as "amazing".

Biographical Sketch: Aaron Pixton

Aaron Pixton was born in Binghamton, New York, and has lived in nearby Vestal, New York, all his life. He was interested in mathematics from an early age, when he enjoyed reading recreational math books. His formal study of mathematics began when he took various math classes from Binghamton University during high school.

Pixton spent the past four years studying mathematics at Princeton University, from which he graduated in June 2008. During this time, he took advantage of opportunities to work on original research both at Princeton during the school year and at REUs during the summers.

Pixton is currently at the University of Cambridge doing Part III of the Mathematical Tripos. Next fall, he will be returning to Princeton to enter the Ph.D. program there, where he plans to study some combination of number theory and algebraic geometry. Pixton's nonmathematical diversions include playing chess, reading fantasy books, and watching his seven cats.

Response: Aaron Pixton

I am extremely honored to have been selected for the 2009 Morgan Prize by the AMS, MAA, and SIAM. I would like to thank everyone who has helped and encouraged me to do research. First, I thank my parents for always supporting my desire to think about mathematics. Next, I thank my coauthors, Tom Church, Carl Erickson, and especially Alison Miller; they not only collaborated and shared their ideas with me, but they also taught me a lot in the process of doing so. I would like to thank Tara Brendle, Ken Ono, and Joe Gallian for giving me interesting mathematics to think about during the enjoyable REUs that they ran. I thank the other students at these research programs for greatly enriching my mathematical experiences. Finally, I would like to thank everyone in the Princeton

Mathematics Department for providing a supportive and stimulating mathematical environment for the last four years; particular thanks are due to Manjul Bhargava for teaching the classes which made me most excited about being a mathematician and to Chris Skinner and Rahul Pandharipande for supervising the research I did at Princeton.

Citation for Honorable Mention: Andrei Negut

The Morgan Prize Committee is pleased to award Honorable Mention for the 2009 Morgan Prize for Outstanding Research by an Undergraduate Student to Andrei Negut. The award recognizes his excellent Princeton senior thesis on "Laumon spaces and many-body systems", which establishes a large part of a conjecture of Braverman made at the 2006 International Congress of Mathematicians. In addition to this work, Negut has made important contributions to problems in very diverse fields: algebraic cobordism theory and dynamical systems. His recommenders consider Negut to be off to a "spectacular start" and look forward to future great achievements.

Biographical Sketch: Andrei Negut

Andrei Negut was born and lived in Romania until the age of 18, by which time his passion for mathematics had been sparked. He attended Princeton University as an undergraduate, where contacts with some of the world's best mathematicians and teachers inspired his passion for the subject. At Princeton, he had the chance to pursue several research projects in different fields, honing his area of interest and broadening his appreciation of mathematics. After finishing his undergraduate studies, Negut spent a year in Europe, traveling between several research institutes (i.e., Institut des Hautes Etudes Scientifiques in France, Max-Planck-Institut für Mathematik in Germany, and Institute of Mathematics "Simion Stoilow" of the Romanian Academy), learning mathematics from various perspectives. Next year, he will pursue graduate studies at Harvard University. Apart from mathematics, he enjoys traveling the world, photography, and the Russian culture.

Response: Andrei Negut

I am very honored to have been awarded this prize, which means very much to me on a personal basis. On a more global scale, it makes me very happy to see that the mathematical community carefully watches over young mathematicians and is always willing to offer them its support.

About the Prize

The Morgan Prize is awarded annually for outstanding research in mathematics by an undergraduate student (or students having submitted joint work). Students in Canada, Mexico, or the United States or its possessions are eligible for consideration for the prize. Established in 1995, the prize was endowed by Mrs. Frank (Brennie) Morgan of Allentown, Pennsylvania, and carries the name of her late husband. The prize is given jointly by the AMS, the Mathematical Association of America (MAA), and the Society for Industrial and Applied Mathematics (SIAM) and carries a cash award of US$1,200.

Recipients of the Morgan Prize are chosen by a joint AMS-MAA-SIAM selection committee. For the 2009 prize, the members of the selection committee were: Georgia Benkart, James H. Curry, Maeve L. McCarthy, Michael E. Orrison, Kannan Soundararajan (chair), and Paul Zorn.

Previous recipients of the Morgan Prize are: Kannan Soundararajan (1995), Manjul Bhargava (1996), Jade Vinson (1997), Daniel Biss (1998), Sean McLaughlin (1999), Jacob Lurie (2000), Ciprian Manolescu (2001), Joshua Greene (2002), Melanie Wood (2003), Reid Barton (2005), Jacob Fox (2006), Daniel Kane (2007), and Nathan Kaplan (2008).

Mathematics People

Mirzakhani Receives 2009 Blumenthal Award

The Leonard M. and Eleanor B. Blumenthal Award for the Advancement of Research in Pure Mathematics has been presented to Maryam Mirzakhani of Princeton University. The award was presented at the Joint Mathematics Meetings in Washington, DC in January 2009.

Citation

The Leonard M. and Eleanor B. Blumenthal Trust Award for the Advancement of Research in Pure Mathematics is awarded to Maryam Mirzakhani for her exceptionally creative, highly original thesis. This work combines tools as diverse as hyperbolic geometry, "classical methods" of automorphic forms, and symplectic reduction to obtain results on three different important questions. These results include a recursive formula for Weil-Petersson volumes of moduli spaces of Riemann surfaces, a determination of the asymptotics of the number of simple closed geodesics on a hyperbolic surface in terms of length, and a new proof of Witten's Conjecture (originally established by Kontsevich) establishing the KdV recursion for the intersection numbers on moduli space.

Biographical Sketch

Maryam Mirzakhani obtained her B.Sc. in mathematics (1999) from the Sharif University of Technology in Tehran, Iran. 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. She is a professor at Princeton University. Her research interests include Teichmüller theory, hyperbolic geometry, and ergodic theory.

Response from Mirzakhani

I am deeply honored to be a recipient of the Leonard M. and Eleanor B. Blumenthal Award.

First, I would like to thank my Ph.D. advisor, Curt McMullen, for introducing me to many fascinating areas of mathematics and for his invaluable help and encouragement throughout all these years. I am also grateful to the math department at Harvard University and all my graduate school teachers for providing a great environment for graduate students. I want to express my gratitude to my teachers at Sharif University of Technology for showing me the beauty of mathematics. I am gratefully indebted to my many friends in the Boston area, especially Roya Beheshti, whose friendship has been a source of happiness and inspiration for me.

Finally, I thank my family for all their unceasing love and support.

About the Award

The Leonard M. and Eleanor B. Blumenthal Trust for the Advancement of Mathematics was created for the purpose of assisting the Department of Mathematics of the University of Missouri at Columbia, where Leonard Blumenthal served as professor for many years. Its second purpose is to recognize distinguished achievements in the field of mathematics through the Leonard M. and Eleanor B. Blumenthal Award for the Advancement of Research in Pure Mathematics, which was originally funded from the Eleanor B. Blumenthal Trust (dated September 24, 1984) upon Mrs. Blumenthal's death on July 12, 1987.

The trust, which is administered by the Financial Management and Trust Services Division of Boone County National Bank in Columbia, Missouri, pays its net income to the recipient of the award each year for four years. The recipient is selected by a committee of five members, each of whom has made notable contributions to mathematics. The award is presented to the individual deemed to have made the most substantial contribution to research in the field of pure mathematics and who is deemed to have the potential for future production of distinguished research in the field. To fulfill these criteria, the prize committee has decided to grant the award for the most substantial Ph.D. thesis produced in the four-year interval between awards.

Previous recipients of the Blumenthal Award are Manjul Bhargava (2005), Stephen J. Bigelow and Elon B. Lindenstrauss (2001), Loïc Merel (1997), and Zhihong Xia (1993).

—AMS Announcement

Gamburd Receives PECASE Award

Alexander Gamburd of the University of California, Santa Cruz, has been chosen to receive a 2007 Presidential Early Career Award for Scientists and Engineers (PECASE) for his work in the mathematical sciences. Gamburd was nominated by the Division of Mathematical Sciences of the National Science Foundation. He was one of sixty-eight young researchers to receive the award, the highest honor bestowed by the U.S. government on outstanding young scientists, mathematicians, and engineers who are in the early stages of establishing their independent research.

The recipients were selected from nominations made by eight participating federal agencies. Each awardee receives a five-year grant ranging from US$400,000 to nearly US$1 million to further his or her research and educational efforts.

—From an NSF announcement

Klartag and Naor Awarded Salem Prize

Bo'az Klartag of Tel Aviv University and Assaf Naor of the Courant Institute of Mathematical Sciences, New York University, have been awarded the 2008 Salem Prize. Klartag was honored for his work in high-dimensional convexity and the local theory of Banach spaces. Naor was recognized for his contributions to the structural theory of metric spaces and its applications to computer science.

The Salem Prize is awarded every year to a young mathematician judged to have done outstanding work in the field of interest of Raphael Salem, primarily the theory of Fourier series.

—Jean Bourgain, Institute for Advanced Study

AAAS Fellows Chosen

Six mathematicians have been elected as new fellows to the Section on Mathematics of the American Association for the Advancement of Science (AAAS). In addition, four researchers whose work involves the mathematical sciences have been elected to the Section on Information, Computing, and Communication. The new fellows in the Section on Mathematics are: Walter Craig, McMaster University; Robert J. Daverman, University of Tennessee, Knoxville; Richard Durrett, Cornell University; Alexander Nagel, University of Wisconsin; Jacob Rubinstein, Technion-Israel Institute of Technology; and William Y. Velez, University of Arizona. The new fellows in the Section on Information, Computing, and Communication are: Chandrajit Bajaj, University of Texas at Austin; Alan Kay, Viewpoints Research Institute; Daniel E. Koditschek, University of Pennsylvania; and Dexter Kozen, Cornell University.

—From an AAAS announcement

A. O. L. Atkin (1923–2008)

A. O. L. (Oliver) Atkin was born in Liverpool, England. He attended Winchester College and the University of Cambridge. He spent the last year of the Second World War at Bletchley Park, where he was one of the many mathematicians and linguists who broke a variety of German ciphers. He returned to Cambridge in 1947 and received his doctorate in 1952. He moved to the United States in 1970 and joined the faculty of the University of Illinois at Chicago Circle (now the University of Illinois at Chicago) in 1972.

Atkin is especially well known for his paper with J. Lehner, "Hecke operators on $\Gamma_0(M)$", *Math. Annalen* **185**, pp. 134–160. This paper introduced the notion of "newform" in the theory of modular forms. As a result of that paper, Atkin's name is attached to the important U-operator in the Hecke theory of modular forms. He continued this work with Winnie Li in subsequent papers.

Atkin made a number of early observations about congruences among modular forms that were fundamental in the later development of the theory of p-adic modular forms. He did important work on partitions.

Atkin was a pioneer in the application of computers to mathematics. He spent several years in England at the Atlas Computer Laboratory. For background on his contributions during that period, see Bryan Birch's article "Atkin and the Atlas Lab" in *Computational Perspectives on Number Theory: Proceedings of a Conference in Honor of A. O. L. Atkin* (D. A. Buell and J. T. Teitelbaum, editors, AMS/IP Studies in Advanced Mathematics, Volume 7, 1998).

Many mathematicians relied on him for numerical data in support of their conjectures; he seemed to have a personal acquaintance with every modular form of relatively low weight and level.

His more recent work included taking an idea of René Schoof on an approach to computing points on elliptic curves mod p and making it practical; after further refinements by Noam Elkies this algorithm is now known as SEA (for Schoof-Elkies-Atkin). He and Dan Bernstein found an improvement to the Sieve of Eratosthenes, now known as the "sieve of Atkin". Together with Morain, Atkin developed a powerful primality test using CM elliptic curves. In practical terms this test is arguably the most efficient currently available.

Especially later in his career, Atkin was not fond of publishing papers in journals and typically made his results known via the NMBRTHRY email list.

He was a fine pianist and organist and a champion duplicate bridge player.

He remained mathematically active until his death and was continuing to work on problems about modular forms for noncongruence subgroups with Winnie Li and her students. He first raised this topic with Swinnerton-Dyer thirty years ago.

He is survived by a son and daughter and five grandchildren.

—Jeremy Teitelbaum, University of Connecticut