2008 Steele Prizes

The 2008 Leroy P. Steele Prizes were awarded at the 114th Annual Meeting of the AMS in San Diego in January 2008.

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 2008 prizes the members of the selection committee were: Rodrigo Bañuelos, Enrico Bombieri, Russel Caflisch, Lawrence C. Evans, Lisa C. Jeffrey, Nicholas M. Katz, Julius L. Shaneson, Richard P. Stanley, and David A. Vogan (chair).

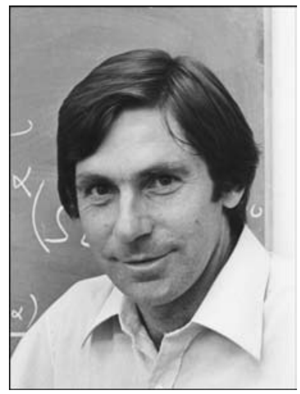
The list of previous recipients of the Steele Prize may be found on the AMS website at `http://www.ams.org/prizes-awards`.

The 2008 Steele Prizes were awarded to Neil Trudinger for Mathematical Exposition, to Endre Szemerédi for a Seminal Contribution to Research, and to George Lusztig for Lifetime Achievement. The text that follows presents, for each awardee, the selection committee's citation, a brief biographical sketch, and the awardee's response upon receiving the prize.

Mathematical Exposition: Neil Trudinger

Citation

The Leroy P. Steele Prize for Mathematical Exposition is awarded to Neil Trudinger in recognition of his book *Elliptic Partial Differential Equations of Second Order*, written with the late David Gilbarg.



Neil Trudinger

The global theory of nonlinear partial differential equations was mostly restricted to PDE involving two variables until the late 1950s, when fundamental estimates of DeGiorgi and Nash for second-order elliptic (and parabolic) equations finally broke open such PDE in more variables. The subject thereupon exploded beyond all expectations, and nowadays the analysis of even extremely degenerate and highly nonlinear second-order elliptic PDE in many variables is fairly routine, if very technical in detail.

Neil Trudinger, starting with the original 1977 edition of his book with Gilbarg, has recorded the progress of the field. He has reworked the breakthroughs, many due to him, recasting these technical estimates into understandable form within the fixed notation and framework of this highly cited book in its various domestic and foreign editions. His service has been invaluable. Having this foundational reference has made it possible for young researchers to enter the field, which would otherwise have been impenetrable. Here they can read in full detail all about Schauder estimates, Sobolev spaces, boundary estimates, Harnack inequalities, a priori derivative bounds, and much, much more.

Good mathematical exposition is always difficult, but it is especially so for technical estimates. The heights to which the research community has pushed the analysis of nonlinear second-order elliptic PDE is amazing, but the fundamental inequalities are mostly without any good heuristic interpretations. Hard analysis is both hard and hard to explain: Neil Trudinger's concise, elegant exposition in this outstanding book is magnificent.

Biographical Sketch

Neil S. Trudinger was born in Ballarat, Australia, in 1942. After schooling and undergraduate education at the University of New England in Australia, he completed his Ph.D. at Stanford University in 1966.

Following appointments at the Courant Institute (1966–67); University of Pisa, Italy (1967); Macquarie University, Australia (1968–70); University of Queensland, Australia (1970–73); University of Minnesota (1970–71); and Stanford University (1971), he took up a chair of mathematics at the Australian National University in 1973, where he has been since. During this period he has also held numerous visiting positions at universities in Asia, Europe, and the United States, as well as a professorship at Northwestern University from 1989 to 1993. Among various administrative positions at the Australian National University, he was head of the Department of Pure Mathematics from 1973 to 1980, director of the Commonwealth Special Research Centre for Mathematical Analysis from 1982 to 1990, and dean of the School of Mathematical Sciences from 1992 to 2000.

Neil Trudinger is a fellow of the Australian Academy of Science and a fellow of the Royal Society of London. He was also chief judge in the Singapore National Science Talent Search in 2002. His research contributions, while largely focused on nonlinear elliptic partial differential equations, have also spread into functional analysis, geometry, computational mathematics, and, more recently, optimal transportation.

Response

I am very honoured and pleased to receive the Steele Prize for Mathematical Exposition. I could never have imagined forty years ago when my book with David Gilbarg on elliptic partial differential equations was first published that it would get such recognition. The book was originally conceived by us after I had prepared lecture notes for the spring quarter of the graduate PDE course at Stanford in 1971. My topics were Sobolev spaces and their application to linear elliptic PDE, and we decided to start by blending these with earlier notes of Dave on the Schauder theory. Six years later and after a lot of hard work, including long and painful negotiations over language, the first edition appeared. We were extremely fortunate to have incredible assistance. First was the impeccable typing of Anna Zalucki in Canberra and Isolde Field at Stanford. Isolde had already typed my Ph.D. thesis at Stanford several years earlier, and Dave had been my supervisor, so the Stanford team was ready to roll from the outset. In Australia I had an amazing research assistant, Andrew Geue, who checked every bibliographical reference against its original publication so that titles and page numbers were always correct. We also got plenty of encouragement and support from many colleagues over the succeeding years to whom I am very grateful, as well as to those old friends Catriona Byrne and Joachim Heinze at Springer in Heidelberg.

My own passage into mathematical exposition was rather severe, akin to learning to swim by being thrown in a deep ocean. My first postdoctoral position in 1966 was a Courant Instructorship, and I was assigned an advanced topics course in PDE for the full year. Armed with books by Bers, John, and Schechter on partial differential equations; Morrey on multiple integrals in the calculus of variations; Friedman on parabolic partial differential equations; as well as works of Ladyzhenskaya and Ural'tseva, Moser, Serrin, and Stampacchia from my graduate days, I struggled to teach a full-year course on elliptic and parabolic equations to students who all looked older than my meagre twenty-four years. But this torture had its rewards. I presented a then recent and now famous paper by John and Nirenberg on BMO as it was needed for the Moser Harnack inequality. Subsequently, I found that it could be bypassed for the Harnack inequality through a simpler argument, a byproduct of which was an exponential-type imbedding result, later sharpened by Moser and now well known as the Moser-Trudinger inequality. At the same time, my quest to understand loss of compactness in Sobolev imbeddings led to the Yamabe "problem". But most of all I was extremely well equipped when I started work on the book a few years later.

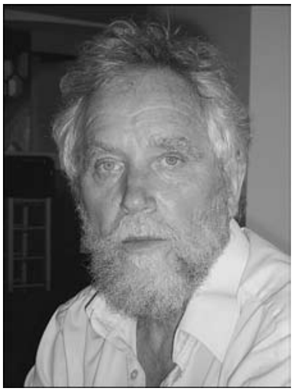
I conclude on a sad note. Both David Gilbarg and Isolde Field passed away in recent years. This honour is for you, Dave and Isolde!

Seminal Contribution to Research: Endre Szemerédi

Citation

The Steele Prize in 2008 for a Seminal Contribution to Mathematical Research is awarded to Endre Szemerédi for the paper "On sets of integers containing no k elements in arithmetic progression", *Acta Arithmetica* XXVII (1975), 199–245.

A famous result of arithmetic combinatorics due to van der Waerden in 1927 proving an earlier conjecture of Baudet states that if we partition the natural integers into finitely many subsets, then one of these subsets contains arithmetic progressions of arbitrary length. In its finite version, because of the inevitable use of a multiple induction argument, it leads to incredibly large bounds for the size of a set of consecutive integers such that for every k-partition of it there is always a subset containing an arithmetic progression of k terms. In 1936 Erdős and Turán proposed, as a natural extension of van der Waerden's theorem, the conjecture that any infinite set of integers of positive density contained arbitrarily long arithmetic progressions; this may be viewed as a discrete analog of the classical theorem of Lebesgue that almost every point of a set of positive measure of real numbers has density 1. This conjecture quickly became one of the major open questions in Ramsey theory.



Endre Szemerédi

The first nontrivial result about the Erdős-Turán conjecture was obtained by K. F. Roth in 1953 using harmonic analysis, proving it for progressions of length 3, but his method did not extend to length 4 in any obvious way. In 1969 Szemerédi proved the Erdős-Turán conjecture for length 4 using a difficult combinatorial method. Finally, the Erdős-Turán conjecture was settled in the affirmative by Szemerédi in his landmark 1975 paper.

The solution is a true masterpiece of combinatorics, containing new ideas and tools whose impact go well beyond helping to solve a specific hard problem. One of these new tools, his by now famous Regularity Lemma, has become a foundation of modern combinatorics. Its statement of striking simplicity asserts roughly that any sufficiently large dense graph can be approximated by a union of a bounded number of very regular subgraphs of almost equal size, looking in pairs like very regular bipartite graphs; the upper and lower bounds for the number of subgraphs are determined only by the desired quality of approximation and are independent of the size of the graph. In essence, every large dense graph is well approximated by a controlled bounded union of quasirandom bipartite graphs of almost equal size. This is a very surprising result, far from intuitive. The proof is short but very subtle, leading to bounds for the number of components larger than any tower of exponentials. The subtlety of the statement has been confirmed by recent work by Gowers, showing that these gigantic bounds are indeed necessary for the validity of the Regularity Lemma in all cases.

The impact in combinatorics of the Regularity Lemma and of the numerous variants that followed it is due to the fact that there are many techniques available for studying random graphs and, via the Regularity Lemma, they can be transferred to the study of completely arbitrary graphs. It is fair to say that the Regularity Lemma has transformed the focus of graph theory from the study of special graphs and of extremal problems to the study of general graphs and random graphs. Beyond combinatorics it has found applications in number theory and in computer science, in particular in complexity theory.

However, the impact of Szemerédi's paper goes beyond this. The solution of the Erdős-Turán conjecture stimulated other mathematicians to find other lines of attack. In 1977 Furstenberg found a new proof of Szemerédi's theorem using deep methods of ergodic theory, together with a correspondence principle showing the equivalence of Szemerédi's theorem with his new ergodic theorem. Furstenberg's new method could then be used to attack multidimensional versions of the theorem as well as nonlinear versions. In 2001 Gowers obtained a new proof of Szemerédi's theorem, based on his novel idea of a Fourier analysis with nonlinear phases. More recently, Green and Tao were able to replace the positive density condition in Szemerédi's theorem by other arithmetical conditions, which allowed them, using again a suitable transference principle, to prove the same result for any sequence of primes of relative positive density, thereby solving another famous conjecture of Erdős considered inaccessible by standard methods of analytic number theory.

Recent work by many authors strongly indicates that these different approaches to Szemerédi's theorem are all interrelated. There is no doubt that Szemerédi's landmark paper is the source of these beautiful developments in mathematics.

Biographical Sketch

Endre Szemerédi was born in Budapest in 1940. He finished university in Budapest, at ELTE University. He received his Ph.D. at the Moscow State University. He has been a member of the Renyi Institute of the Hungarian Academy of Sciences since 1970. Currently he is a professor in the Department of Computer Sciences, Rutgers University. He is a member of the Hungarian Academy of Sciences. In 1976 he received the Pólya Prize.

Response

I am really grateful to the AMS, to the Steele Prize Committee, and to those people who recommended me. This prize is a great honor.

Here is what actually sparked my work on $R_4(n)$. Assuming that it was a well-known fact that dense sets of integers have arithmetic progressions of length four, I proudly showed Paul Erdős a proof that no positive fraction of elements in a long arithmetic progression could be squares. Erdős pointed out a flaw in the argument, namely that $R_4(n)$ was actually an open problem and that the rest of my proof was in fact already known to Euler. So now I really had to work on $R_4(n)$. Once $R_4(n)$ was settled, so was the original problem about squares. Later, Bombieri, Granville, and Pintz greatly improved my result. Luckily for me this occurred several years after $R_4(n)$; otherwise I would never have worked on it.

It is my opinion (and maybe only mine) that the Regularity Lemma was born after the $R_k(n)$ result, though certainly inspired by ideas from that paper. It is necessary to acknowledge Andras Hajnal for the $R_k(n)$ paper and Vasek Chvatal for the Regularity Lemma paper. These friends literally wrote every word of the papers based on my explanations. I also want to express my gratitude to Paul

Erdős and to K. F. Roth for their encouragement to persevere with $R_k(n)$.

This award could not have occurred were it not for the fundamental work of other mathematicians who developed the field of additive combinatorics and established its relations with many other areas. Without them my theorem is only a fairly strong result, but no "seminal contribution to research". I acknowledge my debt to them. Finally, I want to thank my wife, Anna, for all her patience, good humor, and support.

Lifetime Achievement: George Lusztig

Citation

The work of George Lusztig has entirely reshaped representation theory and in the process changed much of mathematics.

Here is how representation theory looked before Lusztig entered the field in 1973. A central goal of the subject is to describe the irreducible representations of a group. The case of reductive groups over locally compact fields is classically one of the most difficult and important parts. There were three more or less separate subjects, corresponding to groups over $\mathbb{R}$ (Lie groups), $\mathbb{Q}_p$ (p-adic groups), and finite fields (finite Chevalley groups).

Lusztig's first great contribution was to the representation theory of groups over finite fields. In a 1974 book he showed how to construct "standard" representations—the building blocks of the theory—in the case of general linear groups. Then, working with Deligne, he defined standard representations for all finite Chevalley groups. This was mathematics that had been studied for nearly a hundred years; Lusztig and Deligne did more in one paper than everything that had gone before.

With the standard representations in hand (in the finite field case), Lusztig turned to describing irreducible representations. The first step is simply to get a list of irreducible representations. This he did almost immediately for the "classical groups", like the orthogonal groups over a finite field. The general case required deep new ideas about connections among three topics: irreducible representations of reductive groups, the representations of the Weyl group, and the geometry of the unipotent cone. Although some key results were contributed by other (great!) mathematicians like T. Springer, the deepest new ideas about these connections came from Lusztig, sometimes in work with Kazhdan.

Lusztig's results allowed him to translate the problem of describing irreducible representations of a finite Chevalley group into a problem about the Weyl group. This allowed results about the symmetric group (like the Robinson-Schensted algorithm and the character theory of Frobenius and Schur) to be translated into descriptions of the irreducible representations of finite classical groups. For the exceptional groups, Lusztig was asking an entirely new family of questions about the Weyl groups, and considerable insight was needed to arrive at complete answers, but eventually he did so.

George Lusztig

Lusztig's new questions about Weyl groups originate in his 1979 paper with Kazhdan. The little that was known about irreducible representations first becomes badly behaved in some very specific examples in $SL(4, \mathbb{C})$. Kazhdan and Lusztig noticed that their new questions about Weyl groups first had nontrivial answers in exactly these same examples (for the symmetric group on four letters). In an incredible leap of imagination, they conjectured a complete and detailed description of singular irreducible representations (for reductive groups over the complex numbers) in terms of their new ideas about Weyl groups. This (in its earliest incarnation) is the Kazhdan-Lusztig conjecture. The first half of the proof was given by Kazhdan and Lusztig themselves, and the second half by Beilinson-Bernstein and Brylinski-Kashiwara independently.

The structure of the proof is now a paradigm for representation theory: use combinatorics on a Weyl group to calculate some geometric invariants, relate the geometry to representation theory, and draw conclusions about irreducible representations. Lusztig has used this paradigm in an unbelievably wide variety of settings. One striking case is that of groups over p-adic fields. In that setting Langlands formulated a conjectural parametrization of irreducible representations around 1970. Deligne refined this conjecture substantially, and many more mathematicians have worked on it. Lusztig (jointly with Kazhdan) showed how to prove the Deligne-Langlands conjecture in an enormous family of new cases. This work has given new direction to the representation theory of p-adic groups.

There is much more to say: about Lusztig's work on quantum groups, on modular representation theory, and on affine Hecke algebras, for instance. His work has touched widely separated parts of mathematics, reshaping them and knitting them together. He has built new bridges to combinatorics and algebraic geometry, solving classical problems in those disciplines and creating exciting new ones. This is a remarkable career and as exciting to watch today as it was at the beginning more than thirty years ago.

Biographical Sketch

George Lusztig was born in Timisoara, Romania, in 1946. After graduating from the University of Bucharest in 1968, he was an assistant at the University of Timisoara and then a member of the Institute for Advanced Study in Princeton, where he studied with Michael Atiyah. During his second year at IAS he was also a graduate student at Princeton University and received a Ph.D. degree (1971) for work on Novikov's higher signature and families of elliptic operators. He then moved to the University of Warwick, U.K., becoming a professor in 1974. For the last thirty years he has been a professor at the Massachusetts Institute of Technology. He has been a frequent visitor to the IHÉS (Institut des Hautes Études Scientifiques) and spent the academic year 1985–86 at the University of Rome. Lusztig received the Berwick Prize (London Mathematical Society, 1977), the Cole Prize in Algebra (American Mathematical Society, 1985), and the Brouwer Medal (Dutch Mathematical Society, 1999). He is a fellow of the Royal Society of London, a fellow of the American Academy of Arts and Sciences, and a member of the National Academy of Sciences.

Response

When writing a response it is very difficult to say something that has not been said before. Therefore, I thought that I might give some quotes from responses of previous Steele Prize recipients which very accurately describe my sentiments.

"What a pleasant surprise!" (Y. Katznelson, 2002). "I feel honored and pleased to receive the Steele prize—with a small nuance, that it is awarded for work done up to now" (D. Sullivan, 2006). "I always thought this prize was for an old person, certainly someone older than I, and so it was a surprise to me, if a pleasant one, to learn that I was chosen a recipient" (G. Shimura, 1996). "But if ideas tumble out in such a profusion, then why aren't they here now when I need them to write this little acceptance?" (J. H. Conway, 2000).

Now, I thank the Steele Prize Committee for selecting me for this prize. It is an unexpected honor, and I am delighted to accept it. I am indebted to my teachers, collaborators, colleagues at MIT, and students for their encouragement and inspiration over the years.

Around the time of my Ph.D., I switched from being a topologist with a strong interest in Lie theory to being a representation theorist with a strong interest in topology. (The switch happened with some coaching by Michael Atiyah and later by Roger Carter.) After that most of my research was concerned with the study of representations of Chevalley groups over a finite field or used the experience I gained from groups over a finite field to explore neighboring areas such as p-adic groups (which can be viewed as groups over a finite field that are infinite dimensional) or quantum groups (which can be viewed as analogues of the Iwahori-Hecke algebras, familiar from the finite group case).

Here are three topics from my research which I am particularly fond of:

(i) the classification of complex irreducible representations of a finite Chevalley group;

(ii) the theory of character sheaves, which helps in computing the irreducible characters in (i);

(iii) the theory of canonical bases arising from quantum groups, which unexpectedly provides a very rigid structure with coefficients in the natural numbers for several of the known objects in Lie theory.

I would like to make some comments on the period in which I focused on topic (i) above, from late 1975 (when my paper with Deligne (DL) was just completed) to the spring of 1978. In the first few months of that period I worked on the "Coxeter paper" (CP), in which I studied in detail the cohomology with compact support of the variety attached in (DL) to a Coxeter element in the Weyl group. Luckily, in this case the eigenvalues of Frobenius could be explicitly computed, and the eigenspaces provided a complete decomposition into irreducible representations, giving several new key examples of cuspidal representations. Then during the next year I found the classification and degrees of the irreducible representations of classical groups over a finite field using an extension of the method of (DL). After this (in 1977), as I wrote the notes for my lectures in the CBMS Regional Conference Series, No. 39, I found the classification and degrees of the irreducible unipotent representations of the finite exceptional groups of type other than E_8, based on (DL) and (CP). Towards the end of 1977 I discovered the nonabelian Fourier transform attached to any finite group H (which in the case where H is abelian reduces to the ordinary Fourier transform for functions on H times its dual). This new Fourier transform allowed me to find (in the spring of 1978) the classification and degrees of the irreducible unipotent representations for E_8. The same (or somewhat easier) methods can be used to obtain the classification and degrees of nonunipotent irreducible representations of finite exceptional groups. Thus, contrary to what the citation says, the classification of irreducible representations of finite exceptional groups does not depend on the "geometry of the unipotent cone" or on my work with Kazhdan done in 1979 (KL). On the other hand, the latter (KL) did play a role in my work (1981, 1982) on computing the values of irreducible characters on semisimple elements, and the former played a role in my work (1983–1986) on character sheaves. Moreover, the use of (KL) simplifies some of the arguments in the classification, as I showed in my 1984 book.

2008 Conant Prize

The 2008 Levi L. Conant Prize was awarded at the 114th Annual Meeting of the AMS in San Diego in January 2008.

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 2001, 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 2008 prize the members of the selection committee were: Noam D. Elkies, 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), and Jeffrey Weeks (2007).

The 2008 Conant Prize was awarded to J. Brian Conrey; and to Shlomo Hoory, Nathan Linial, and Avi Wigderson. The text that follows presents the committee's citations, brief biographical sketches of the authors, and their responses upon receiving the prize.

J. Brian Conrey

Citation

"The Riemann Hypothesis", *Notices*, March 2003, pages 341–353.

The Riemann Hypothesis (RH) has a strong claim to being the outstanding open problem in mathematics. Much has been written about RH, but rarely with anything like the scope that Conrey covers in but a dozen *Notices* pages, outlining the mathematical context that justifies the importance of RH, key moments in the problem's 140-plus-year history, known partial results and blind alleys, various threads of numerical and theoretical evidence, and suggestive connections with disparate branches of mathematics and theoretical physics. The mathematical exposition is enhanced by the judicious use of anecdotes illustrating the human drama of the quest for a proof and of figures that help the reader visualize the zeta function as a function of a complex variable and the key connections between the distribution of prime numbers, the distribution of the zeros of the Riemann zeta function, and conjecturally also the distribution of the eigenvalues of random Hermitian operators.

Conrey remarks on one of those fascinating connections (Gauss's class number problem and a "conspiracy of L-functions") that "we seem to be players in the middle of a mystery novel." The same can be said of the status of the Riemann Hypothesis itself. Conrey has given a masterly and lucid introduction to the plot thus far, to the detectives who brought us to this point, and to what may be called the main suspects: the mathematical structures that might be expected to figure in the eventual resolution of this central mystery of modern mathematics.

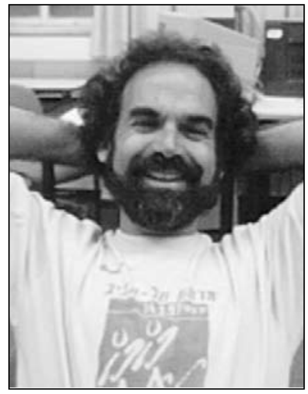
Biographical Sketch

J. Brian Conrey is the founding executive director of the American Institute of Mathematics (AIM). In this position, he oversees AIM's operations and helps to initiate programs that further AIM's goal of solving problems through focused collaborative efforts.

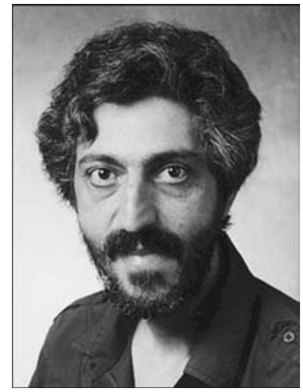
Conrey received his Bachelor of Science from Santa Clara University in 1976 and his doctorate from the University of Michigan in 1980. He conducted his postdoctoral studies at the University of Illinois, 1980–1982, and the Institute for Advanced Study in Princeton, 1982–1983. He was awarded an Alfred P. Sloan Fellowship in 1986.

J. Brian Conrey

Shlomo Hoory



Nathan Linial



Avi Wigderson

Conrey was a mathematics professor at Oklahoma State University, serving as head of the department from 1991 to 1997. He joined AIM in 1997. In 2005 he also became a professor at the University of Bristol.

Conrey's mathematical specialty is number theory, and he has a particular interest in the nearly 150-year-old Riemann Hypothesis. He has published more than fifty research papers and serves as an editor of the *Journal of Number Theory*.

Conrey has also helped launch several outreach programs for students interested in mathematics, including the San Jose Math Circle, MathCounts, and the Math MardiGras in Morgan Hill, and has been involved in several Research Experiences for Undergraduates programs working with undergraduates doing research. Conrey lives in San Martin, California, with his wife, Jan. They have three children: Brianna, Jennifer, and Rick.

Response

I am honored to receive the Levi Conant Prize for my article on the Riemann Hypothesis. I really enjoyed working on it and found the endeavor to be interesting and instructive. I hope that the article will play some small role in the eventual solution of this beautiful problem, perhaps by inspiring a young mathematician to think about it.

I would like to thank the people who helped me with the writing: Harold Boas, Brianna Conrey, David Farmer, Roger Heath-Brown, and K. Soundararajan, and with the graphics: Sandra Frost, Andrew Odlyzko, Mike Rubinstein, and Nina Snaith.

Shlomo Hoory, Nathan Linial, and Avi Wigderson

Citation

Expander graphs are (finite) graphs that are both sparse and highly connected: a sequence of graphs G_i of increasing size is a family of expander graphs if there is an $\epsilon > 0$ such that for each i and each subset S of G_i, the number of edges from S to its complement is at least $\epsilon|G_i|$. Since their introduction thirty years ago, the study of these graphs has blossomed into a substantial area of research with many branches. One direction involves understanding the relationship of graph expansion to other graph invariants, most notably the second largest eigenvalue of its adjacency matrix. Identifying classes of expanders and proving that they are indeed expanders involves a variety of techniques from harmonic analysis, group representation theory, graph theory, and information theory. Expanders have found a variety of applications within the theory of computing and other fields, from direct application to interconnection networks, to more surprising applications such as the problem of understanding the relative power of deterministic and randomized computation, the construction of computationally efficient error-correcting codes, and the construction of finite metric spaces that cannot be well approximated in Euclidean space. These applications confirm that computer science is an area with problems, techniques, and results that engage mathematicians in many fields.

This very readable article, "Expander graphs and their applications", which appeared in *Bull. Amer. Math. Soc. (N.S.)* **43** (2006), 439–561, provides a thorough overview of these and other developments. It is readily accessible for self-study by experienced graduate students and, with appropriate guidance, could even be appropriate for an advanced undergraduate seminar.

Biographical Sketch: Shlomo Hoory

Shlomo Hoory received his Ph.D. in computer science in 2002 under Nathan Linial at the Hebrew University of Jerusalem. His postdoctoral work was done at the University of Toronto and at the University of British Columbia. Currently he is working at the IBM Haifa research labs in the Constraint Satisfaction and Machine Learning group.

Response: Shlomo Hoory

It is a great honor for me to receive the Conant Prize for my joint paper with Nati Linial and Avi Wigderson. I would like to thank Nati and Avi for the pleasure of being a teacher assistant in their course on expander graphs at the Hebrew University and later for their help and encouragement while I taught the course at the University of

Toronto. Special thanks are due to the students of the course who wrote the scribe notes that formed the foundation for our paper and to Mark Goresky, who convinced us to make the effort and turn the notes into a full-scale review of the subject. Mark Goresky also assisted us throughout the writing process. I see great potential in the field of expander graphs for advancing areas in mathematics, computer science, and engineering. I hope that our expository paper will make the subject accessible to a wide audience.

Biographical Sketch: Nathan Linial

Nathan (Nati) Linial was born in Haifa, Israel, in 1953. He received his undergraduate education in mathematics at the Technion. His Ph.D. thesis in graph theory was written under Micha Perles at the Hebrew University of Jerusalem in 1978. Following a postdoctoral period at the University of California, Los Angeles, he returned to the Hebrew University to become a professor of computer science, a position he has held ever since. His main research interests include the mathematical foundations of computer science and combinatorics. He is particularly fascinated by the interaction between geometry and combinatorics. In addition, he is interested in mathematical problems that are motivated by other scientific disciplines, such as bioinformatics.

Response: Nathan Linial

I was first exposed to graph theory in a class for mathematically oriented high school kids. As my mathematical horizons expanded, I came to like the connections between combinatorics and other parts of mathematics. There are few places where these connections shine as brightly as in the study of expander graphs. I believe that the full potential impact of combinatorics on the rest of mathematics is only starting to reveal itself and the study of expander graphs can give us some idea of the true power of these connections.

Biographical Sketch: Avi Wigderson

Avi Wigderson is a professor at the School of Mathematics, Institute for Advanced Study (IAS), Princeton. He obtained his B.Sc. in computer science from the Technion in 1980 and his Ph.D. from Princeton in 1983. He was a member of the faculty at the Hebrew University in Jerusalem from 1986 to 2003. He joined the permanent faculty of the IAS in 1999. His research interests lie principally in complexity theory, algorithms, randomness, and cryptography. His awards include the Nevanlinna Prize (1994).

Response: Avi Wigderson

I am honored to receive the Conant Prize for my joint paper with Shlomo Hoory and Nati Linial. Many thanks are in order. First and foremost, to Nati and Shlomo for the pleasure of teaching together (at the Hebrew University) the course which resulted in this manuscript and for the big effort of writing it. Thanks to the many students of this course whose scribe notes formed the foundation of that paper. Special thanks to Mark Goresky, who convinced us to write it and whose enthusiasm and meticulous reading of earlier drafts helped get us through the process. Thanks to the many others who read and corrected earlier versions. And finally, thanks to the many colleagues and collaborators from whom I learned so much in the wonderful world of expander graphs.

2008 Morgan Prize

Nathan Kaplan

The 2008 AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student was awarded at the Joint Mathematics Meetings in San Diego in January 2008.

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$1,000.

Recipients of the Morgan Prize are chosen by a joint AMS-MAA-SIAM selection committee. For the 2008 prize, the members of the selection committee were Kelly J. Black, James H. Curry, Karen E. Smith, Kannan Soundararajan, Judy L. Walker, and Paul Zorn (chair).

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), and Daniel Kane (2007).

The 2008 Morgan Prize was awarded to Nathan Kaplan. The text that follows presents the selection committee's citation, a brief biographical sketch, and the awardee's response upon receiving the prize.

Citation

Nathan Kaplan has been named the recipient of the 2008 Morgan Prize for Outstanding Research by an Undergraduate. He graduated in 2007 from Princeton University with high honors. He also received the mathematics department's Peter Greenberg Prize, which honors outstanding mathematical accomplishments.

This award is based principally on four impressive papers in algebraic number theory, two of them individual and two with other authors. (Coauthors of the joint papers were careful to highlight Kaplan's substantial contributions.) At least three of these papers have been accepted for publication in such venues as the *Journal of Number Theory*, the *Journal of Algebra and Its Applications*, and *Acta Arithmetica*. Concerning Nathan's paper "Flat cyclotomic polynomials of order three", the *Journal of Number Theory* wrote that the work "contains…rather definitive results substantially advancing our understanding of cyclotomic polynomials of order three." Another recommender observed that this and related work of Kaplan demonstrates "remarkable creativity [and] technical facility…[and] will provide researchers new tools."

Kaplan participated in three summer REU [Research Experiences for Undergraduates] programs (at Trinity University, Williams College, and the University of Minnesota-Duluth) during his undergraduate career and produced publishable, professional-level work at all three. One of his supervisors described him as the most outstanding undergraduate with whom he had worked. Another supervisor described Kaplan as an extraordinary student—brilliant, friendly, outgoing, polite, and fun to work with. All of his recommenders, and this committee, fully expect Kaplan to become a very successful research mathematician.

Biographical Sketch

Nathan Kaplan was raised in Brooklyn, New York, and began taking mathematics classes at Columbia University while in high school. He graduated in June 2007 with a degree in mathematics from Princeton University and is currently at Cambridge

University doing Part III of the Mathematical Tripos.

His first research experience was in the summer of 2004 at the Trinity University REU program studying numerical monoids with Scott Chapman. The following summer he worked in the algebraic number theory group at the Williams College SMALL program under the direction of Allison Pacelli. In 2006 Kaplan attended Joe Gallian's REU at the University of Minnesota-Duluth and studied cyclotomic polynomials. This past summer he returned to the Trinity REU and worked as a graduate assistant. He also participated in independent research at Princeton with Ramin Takloo-Bighash, who has advised him since his first week on campus.

Next fall he will begin the mathematics Ph.D. program at Harvard University on a National Science Foundation Graduate Fellowship. He plans to study algebraic number theory. He is enthusiastic about teaching and has been active in tutoring since high school. Outside of math he is a dedicated New York Mets fan, enjoys theater and film, and once bowled a 162.

Response

I am very honored to be selected for the 2008 Morgan Prize. I would like to thank Mrs. Frank Morgan for endowing the award and the AMS, MAA, and SIAM for sponsoring it. I am very grateful to all of my advisers who have taught me what research is all about: Ramin Takloo-Bighash and Manjul Bhargava at Princeton, Scott Chapman at Trinity University, Allison Pacelli at Williams, and Joe Gallian at the University of Minnesota-Duluth. I owe a lot of thanks to the other students I worked with at summer REU programs and also to the students in my problem set groups at Princeton for helping me get the most out of my academic experiences. I would also like to thank my friends in Princeton, NYC, and elsewhere for giving me something to do when I needed a mathematical break. Most importantly, I must thank my parents for their love and support and for giving me so many opportunities to succeed.

2008 Cole Prize in Number Theory

The 2008 Frank Nelson Cole Prize in Number Theory was awarded at the 114th Annual Meeting of the AMS in San Diego in January 2008.

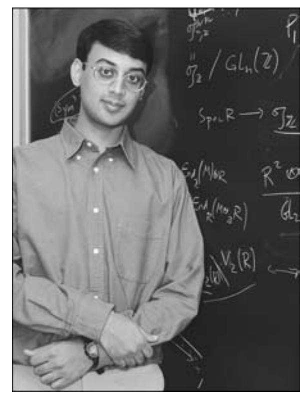
The Cole Prize in Number Theory is awarded every three years for a notable research memoir in number theory that has appeared during the previous five years. The awarding of this prize alternates with the awarding of the Cole Prize in Algebra, also given every three years. These prizes were established in 1928 to honor Frank Nelson Cole (1861–1926) 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 endowment was made by Cole, contributions from Society members, and his son, Charles A. Cole. The Cole Prize carries a cash award of US$5,000.

The Cole Prize in Number Theory is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2008 prize the members of the selection committee were: Nicholas M. Katz, Kenneth A. Ribet (chair), and Alice Silverberg.

Previous recipients of the Cole Prize in Number Theory are: H. S. Vandiver (1931), Claude Chevalley (1941), H. B. Mann (1946), Paul Erdős (1951), John T. Tate (1956), Kenkichi Iwasawa (1962), Bernard M. Dwork (1962), James B. Ax and Simon B. Kochen (1967), Wolfgang M. Schmidt (1972), Goro Shimura (1977), Robert P. Langlands (1982), Barry Mazur (1982), Dorian M. Goldfeld (1987), Benedict H. Gross and Don B. Zagier (1987), Karl Rubin (1992), Paul Vojta (1992), Andrew J. Wiles (1997), Henryk Iwaniec (2002), Richard Taylor (2002), and Peter Sarnak (2005).

The 2008 Cole Prize in Number Theory was awarded to Manjul Bhargava. The text that follows presents the selection committee's citation, a brief biographical sketch, and the awardee's response upon receiving the prize.

Citation



Manjul Bhargava

Professor Manjul Bhargava of Princeton University is cited for his revolutionary work on higher composition laws. His series of articles on this subject introduced completely new and unexpected ideas into a subject that began with work of Carl Friedrich Gauss in 1801.

At that time, Gauss anticipated the modern theory of abelian groups by constructing a law of composition on the set of equivalence classes of binary quadratic forms of given discriminant. By the end of the nineteenth century, the fundamental concept of an abstract group allowed one to view the system of equivalence classes of binary quadratic forms of given discriminant as the "ideal class group" of a quadratic field. Once this recasting of Gauss's work became established, Gauss's "law of composition" became something of a curiosity—evidence of how a brilliant mathematician can uncover a fundamental phenomenon even without the right tools to think about it.

Bhargava's original and surprising contribution is the discovery of laws of composition on forms of higher degree. His techniques and insights into this question are dazzling; even in the case considered by Gauss, they lead to a new and clearer presentation of that theory. If Bhargava had stopped with this discovery, his work would already be quite remarkable. But Bhargava has gone on to use his composition laws to solve a new case of one of the fundamental questions of number theory, that of asymptotic enumeration of number fields of given degree as the discriminant grows. The question is trivial for degree 1, and the quadratic case was solved by Gauss's work. Davenport and Heilbronn treated the cubic case in 1971. Bhargava used his new composition laws to solve the degree 4 case, brilliantly overcoming very serious analytic problems that had completely blocked all previous work on the problem.

Biographical Sketch

Manjul Bhargava was born in Hamilton, Ontario, Canada, but spent most of his early years in Long Island, New York. He received his A.B. in mathematics summa cum laude from Harvard University in 1996 and his Ph.D. from Princeton University in 2001. After holding visiting positions at the Mathematical Sciences Research Institute in Berkeley, the Institute for Advanced Study in Princeton, and Harvard University, he joined the faculty at Princeton University as professor of mathematics in 2003. He was also named the Clay Mathematics Institute's first Five-Year Long-Term Prize Fellow in 2001. An accomplished tabla player whose research interests span number theory, combinatorics, and representation theory, Bhargava has received numerous awards and honors, including the Hoopes Prize for Excellence in Scholarly Work and Research from Harvard University (1996), the AMS-MAA-SIAM Frank and Brennie Morgan Prize for Outstanding Undergraduate Research in Mathematics (1997), the MAA Merten M. Hasse Prize for Exposition (2003), the Packard Foundation Fellowship in Science and Engineering (2004), the Clay Research Award (2005), the SASTRA Ramanujan Prize (2005), and the Blumenthal Award for the Advancement of Research in Pure Mathematics (2005). He has been a three-time recipient of the Derek Bok Award for Excellence in Teaching and was named one of *Popular Science* magazine's "Brilliant 10" in 2002. Bhargava was an invited speaker at the International Congress of Mathematicians in Madrid in 2006 and has given numerous other invited addresses, colloquia, seminars, and public lectures at colleges and universities across North America and Europe.

Response

I am very grateful and honored to be the recipient of the 2008 Cole Prize. During the past few years I have had the good fortune of interacting with many wonderful mathematicians (both faculty and students) whose friendship and wisdom have been a constant source of inspiration for me. I would like to thank them all. In particular, I wish to express my deep gratitude to my graduate school teachers, Andrew Wiles, Peter Sarnak, and John Conway; and my undergraduate teachers and mentors, Dick Gross, Barry Mazur, Persi Diaconis, Joe Gallian, and Dave Cargo, from whom I have learned (and continue to learn!) so much and by whom I have been constantly inspired. I am also extremely grateful to Hendrik Lenstra and Don Zagier for their kindness and generosity and for always being available to discuss interesting mathematics!

I thank the Department of Mathematics at Princeton University for providing me with a wonderful work environment and the Clay Mathematics Institute and the Packard Foundation for funding my work.

The papers cited above build on ideas that go way back, starting with the mathematical works of Brahmagupta, Gauss, Dirichlet, Eisenstein, and Dedekind and leading up to the works of modern mathematicians such as Delone-Faddeev, Davenport-Heilbronn, Sato-Kimura, Wright-Yukie, and Gan-Gross-Savin. I gratefully acknowledge my indebtedness to all these mathematicians!

Perhaps I should also take this opportunity to thank here Erno Rubik for making his cube!

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

2008 Bôcher Prize

The 2008 Maxime Bôcher Memorial Prize was awarded at the 114th Annual Meeting of the AMS in San Diego in January 2008.

Established in 1923, the prize honors the memory of Maxime Bôcher (1867–1918), who was the Society's second Colloquium Lecturer in 1896 and who served as AMS president during 1909–1910. Bôcher was also one of the founding editors of *Transactions of the AMS*. The original endowment was contributed by members of the Society. The prize is awarded for a notable paper in analysis published during the preceding six years. To be eligible, the author should be a member of the AMS or the paper should have been published in a recognized North American journal. The prize is given every three years and carries a cash award of US$5,000.

The Bôcher Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2008 prize the members of the selection committee were: Peter S. Constantin, Tai-Ping Liu (chair), and Elias M. Stein.

Previous recipients of the Bôcher Prize are: G. D. Birkhoff (1923), E. T. Bell (1924), Solomon Lefschetz (1924), J. W. Alexander (1928), Marston Morse (1933), Norbert Wiener (1933), John von Neumann (1938), Jesse Douglas (1943), A. C. Schaeffer and D. C. Spencer (1948), Norman Levinson (1953), Louis Nirenberg (1959), Paul J. Cohen (1964), I. M. Singer (1969), Donald S. Ornstein (1974), Alberto P. Calderón (1979), Luis A. Caffarelli (1984), Richard B. Melrose (1984), Richard M. Schoen (1989), Leon Simon (1994), Demetrios Christodoulou (1999), Sergiu Klainerman (1999), Thomas Wolff (1999), Daniel Tataru (2002), Terence Tao (2002), Fanghua Lin (2002), and Frank Merle (2005).

The 2008 Bôcher Prize was awarded to Alberto Bressan, Charles Fefferman, and Carlos Kenig. The text that follows presents, for each awardee, the selection committee's citation, a brief biographical sketch, and the awardee's response upon receiving the prize.

Alberto Bressan

Citation

Alberto Bressan of Penn State University is awarded the Bôcher Prize for his fundamental works on hyperbolic conservation laws. Professor Bressan has made important contributions to the well-posedness theory; the results have been summarized in his monograph *Hyperbolic Systems of Conservation Laws. The One-Dimensional Cauchy Problem* (Oxford Lecture Series in Mathematics and Its Applications, 20, Oxford University Press, Oxford, 2000, xii + 250 pp.). Another landmark achievement is the work on zero dissipation limit (with Stefano Bianchini), "Vanishing viscosity solutions of nonlinear hyperbolic systems", *Ann. of Math. (2)* **161** (2005), no. 1, 223–342.

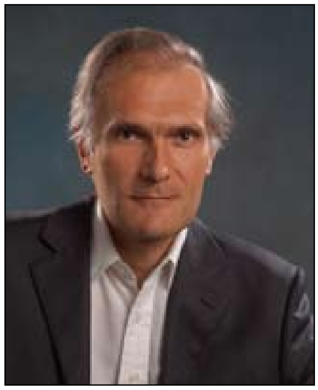
Biographical Sketch

Alberto Bressan was born in Venice, Italy. He completed his undergraduate studies at the University of Padova, Italy, and received a Ph.D. from the University of Colorado, Boulder, in 1982. He has held faculty positions at the University of Colorado and at the International School for Advanced Studies in Trieste, Italy. Presently he holds the Eberly Chair Professor of Mathematics at Pennsylvania State University. His scientific interests lie in the areas of differential inclusions, control theory, differential games, partial differential equations, and hyperbolic systems of conservation laws. He gave a plenary lecture at the International Congress of Mathematicians, Beijing, 2002. In 2006 he received the A. Feltrinelli Prize for Mathematics, Mechanics, and Applications from the Accademia Nazionale dei Lincei in Rome. Besides mathematics he enjoys playing piano and flute. He lives in State College, Pennsylvania, with his wife, Wen Shen, and two daughters, Luisa Mei and Maria Lan.

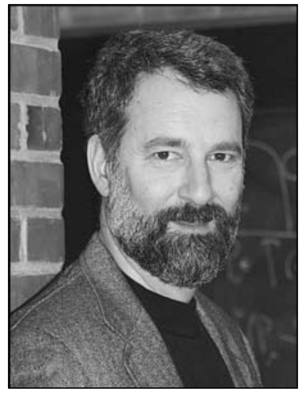
Response

It is a great honor for me to receive this prize. It was also a pleasant surprise to discover that my name is now listed among the 1,631 direct descendents of Maxime Bôcher listed in the Math Genealogy Project.

When I first became interested in hyperbolic conservation laws in the 1980s, my main training had been in other fields: parabolic equations, differential inclusions, and control theory. But as a fresh Ph.D. recipient, I was intrigued by the fact that something apparently so basic as the well-posedness of the equations for gas dynamics could have remained an open problem for so many years.



Alberto Bressan



Charles Fefferman

Carlos Kenig

The key estimates needed to establish continuous dependence of solutions were something I could figure out fairly quickly. However, it took me nearly ten years to fix details and achieve a rigorous proof in some significant cases. When I attended my first hyperbolic meeting in Stony Brook in 1994, I was still an outsider. Within the research community on hyperbolic problems I found very friendly and encouraging people. One can now say that the well-posedness for hyperbolic conservation laws in one space dimension has really been a cooperative accomplishment. In particular, the ideas contributed by Tai Ping Liu and Tong Yang have been instrumental in creating the polished theory we now have.

Understanding vanishing viscosity approximations was a second major challenge. This was achieved in 2001 in joint work with Stefano Bianchini at the International School for Advanced Studies in Trieste. Bianchini was the kind of student that you can call yourself fortunate if you find one in a lifetime. He took up my research program and contributed a new and fundamental idea: using the center manifold theorem to decompose a solution as local superposition of traveling waves. He also found the energy and determination to push his way through an incredible amount of computational details, eventually completing the proof.

In the end, all this is far beyond anything I could have hoped for when I first started reading about conservation laws and the Glimm scheme in Joel Smoller's book. I am delighted to receive this prize, and I thank the American Mathematical Society for the award.

Charles Fefferman

Citation

Charles Fefferman of Princeton University is awarded the Bôcher Prize for his many fundamental contributions to different areas of analysis, including his recent work on the Whitney extension problem. His important work in this area is contained in his papers "A sharp form of Whitney's extension theorem", *Annals of Math.* **161** (2005), 509–577, and "Whitney's extension problem for C^m", *Annals of Math.* **164** (2006), 313–359.

Biographical Sketch

Charles Fefferman was born in Washington, D.C., in 1949. He received his B.S. at the University of Maryland in 1966 and his Ph.D. at Princeton in 1969 under E. M. Stein. He taught at Princeton from 1969 to 1970, at the University of Chicago from 1970 to 1974, and again at Princeton since 1974. Fefferman has worked in classical Fourier analysis, partial differential equations, several complex variables, conformal geometry, quantum mechanics, fluid mechanics, and computational geometry. His honors include the Salem Prize, the Waterman Award, the Fields Medal, the Bergman Prize, and several honorary doctorates. He has served as chairman of the Princeton mathematics department and currently chairs the board of trustees of the Mathematical Sciences Research Institute in Berkeley. He is a member of the American Academy of Arts and Sciences, the National Academy of Sciences, and the American Philosophical Society.

Response

I am grateful for my selection for the Bôcher Prize and for the recognition of my work on Whitney's problem. That question and its close relatives have fascinated me for years. In solving them, I've had crucial help in the form of beautiful, highly original ideas due to several people. Let me mention especially G. Glaeser, who invented a key geometric construction; E. Bierstone, P. Milman, and W. Pawłucki, who discovered a general form of Glaeser's construction; and Y. Brudnyi and P. Shvartsman, who conjectured a basic finiteness principle and proved it in the first hard case.

It has been a joy to collaborate with Bo'az Klartag on the effective finite version of Whitney's problem, which I hope will one day connect to applied problems. Bo'az's brilliant ideas (he insists they are obvious) have gotten us out of many an impasse.

Most of all, I am grateful that I can share the pleasure of this occasion with my wife, Julie.

Carlos Kenig

Citation

Carlos Kenig of the University of Chicago is awarded the Bôcher Prize for his important contributions to harmonic analysis, partial differential equations, and in particular to nonlinear dispersive PDE. Kenig's work has been influential in the analysis of well-posedness under minimal regularity assumptions for physical equations. Examples of this work include his seminal paper with G. Ponce and L. Vega, "Well-posedness and scattering results for generalized Korteweg-de Vries equations via the contraction principle", *Comm. Pure Appl. Math.* **46** (1993), 527–620; his remarkable work with A. Ionescu, "Global well-posedness of the Benjamin-Ono equation in low regularity spaces", *J. Amer. Math. Soc.* **20** (2007), 3, 753–798; and his outstanding work with F. Merle, "Global well-posedness, scattering and blow-up for the energy critical focusing nonlinear wave equation", to appear, *Acta Math.*

Biographical Sketch

Carlos E. Kenig was born on November 25, 1953, in Buenos Aires, Argentina, where he received his early education. He obtained his Ph.D. at the University of Chicago in 1978 under the direction of Alberto Calderón. From 1978 to 1980 he was an instructor at Princeton University, after which he held positions at the University of Minnesota, becoming professor in 1983. In 1985 he returned to the University of Chicago, where he now is the Louis Block Distinguished Service Professor.

Kenig has been a recipient of Sloan and Guggenheim Fellowships. In 1984 he was awarded the Salem Prize. He was an invited speaker at the International Congress of Mathematicians in Berkeley (1986) and in Beijing (2002). Since 2002 he has been a fellow of the American Academy of Arts and Sciences.

Kenig's current research interests include boundary value problems under minimal regularity conditions, degenerate diffusions, free boundary problems, inverse problems, and nonlinear dispersive equations.

Response

It is a great honor to be a corecipient of this year's Bôcher Memorial Prize. I am grateful to the American Mathematical Society and to the selection committee for their recognition of my research. I would like to thank my family—my wife, Sarah, and my daughters, Lucy and Anna—for their love and support throughout the years. I would also like to thank my teachers, my many collaborators, and my students, all of whom have shared many insights with me. I am especially indebted to my long-time collaborators Gustavo Ponce and Luis Vega for more than twenty years (and still counting) of joint work, friendship, and shared fun.

There are many people who have influenced my mathematical career to whom I owe thanks, beginning with Alberto Calderón, my advisor, and Antoni Zygmund (both now deceased), who introduced me as a graduate student to the Calderón-Zygmund school of analysis. Eli Stein was my postdoctoral mentor, and I have greatly profited from many mathematical discussions with him and from his continued support and encouragement. The late Gene Fabes introduced me to research in partial differential equations; he was my mentor, collaborator, and dear friend. I continue to miss him. I am also particularly indebted to David Jerison and to the late Björn Dahlberg for their influence on me early on in my career. The three papers cited by the selection committee are joint works. I am very thankful to Gustavo Ponce, Luis Vega, Alex Ionescu, and Frank Merle, my coauthors in the cited papers, for their fundamental contributions to these joint works, without which these projects could not have been carried out. Finally, I would like to thank the University of Chicago, my home institution for more than twenty years, for providing me with the excellent working conditions in which my research is carried out.

The use of harmonic analysis techniques in the study of nonlinear dispersive equations was pioneered in works of I. Sigal, R. Strichartz, J. Ginibre-G. Velo, and T. Kato. In the late 1980s in joint work with Ponce and Vega, we introduced the use of the machinery of modern harmonic analysis for the study of nonlinear dispersive equations with derivatives in the nonlinearity. We showed for the first time that the initial value problem for the generalized Korteweg-de Vries equation with data in Sobolev spaces can be solved by the contraction mapping principle. In doing so, we obtained results that (for many powers in the nonlinearity) turned out to give the minimal regularity assumptions on the data for which this can be done. This was not the case with our first results for the quadratic nonlinearity in the KdV equation. Here, fundamental work of J. Bourgain (1993) expanded the functional framework for the use of the contraction mapping principle in this setting. This eventually led, in joint work with Ponce and Vega (1996), to the minimal regularity result for this case too. The resulting body of techniques (with refinements and extensions by many authors) has proved extremely powerful in many problems and settings and has attracted the attention of a large community of researchers.

In recent years I have been interested in some natural equations for which there is an exact balance between the smoothing properties of the linear part and the strength of the nonlinearity, which precludes the direct application of the techniques described before. The Benjamin-Ono equation is one such model. For this equation, examples of Molinet-Saut-Tzvetkov (2001) show that it is not possible to use the contraction mapping principle on any Sobolev space. After an important contribution by Tao (2004), who introduced a gauge transform into the problem (with a further extension by Burq-Planchon (2005) simultaneous to our work), Ionescu and I were able to obtain the conjectured global well-posedness for data of finite mass. This was achieved by combining the gauge transform of Tao with some new function spaces inspired by earlier work of Tataru in the wave map problem. These new functional structures have since proved useful for Schrödinger maps in joint works with Ionescu and with Bejenaru and Ionescu.

Lately there has been considerable interest in the study (for nonlinear dispersive and wave equations) of the long-time behavior of solutions. Issues like blow-up, global existence, and scattering have come to the forefront, especially in critical problems. The case of the energy critical, defocusing nonlinear wave equation was studied in pioneering works of many researchers in the 1980s and 1990s. (For instance M. Struwe (radial case), M. Grillakis (general case), J. Shatah-M. Struwe, H. Bahouri-J. Shatah, H. Bahouri-P. Gerard, and others.) These works show that for general data in the energy space we have global existence and scattering. Corresponding results for the energy critical, defocusing nonlinear Schrödinger equations were obtained in groundbreaking works of Bourgain (radial case, 1998), Colliander-Keel-Staffilani-Takaoka-Tao (general three-dimensional case), with higher-dimensional extensions due to Ryckman-Visan and to Visan (2005). For the corresponding focusing problems, say in the case of the wave equation, H. Levine (1974) had shown that blow-up in finite time can occur. Moreover, there is a stationary solution W (which solves the corresponding elliptic problem and plays an important role in the Yamabe problem). For this solution, scattering obviously does not occur. In a series of joint works with Merle, partly inspired by the elliptic case and also by works of Merle and Martel-Merle in mass critical problems, we have developed an approach to critical dispersive problems that applies to defocusing and for the first time also to focusing problems. The approach goes through a concentrated compactness procedure that reduces matters to a rigidity theorem. For instance, for the case of the energy critical focusing nonlinear wave equation, we show that the energy of W is a threshold. For data of energy smaller than that of W, if the critical Sobolev norm is smaller than the one of W, we have global existence and scattering; while if it is bigger, there is finite time blow-up.

There are many natural directions for future research in the areas just described. I look forward to continued research in them. I thank the selection committee once more for honoring these lines of research.

2008 Doob Prize

The 2008 Joseph Doob Prize was awarded at the 114th Annual Meeting of the AMS in San Diego in January 2008.

This prize was established by the AMS in 2003 and endowed in 2005 by Paul and Virginia Halmos in honor of Joseph L. Doob (1910–2004). Paul Halmos (1916–2006) was Doob's first Ph.D student. Doob received his Ph.D. from Harvard in 1932 and three years later joined the faculty at the University of Illinois, where he remained until his retirement in 1978. He worked in probability theory and measure theory, served as AMS president in 1963–1964, and received the Steele Prize in 1984. The Doob Prize recognizes a single, relatively recent, outstanding research book that makes a seminal contribution to the research literature, reflects the highest standards of research exposition, and promises to have a deep and long-term impact in its area. The book must have been published within the six calendar years preceding the year in which it is nominated. Books may be nominated by members of the Society, by members of the selection committee, by members of AMS editorial committees, or by publishers. The prize of US$5,000 is given every three years.

The Doob Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2008 prize, the members of the selection committee were Andrew Granville, Robin Hartshorne, Steven G. Krantz, Dale P. Rolfsen (chair), and Bhama Srinivasan.

The previous recipient of the Doob Prize is William P. Thurston.

The 2008 Doob Prize was awarded to Enrico Bombieri and Walter Gubler. The text that follows presents the selection committee's citation and, for each awardee, a brief biographical sketch and the awardee's response upon receiving the prize.

Citation

Heights in Diophantine Geometry, by Enrico Bombieri and Walter Gubler (Cambridge University Press, 2006).

The book is a research monograph on all aspects of Diophantine geometry, both from the perspective of arithmetic geometry and of transcendental number theory. The key emphasis is on the (delicate) theory of heights, which is developed with extraordinary precision and elegance.

The choice of subjects is broad and gives the sense of a powerful body of ideas. The great results of arithmetic geometry, the theorems of Mordell-Weil, Roth, Siegel, and Faltings, are all proved with a consistent, remarkably accessible point of view. The book also develops the extraordinary work of Zhang and others on the Bogomolov conjecture, puts forward an elegant approach to Hilbert irreducibility, and includes a detailed discussion of the Nevanlinna-Vojta theory. There is a lovely exposition of the important theory of unit equations and a most brilliant discussion of the Subspace Theorem of Schmidt and Schlickewei, as well as the possibilities afforded by the abc-conjecture and further developments along these lines.

Enrico Bombieri

Walter Gubler

The book is self-contained, yet surprisingly accessible given the depth of the material. Links between classical Diophantine arithmetic and modern arithmetic geometry are emphasized throughout the text in an appealing way. There are well-constructed appendices on key technical issues such as basic algebraic geometry, algebraic ramification theory, and the geometry of numbers (a subject which is going through a revival at the moment).

One gets the sense that every lemma, every theorem, every remark has been carefully considered, and every proof has been thought through in every detail. There are well-chosen illuminating examples throughout every chapter. The book is a masterpiece in terms of its original approach, its unrivaled comprehensiveness, and the sheer elegance of the exposition. There can be no doubt that this book will become the basis for the future development of this central subject of modern mathematics.

Biographical Sketch: Enrico Bombieri

Enrico Bombieri was born in Milan, Italy, in 1940. He started studying mathematics, and in particular number theory, at an early age with Giovanni Ricci. He graduated from the University of Milan in 1963 and became assistant professor there immediately after. He spent the next year in Cambridge, England, working with Davenport and Swinnerton-Dyer, studying geometry over finite fields and the distribution of prime numbers. He became a full professor in 1965, with his first appointment at the University of Cagliari and in 1966 at the University of Pisa. In 1975 he moved to the Scuola Normale Superiore in Pisa and in 1977 joined the School of Mathematics of the Institute for Advanced Study in Princeton as a full professor. He became a U.S. citizen in 1994.

He was elected a member of the U.S. National Academy of Sciences in 1965 and of the Accademia Nazionale dei Lincei, Italy, in 1976; fellow of the American Academy of Arts and Sciences in 1979; foreign member of the Institut de France, Académie des Sciences in 1984; foreign member of the Royal Swedish Academy of Sciences in 1982; honorary member of the London Mathematical Society in 1977; Chevalier de l'Ordre des Palmes Académiques, France, in 1993; Doctor Honoris Causa, University of Pisa, in 2001; and Cavaliere di Gran Croce al Merito della Repubblica, Italy, in 2002. He received the Fields Medal at the International Congress of Mathematicians in 1974 in Vancouver, the Feltrinelli Prize in 1976, and the Balzan Prize in 1980. His first studies in number theory were with Giovanni Ricci and Davenport and in algebraic geometry with Swinnerton-Dyer and Aldo Andreotti. During his tenure in Pisa he was initiated into the theory of partial differential equations and minimal surfaces by Guido Stampacchia and Ennio De Giorgi.

His main interests in number theory are prime number theory, zeta functions, Diophantine geometry, and Diophantine approximation; in analysis, complex function theory in one and several variables, minimal surfaces, and geometric measure theory; in algebraic geometry, geometry over finite fields, arithmetic geometry, and classification problems.

He is the author of two short monographs, a comprehensive monograph (with Walter Gubler) on the theory of heights in Diophantine geometry, and over 160 research papers published in leading mathematical journals. After mathematics his main activities are painting and drawing.

Response: Enrico Bombieri

It is indeed a great surprise for me, and certainly a great honor, to receive the Doob Prize for my book with Walter Gubler on the theory of heights in Diophantine geometry. The origin of this book goes back to 1992 after I found a simplification of Vojta's landmark new proof of the Mordell conjecture. I had been invited to give a series of lectures to graduate students and young researchers in Pisa, and I thought it appropriate to give a short course on Diophantine geometry, culminating with the proof of the Mordell conjecture. This course was well received, so when a little later I was asked by Wüstholz to give a *Nachdiplom* course to students at the ETH in Zürich, we quickly agreed that the same topic would be fine. There was a little condition, namely, to develop all the material from scratch. Walter Gubler, who was then just finishing his Ph.D. thesis with Professor Wüstholz, was given the job of taking notes in the best old-fashioned European style.

To my great surprise, Walter's notes were absolutely superb: well organized, clearly written, amplified in places, and correcting the inaccuracies and mistakes I had made during my lectures. They formed an excellent basis for an introductory course, so it was decided to expand them to book form. Walter collaborated enthusiastically in the writing, and after a short while when the rough notes expanded well beyond the initial text in order to include more and more foundational material as well as complements to the main theory, he became a coauthor. The unifying theme would be the theory of heights and its application to Diophantine geometry on commutative groups.

Without Walter, this book could not have been written.

It was a long task to write up and organize the material, and in the meantime the subject itself kept growing and we had to play a catch-up game. So it took almost twelve years to write and revise the book. It was not the first one on the subject, and there were already several other excellent monographs where one could learn the subject. So why one more book? For me, writing this book was like preparing carefully a series of lectures to bright students, and I received a lot of satisfaction doing it. Now it is time for it to go out and establish its little place in the mathematical world, with the hope that it will be well received and prove itself to be useful to young mathematicians entering the beautiful subject of Diophantine geometry and arithmetic geometry.

Biographical Sketch: Walter Gubler

Walter Gubler was born October 30, 1965, in Olten, Switzerland. He received his diploma in mathematics at the Eidgenössisches Technische Hochschule Zürich in 1989. At the same place, he earned his Ph.D. in 1992 under Gisbert Wüstholz. For his thesis, *Heights of subvarieties*, he won the silver medal of the ETH. From 1992 to 1993 he visited the Institute for Advanced Study in Princeton. Then he held postdoc positions at the ETH Zürich and at the Humboldt University in Berlin. In 2003 Walter Gubler received the *venia legendi* at the ETH for his habilitation thesis. From 2003 to 2007 he was a lecturer at the University of Dortmund. Currently he is BMS substitute professor at the Humboldt University in Berlin.

Response: Walter Gubler

It is an honour for me to receive the Doob Prize 2008 together with my coauthor, Enrico Bombieri. Our book project started with a lecture by Enrico at the ETH Zürich. I had not anticipated that we would have to invest more than ten years of hard work to finish this book. On the one hand, new results came from research, and on the other hand, a lot of efforts were necessary to make the book self-contained. From my point of view, the time was well invested, as I learned so much about the subject and it was great fun to work with Enrico. I wish to thank him for giving me the opportunity to collaborate. I am very gratified to receive this prize for all the effort. Thank you.

2008 Eisenbud Prize

The 2008 Leonard Eisenbud Prize for Mathematics and Physics was awarded at the 114th Annual Meeting of the AMS in San Diego in January 2008.

The Eisenbud Prize was established in 2006 in memory of the mathematical physicist Leonard Eisenbud (1913–2004) by his son and daughter-in-law, David and Monika Eisenbud. Leonard Eisenbud, who was a student of Eugene Wigner, was particularly known for the book *Nuclear Structure* (1958), which he coauthored with Wigner. A friend of Paul Erdős, he once threatened to write a dictionary of "English to Erdős and Erdős to English". He was one of the founders of the physics department at the State University of New York, Stony Brook, where he taught from 1957 until his retirement in 1983. His son David was president of the American Mathematical Society in 2003–2004. The Eisenbud Prize for Mathematics and Physics honors a work or group of works that brings the two fields closer together. Thus, for example, the prize might be given for a contribution to mathematics inspired by modern developments in physics or for the development of a physical theory exploiting modern mathematics in a novel way. The US$5,000 prize will be awarded every three years for a work published in the preceding six years. This is the first time the prize has been awarded.

The Eisenbud Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2008 prize, the members of the selection committee were Joel L. Lebowitz, David R. Morrison (chair), and Edward Witten.

The 2008 Eisenbud Prize was awarded to Hirosi Ooguri, Andrew Strominger, and Cumrun Vafa. The text that follows presents the selection committee's citation, brief biographical sketches of the awardees, and their responses upon receiving the prize.

Citation

The Eisenbud Prize for 2008 is awarded to Hirosi Ooguri, Andrew Strominger, and Cumrun Vafa for their paper "Black hole attractors and the topological string" (*Physical Review D (3)* **70** (2004), 106007). This paper contains a beautiful and highly unexpected proposal: that the counting of black hole states, in certain string theories obtained by compactification on a Calabi-Yau manifold X, can be expressed in terms of the topological string partition function of X (i.e., in terms of the so-called Gromov-Witten invariants of X). The proposal explains some mysterious earlier results to the effect that certain scattering amplitudes in physical string theory can be expressed in terms of the topological string; the authors here argue that these amplitudes control the counting of microscopic states of certain electrically and magnetically charged black holes. Black holes and enumerative invariants such as Gromov-Witten invariants are both intensively studied but had not been significantly related to each other prior to this work.

Biographical Sketch: Hirosi Ooguri

Hirosi Ooguri was born on March 13, 1962, in Japan. He attended Gifu High School, whose notable alumni include Teiji Takagi, who developed class field theory. Ooguri received a B.A. in 1984 and an M.S. in 1986 from Kyoto University.

In 1986 Ooguri became an assistant professor at the University of Tokyo. After a year at the Institute for Advanced Study in Princeton, he moved to the University of Chicago as an assistant professor in 1989. In the same year he was awarded an Sc.D. from the University of Tokyo. A year later he returned to Japan as an associate professor at the Research Institute for Mathematical Sciences in Kyoto University. In 1994 he became a professor at the University of California at Berkeley and was appointed a faculty senior scientist at the Lawrence Berkeley National Laboratory in 1996. Since 2000 he has been at Caltech, where he is now Fred Kavli Professor of Theoretical Physics.

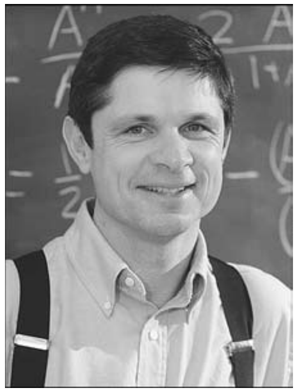
In 2007 Ooguri and his friends in Japan proposed establishing the Institute for the Physics and Mathematics of the Universe at the University of Tokyo. The proposal was approved with funding for two hundred staff scientists and visitors for the next ten years. Ooguri will continue to keep his intellectual base at Caltech, but he will spend a few months a year in Tokyo as a principal investigator at the new institute to lead activities at the interface of mathematics and physics.

Response: Hirosi Ooguri

I am deeply honored to share the Leonard Eisenbud Prize for Mathematics and Physics with such outstanding physicists as Andy Strominger and Cumrun Vafa.

In an early stage of my career I had the good fortune to work with Tohru Eguchi in Tokyo and to experience the power of quantum field theory in revealing new connections between different areas of mathematics. I have collaborated with Cumrun Vafa for over eighteen years on various aspects of gauge theory and string theory, including $N = 2$

Hirosi Ooguri



Andrew Strominger

Cumrun Vafa

string theory, topological string theory, gauge theories on D-branes, and their geometric engineering. Our collaborations have almost always aimed to discover hidden geometric structures in physical problems and to exploit them to develop new theoretical tools. Cumrun brims over with ideas that he has generously shared with me and many others. I thank him for the collaboration and friendship. I have always admired Andy Strominger for his creative insights, and I am happy to have had the chance to collaborate with both Andy and Cumrun in the academic year of 2003–2004, which led to the paper cited above. In this work we formulated a conjecture that relates two different concepts: topological string theory, which computes the Gromov-Witten invariants, and the counting of quantum states of black holes, which has to do with topological invariants of gauge theories in various dimensions. I would like to make a brief comment on each of them.

Topological string theory was introduced by Edward Witten. The construction of mirror pairs of Calabi-Yau manifolds by Brian Greene and Ronen Plesser and their application to the computation of the genus-zero Gromov-Witten invariants by Philip Candelas, Xenia De La Ossa, Paul Green, and Linda Parkes sparked interest in the mathematics community. I spent the academic year of 1991–1992 at Harvard University and collaborated with Michael Bershadsky, Sergio Cecotti, and Cumrun Vafa to generalize their results to higher genus. We found that the higher genus topological string partition functions can be used to compute certain scattering amplitudes in superstring theory compactified on a Calabi-Yau manifold. It took another twelve years to find the compelling question in physics, i.e., the counting of quantum states of black holes, to which these amplitudes give an answer. We also derived the holomorphic anomaly equations for the topological string partition functions and developed a method to solve them recursively in the genus. In this work we made several mathematical conjectures. Recently, the conjecture on the genus-one Gromov-Witten invariants for a quintic threefold was proven by Aleksey Zinger, and the conjecture on the so-called BCOV torsion for the mirror of the quintic was proven by Hao Fang, Zhiqin Lu, and Ken-ichi Yoshikawa. The conjectures for genus greater than one remain open.

The black hole entropy formula was proposed by Jacob Bekenstein and Stephen Hawking based on a remarkable mathematical analogy between thermodynamics and black hole mechanics and on the semiclassical theory of black hole radiance. It was expected that if there is a theory that successfully unifies quantum mechanics and general relativity, in such a theory the Bekenstein-Hawking formula can be derived as the statistical entropy of quantum states of black holes. Thanks to the D-brane construction by Joseph Polchinski for a certain class of black holes in string theory, it has become possible to count quantum states by evaluating topological invariants of gauge theory on D-branes, such as the Euler characteristic of instanton moduli space. The counting was carried out by Strominger and Vafa in 1996, and they found a perfect agreement with the Bekenstein-Hawking formula in the limit of large black holes, for which the approximation used by Bekenstein and Hawking becomes precise. Our paper cited above showed that this approximation can be significantly improved by using topological string theory. I was surprised and delighted to find the application of topological string theory to the counting of quantum states of black holes. This reaffirmed my belief that exact results in quantum field theory and string theory have enduring value and unintended applications.

When I was a high school student, physics was my least favorite subject until I learned calculus. Clearly, physicists need mathematics to formulate fundamental laws of nature. In return, physicists' search for fundamental laws has inspired many important developments in mathematics. In the past couple of decades interactions of mathematicians and physicists have been particularly intense and productive in the area involving quantum field theory and string theory. Since neither of them has a proper definition, mathematicians often view them as black boxes from which interesting conjectures materialize. I think that collaborations of mathematicians and physicists can be elevated to an even higher level if these physical theories are placed on more solid mathematical foundations.

I would like to thank Andy Strominger and Cumrun Vafa for the wonderful collaboration. Topological string theory has been developed by many people. In particular, I would like to acknowledge the influence of the earlier work by Gabriel Lopes Cardoso, Bernard de Wit, and Thomas Mohaupt.

I would like to thank the American Mathematical Society and the Eisenbud Prize Committee for recognizing the progress in this line of research. I am grateful to my teachers, collaborators, and friends for helping me make contributions to this area. Finally, I would like to thank my wife, Kyoko, for her love and support and my daughter, Tomoko, for adding extra dimensions to my life.

Biographical Sketch: Andrew Strominger

Andrew Strominger, the son of biochemist Jack Strominger, is an American theoretical physicist whose research centers around string theory. He is currently a professor at Harvard University, cofounder of the Center for the Fundamental Laws of Nature at Harvard, and a senior fellow at the Society of Fellows. He received his undergraduate degree from Harvard University in 1977 and his Ph.D. from the Massachusetts Institute of Technology in 1982 under the supervision of Roman Jackiw. His wide and varied contributions to physics include:

- a paper with Cumrun Vafa that explains the microscopic origin of the black hole entropy, originally calculated thermodynamically by Stephen Hawking and Jacob Bekenstein from string theory;
- a paper with Philip Candelas, Gary Horowitz, and Edward Witten about the relevance of Calabi-Yau manifolds for obtaining the Standard Model from string theory;
- other articles discussing the dS/CFT correspondence (a variation of AdS/CFT correspondence), S-branes (a variation of D-branes), and OM-theory (with Shiraz Minwalla and Nathan Seiberg);
- research on massless black holes in the form of wrapped D3-branes that regulate the physics of a conifold and allow topology change interpretation of mirror symmetry as a special case of T-duality (with Eric Zaslow and Shing-Tung Yau).

The fundamental laws of nature as we currently understand them are both incomplete and contradictory. Unsolved problems concerning these laws include the incompatibility of quantum mechanics and Einstein's theory of gravity, the origin of the universe, and the origin of the masses of the elementary particles. Strominger's research has concerned various aspects of these problems. The emergence of string theory as the most promising approach to these problems began with Strominger's 1985 codiscovery of so-called Calabi-Yau compactifications. This construction demonstrated that string theory not only reconciles quantum mechanics and gravity but can also contain within it electrons, protons, photons, and all the other observed particles and forces and hence is a viable candidate for a complete unified theory of nature. In 1991 Strominger codiscovered the brane solutions of string theory, which have played a crucial role in unraveling the beautiful mathematical structure and duality symmetries of the theory. The branes were eventually used by Strominger and collaborators to give a microscopic explanation of how black holes are able to store information, finally resolving a deep paradox uncovered by Hawking and Bekenstein a quarter century earlier. He and coworkers also used the branes to derive new relations in algebraic geometry, equating the moduli space of a brane in a Calabi-Yau space to the mirror Calabi-Yau. Preliminary attempts have been made to apply these insights to cosmology. Current research continues attempts to better understand the fundamental laws of nature.

Response: Andrew Strominger

I am greatly honored to receive, along with my collaborators Cumrun Vafa and Hirosi Ooguri, the first Leonard Eisenbud Prize of the American Mathematical Society for our work demonstrating a connection between Gromov-Witten invariants and microstate degeneracies of black hole attractors. Our success in discovering this connection relied on the uncanny ability of physical reasoning to lead to insights into pure mathematics.

Biographical Sketch: Cumrun Vafa

Cumrun Vafa is a Donner Professor of Science at Harvard University, where he teaches and does research on theoretical physics.

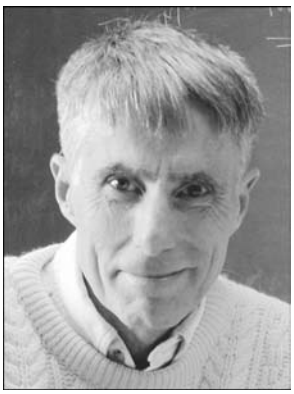
Vafa was born in Tehran, Iran, in 1960 and came to the U.S. for continuation of his education in 1977. He earned his B.S. in mathematics and physics from the Massachusetts Institute of Technology in 1981. He went on to earn his Ph.D. in physics from Princeton University in 1985 under the supervision of Edward Witten. He came to Harvard University in 1985 as a junior fellow of the Harvard Society of Fellows and has been on the Harvard faculty since 1988. He is married to Afarin Sadr, and they are the proud parents of three sons: Farzan, Keyon, and Neekon.

Response: Cumrun Vafa

It is a great pleasure to receive the 2008 Leonard Eisenbud Prize, together with my collaborators. I view this not only as an acknowledgment of a single paper but also as an appreciation of the work of so many physicists and mathematicians that led to this work. With the intrinsic beauty of the connection between mathematics and physics and with so many talented researchers, I hope to witness the continuing development of this remarkable area of science.

I am greatly indebted for the support I have received from my family and my parents, as well as my teachers over the years.

2008 Award for Distinguished Public Service



Herbert Clemens

The 2008 Award for Distinguished Public Service was presented at the 114th Annual Meeting of the AMS in San Diego in January 2008.

The Award for Distinguished Public Service is presented every two years to a research mathematician who has made a distinguished contribution to the mathematics profession during the preceding five years. The purpose of the award is to encourage and recognize those individuals who contribute their time to public service activities in support of mathematics. The award carries a cash prize of US$4,000.

The Award for Distinguished Public Service is made by the AMS Council acting on the recommendation of a selection committee. For the 2008 award the members of the selection committee were: William J. Lewis, Carolyn R. Mahoney, Paul J. Sally (chair), Richard A. Tapia, and Margaret H. Wright.

Previous recipients of the award are: Kenneth M. Hoffman (1990), Harvey B. Keynes (1992), I. M. Singer (1993), D. J. Lewis (1995), Kenneth C. Millett (1998), Paul J. Sally Jr. (2000), Margaret H. Wright (2002), Richard A. Tapia (2004), and Roger Howe (2006).

The 2008 Award for Distinguished Public Service was presented to Herbert Clemens. The text that follows presents the selection committee's citation, a brief biographical sketch, and the recipient's response upon receiving the award.

Citation

The American Mathematical Society's Distinguished Public Service Award for 2008 is awarded to Herbert Clemens for his superb research in complex algebraic geometry, for his continuing efforts in education, beginning with his days at Columbia University and his work with teachers in Chile to his teaching and collaborating with teachers in the Salt Lake City public schools and his influence in mathematics education at the national level; and, in addition, for his seminal role in the founding and continuation of the Park City/IAS Mathematics Institute.

Biographical Sketch

Herbert Clemens earned his Ph.D. in 1966 from the University of California, Berkeley, under the direction of Phillip A. Griffiths. He has taught at Columbia University, the University of Utah, and the Ohio State University, where he has been on the faculty since 2002. He has served as director of the NSF Regional Geometry Institute, Park City, UT, and chair of the Steering Committee for the IAS Park City Mathematics Institute. He was an invited speaker at the International Congress of Mathematicians in 1974 and in 1986. His academic honors include a Silver Medal from the Italian Mathematical Society and a Laurea de honoris causa from the Universita di Torino, among others. His research area is complex geometry.

Response

I feel very honored to receive the 2008 Award for Distinguished Public Service from the American Mathematical Society and regret that I am unable to be present in person to receive the award. I accept the award in the name of the hundreds of AMS members engaged in professional outreach, which, though often viewed to lie at the margins of our calling as mathematicians, is vital to the long-term sustainability of our discipline, especially as pertains to the discipline's continued support by society at large.

More particularly and currently, I accept this award as recognizing the more than forty AMS members offering their services for university lecturing in Cambodia, as recognizing an equivalent number working with African mathematicians through the International Mathematical Union, and finally as recognizing the countless AMS members currently working in cooperation with the education community to improve pre-university mathematics education in our country's schools.

Mathematics People

Awards Presented at 2007 ICCM

At each International Congress of Chinese Mathematicians (ICCM), the winners of several prestigious awards are announced during the opening ceremony. These awards include the Morningside Medal of Mathematics, the Chern Prize in Mathematics, and the ICCM International Cooperation Award. The Fourth ICCM was held in Hangzhou, China, December 17–22, 2007. At ICCM 2007, two new prizes were introduced: the New World Mathematics Awards and the S. T. Yau Mathematics Awards.

The Morningside Medal of Mathematics is awarded to exceptional mathematicians of Chinese descent under the age of forty-five for their seminal achievements in mathematics and applied mathematics. The winners of the Morningside Medal of Mathematics are traditionally announced at the ICCM. The inaugural medals were presented in 1998. Each Morningside Medalist receives a certificate and medal, as well as a cash award of US$25,000 for a gold medal or US$10,000 for a silver medal.

The 2007 Morningside Gold Medal of Mathematics is awarded to Jianqing Fan, Princeton University, and Xujia Wang, Australian National University. The 2007 Morningside Silver Medal of Mathematics is awarded to Chiu-Chu Liu, Northwestern University and Columbia University; Lizhen Ji, University of Michigan and Zhejiang University; Shi Jin, University of Wisconsin at Madison; Chiun-Chuan Chen, Taiwan University; and Ye Tian, Morningside Center of Mathematics at the Chinese Academy of Sciences.

The Chern Prize in Mathematics was established in 2001 in honor of Shing-Shen Chern, one of the greatest geometers and Chinese mathematicians of the twentieth century. The Chern Prize is presented every three years at the ICCM to mathematicians of Chinese descent who have made exceptional contributions to mathematical research or to public service activities in support of mathematics. The 2007 Chern Prize is awarded to Shiu-Yuen Cheng, Hong Kong University of Science and Technology, and Mu-Tao Wang, Columbia University.

The ICCM International Cooperation Award is presented to an individual who has promoted the development of mathematics in China, Hong Kong, and Taiwan through collaboration, teaching, and support of Chinese mathematicians. The inaugural award was presented in 2004. The 2007 ICCM International Cooperation Award is awarded to Stanley Osher, University of California at Los Angeles.

Supported by the New World Development Company Ltd., the New World Mathematics Awards recognize outstanding doctoral, master's, and undergraduate theses written by mathematicians of Chinese descent who have graduated from universities and institutes in the past three years. The purpose is to provide encouragement to talented Chinese mathematicians and to promote creativity and innovation in mathematics. Six Ph.D. Thesis Awards, five Master Thesis Awards, and ten Bachelor Thesis Awards were presented at the 2007 ICCM.

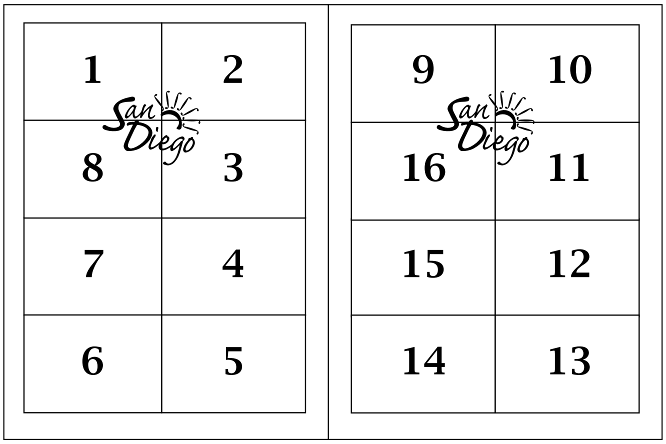
Coorganized by the International Congress of Chinese Mathematicians and the Taikang Life Insurance Company Ltd., the S. T. Yau Mathematics Awards recognize excellence in mathematics research projects among high school students of Chinese descent throughout the world. The goal is to identify gifted mathematicians at a young age and foster their interest in this field of study. A press briefing marking the establishment of the awards was held in December 2007. The first awards will be presented in October 2008 in Beijing.

—From an ICCM announcement

Deloro and Moczydlowski Awarded ASL Sacks Prize

Adrien Deloro of Rutgers University and Wojciech Moczydlowski of Cornell University have been awarded the 2007 Sacks Prizes of the Association for Symbolic Logic

2008 San Diego Joint Mathematics Meetings Photo Key



Page 476 (left), clockwise from Number 1. Page 477 (right), clockwise from Number 9:

1. Welcome!
2. David Eisenbud (right) presenting the 2008 Eisenbud Prize to Cumrun Vafa.
3. 3-D sculptures in the mathematical art exhibit.
4. In the Networking Center.
5. Message Board area in the San Diego Convention Center.
6. AMS Colloquium speaker Wendelin Werner.
7. Entrance to the Employment Center.
8. AMS-MAA Joint Invited Address speaker Terence Tao.
9. Opening ceremony ribbon cutting for the JMM Exhibits area (left to right: AMS executive director John Ewing, MAA president Joseph Gallian, AMS president James Glimm, MAA associate secretary James Tattersall, AMS associate secretary Michel Lapidus).
10. MAA Invited Address speaker Karen Parshall.
11. San Diego Convention Center.
12. Who Wants to Be a Mathematician game host Mike Breen and San Diego game winners Hansen Han (left) and Ben Wendel (right).
13. AMS Membership Booth.
14. Avi Wigderson (left) receives Conant Prize from AMS president James Glimm.
15. AMS Booth in the Exhibits area.
16. Morgan Prize winner Nathan Kaplan.

(ASL). The prize is awarded to the most outstanding doctoral dissertation or dissertations in mathematical logic.

Deloro received his Ph.D. in 2007 from the Université Paris 7. The prize citation notes that his thesis "deals with the Cherlin-Zilber conjecture, according to which every simple group of finite Morley rank is isomorphic to an algebraic group over an algebraically closed field. In particular, the thesis removes the assumption that there are no bad fields from the classification of minimal counterexamples." Moczydlowski received his Ph.D. in 2007 from Cornell University. According to the prize citation, his thesis "contains groundbreaking results on constructive set theory and its relation to type theory" and proves weak normalization for the intuitionistic Zermelo-Fraenkel set theory with replacement rather than collection.

The Sacks Prize was established in honor of Gerald Sacks for his unique contribution to mathematical logic. It consists of a cash award and five years' free membership in the ASL.

—From an ASL announcement

AWM Essay Contest Winners Announced

The Association for Women in Mathematics (AWM) has announced the winners of its 2007 essay contest, "Biographies of Contemporary Women in Mathematics".

The grand prize was awarded to Leena Shah, Hartland Middle School at Ore Creek, Brighton, Michigan, for her essay "The Creation of a Female Mathematician: Ms. Melanie Wood". Shah's essay won first place in the Grade 6–8 category. As the grand prize winner, this essay will be published in the *AWM Newsletter*.

In the College category, first place went to Sarah Budrus, Hollins University, Huntington, West Virginia, for "Dr. Marjorie Senechal: What do Silk, Crystals, Culture, and History Have in Common?" In the Grades 9–12 category, first place went to Elizabeth Faiella, homeschooled in Northwood, New Hampshire, for "Dr. Rita Hibschweiler: Exploring the Pure Beauty of Mathematics", while the honorable mention went to Haley Kossek, Elk Rapids High School, Williamsburg, Michigan, for "Mrs. Ann Weber: Hard Work Pays Off". An honorable mention in the Grade 6–8 category went to Helen A. Rawlins, Brier Terrace Middle School, Bothell, Washington, for "Dr. Eve Riskin: Engineer, Professor, Role Model".

—From an AWM announcement

Correction

Because of incorrect information supplied to the *Notices*, the list of Doctoral Degrees Conferred that appeared in the February 2008 issue contained a misspelling of the name of John Kittrell, who received a doctorate from the University of California, Los Angeles.

—Allyn Jackson