Browder, Coifman, and Kadanoff Receive 2000 National Medals of Science

In January 2000 President Clinton announced the names of twelve individuals to receive the National Medal of Science, the nation's highest scientific honor. Among these were three who work in the mathematical sciences: FELIX E. BROWDER, RONALD R. COIFMAN, and LEO P. KADANOFF.

Felix E. Browder

Felix E. Browder was honored for "pioneering mathematical work in the creation of nonlinear functional analysis that opened up new avenues in nonlinear problems, and for leadership in the scientific community that broadened the range of interactions among disciplines." Browder, University Professor of Mathematics at Rutgers University, is president of the AMS.

Browder's work in nonlinear functional analysis and its applications to nonlinear partial differential equations have had a long-term impact on mathematics. One of his major early achievements was to advance the study of elliptic partial differential equations to treat nonlinear problems that had previously been out of reach. The thrust of his theory was a liberation from the requirements of compactness and convexity, thus opening up a wide range of problems of nonlinear partial differential equations to precise analysis. His seminal work on nonlinear equations of evolution has had a profound influence on the subject.

Browder's progressive international view of science made him a leader for his time. It was through his efforts that the French analysts developed the strong interactions with their American counterparts that characterizes present-day research efforts. His supportive efforts to improve undergraduate and graduate education in the mathematical sciences included bringing about the successful AMOCO project at the University of Chicago, a program to engage inner-city youth in science; as well as the Center for Mathematics, Science and Computer Education; and the Outreach Program in Mathematics at Rutgers University. He has sustained over many years, advocacy of the involvement of women and minorities in science and mathematics.

At a time when it was not popular within mathematical circles, Browder advocated including applied mathematics at the highest levels into mathematics departments and did so successfully at Rutgers and at the University of Chicago, where he is the Max Mason Distinguished Service Award Professor Emeritus.

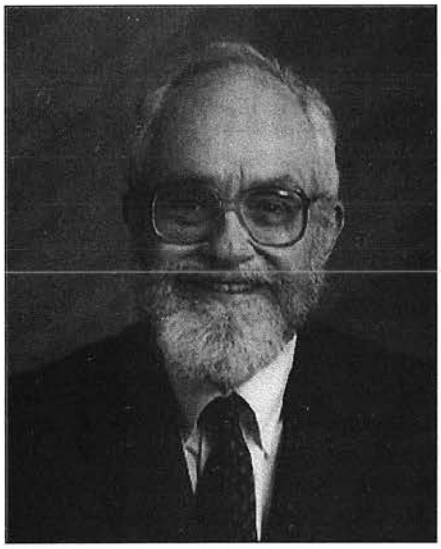
Ronald R. Coifman

Ronald R. Coifman was honored "for fundamental contributions to the field of harmonic analysis and for adapting that field to the capabilities of the digital computer to produce a family of fast, robust computational tools that have substantially benefited science and technology." He is the Phillips Professor of Mathematics at Yale University.

Coifman is a world leader in harmonic analysis. He introduced tools powerful enough to solve key problems in pure mathematics, yet sufficiently simple and flexible to become the basis for new, fast algorithms to handle the problems of wave propagation, data storage, de-noising, and medical imaging. As Coifman moved to applied mathematics, his work in the development of wavelet analysis had a revolutionary impact.

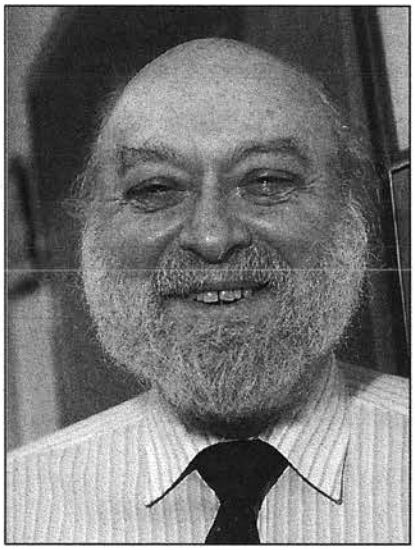
In collaboration with Yves Meyer, Coifman constructed a huge library of waveforms of various duration, oscillation, and other behavior. Through a clever algorithm developed with Victor Wickerhauser, it became possible to do very rapidly computerized searches through an enormous range of signal representations in order to quickly find the most economical transcription of measured data. This development allowed, for example, the FBI to compress a fingerprint database of 200 terabytes into less than 20 terabytes, saving millions of dollars in transmission time and storage costs.

Coifman also used wavelet analysis to develop tools for processing noisy data. He recognized



Felix E. Browder

Ronald R. Coifman



Leo P. Kadanoff

that one can essentially remove noise completely, allowing for short time exposure magnetic resonance images that would enable real-time "movies" inside the human body.

Coifman has continued to work on many computational problems in numerical analysis. The Beylkin-Coifman-Rokhlin matrix multiplication algorithm makes it possible to solve certain problems in high-intensity computations that were beyond the capability of any computer one might envision using previous algorithms.

Coifman's intellectual leadership has attracted first-class scientific talent from around the world to come to the United States to work on problems of national importance in signal processing and scientific computing.

Leo P. Kadanoff

Leo P. Kadanoff was honored "for leadership in fundamental theoretical research in statistical, solid state, and nonlinear physics which has led to numerous and important applications in engineering, urban planning, computer science, hydrodynamics, biology, applied mathematics, and geophysics." Kadanoff is the John D. MacArthur Distinguished Service Professor at the James Franck Institute of the University of Chicago.

Kadanoff has been a force in theoretical physics for nearly forty years. His concepts of scaling and universality have been used widely, both in research and in teaching. His textbook with Gordon Baym, *Quantum Statistical Mechanics*, is considered a classic and has been translated into many languages.

In his most important study, Kadanoff showed that sudden changes in material properties (for example, the magnetization of a magnet or the boiling of a fluid) could be understood in terms of scaling and universality. With his collaborators he showed how all the experimental data then available for the changes, called second-order phase transitions, could be understood in terms of these two ideas. These same ideas have now been extended to apply to a broad range of scientific and engineering problems and have found numerous and important applications in a wide range of areas.

Kadanoff has played a major role in the education of students. At the University of Chicago he was awarded the Quantrell Award for excellence in undergraduate teaching. He has been instrumental in introducing computers into physics laboratories as well as in developing associated instructional material. He has influenced the University of Chicago's entire academic approach by his strongly interdisciplinary techniques that blend experiment, theory, and computation. He creates opportunities for significant participation by students, postdoctoral associates, and young colleagues in a very broad range of research topics.

About the National Medal of Science

Established by Congress in 1959, the National Medal of Science is bestowed annually by the President of the United States on a select group of individuals deserving of special recognition by reason of their outstanding contributions to knowledge in the physical, biological, mathematical, engineering, social, or behavioral sciences. In 1962 President John F. Kennedy awarded the first Medal of Science to the late Theodore Von Karman, professor emeritus of the California Institute of Technology. The National Science Foundation administers the National Medal of Science program for the President. A distinguished, independent, twelve-member, presidential-appointed committee reviews the nominations and sends its list of recommendations to the President for final selection.

—Compiled from NSF news releases

Ingrid Daubechies Receives NAS Award in Mathematics

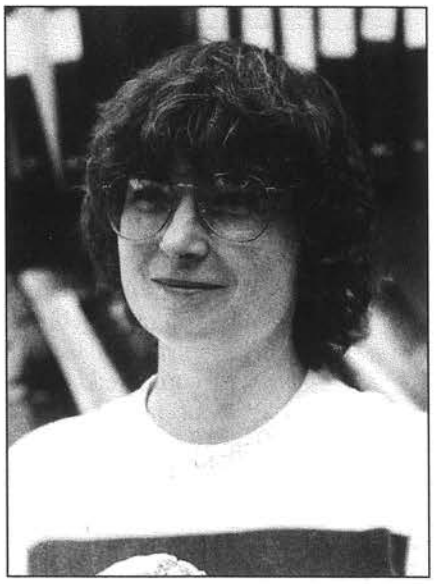
INGRID DAUBECHIES has received the 2000 National Academy of Sciences (NAS) Award in Mathematics. The $5,000 award, established by the AMS in commemoration of its centennial in 1988, is presented every four years for excellence in published mathematical research. Daubechies was chosen "for fundamental discoveries on wavelets and wavelet expansions and for her role in making wavelet methods a practical basic tool of applied mathematics."

Ingrid Daubechies received both her bachelor's and Ph.D. degrees (in 1975 and 1980) from the Free University in Brussels, Belgium. She held a research position at the Free University until 1987. From 1987 to 1994 she was a member of the technical staff at AT&T Bell Laboratories, during which time she took leaves to spend six months (in 1990) at the University of Michigan and two years (1991–93) at Rutgers University. She is now a professor in the Mathematics Department and in the Program in Applied and Computational Mathematics at Princeton University. Her research interests focus on the mathematical aspects of time-frequency analysis, in particular wavelets, as well as applications.

In 1993 Daubechies was elected as a member of the American Academy of Arts and Sciences, and in 1998 she was elected as a member of the NAS and as a fellow of the Institute of Electrical and Electronics Engineers. The AMS awarded her the 1994 Steele Prize for mathematical exposition for her book *Ten Lectures on Wavelets* (Society for Industrial and Applied Mathematics, 1992), as well as the 1997 Ruth Lyttle Satter Prize. From 1992 to 1997 she was a fellow of the John D. and Catherine T. MacArthur Foundation.

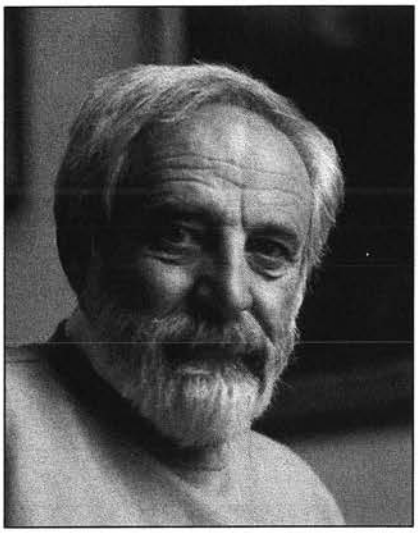
The previous recipients of the NAS Award in Mathematics are Robert P. Langlands (1988), Robert D. MacPherson (1992), and Andrew J. Wiles (1996).

—Allyn Jackson

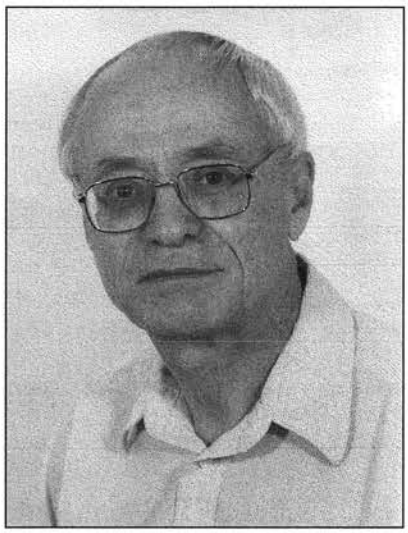


Ingrid Daubechies

Bott and Serre Share 2000 Wolf Prize



Raoul Bott



Jean-Pierre Serre

RAOUL BOTT and JEAN-PIERRE SERRE will share the $100,000 Wolf Prize in Mathematics for 2000. Bott is honored "for his deep discoveries in topology and differential geometry and their applications to Lie groups, differential operators, and mathematical physics." Serre is recognized "for his many fundamental contributions to topology, algebraic geometry, algebra, and number theory and for his inspirational lectures and writing." The prize is to be conferred by Israeli president Ezer Weizman at a special ceremony in Jerusalem on May 21, 2000.

Raoul Bott

Raoul Bott has been one of the leading figures in differential geometry, particularly in its links with topology and Lie groups. Through his publications, his students, and his personal qualities, he has significantly influenced the mathematics of our times.

Bott's first major contribution was the application of Morse theory to the topology of Lie groups and homogeneous spaces, culminating in the famous "periodicity theorems" for the stable homotopy of the classical groups. This result provided the foundation for the development of K-theory, to which Bott also contributed greatly, particularly through his joint work with Michael Atiyah on the index theory of differential operators and its applications to equivariant topology. Bott also obtained seminal results in the theory of foliations. His later work on Yang-Mills theory, moduli spaces of vector bundles, and elliptic genera has been marked by a combination of the same geometric insight, coupled with new points of view coming from mathematical physics.

Raoul Bott was born in 1923 in Budapest, Hungary. After receiving bachelor's and master's degrees from McGill University, he received his Ph.D. in 1949 from the Carnegie Institute of Technology. After two years at the Institute for Advanced Study (IAS) in Princeton, he moved to the University of Michigan in 1951. Since 1959 he has been at Harvard University. He is now William Casper Graustein Research Professor. He has also held visiting positions at the IAS and at the Institut des Hautes Études Scientifiques in Bures-sur-Yvette, France. Bott was elected to the National Academy of Sciences of the USA in 1965, and he is an honorary member of the Académie des Sciences de Paris. In 1990 he received the AMS Steele Prize for Lifetime Achievement. He received the National Medal of Science in 1987.

Jean-Pierre Serre

Jean-Pierre Serre is a mathematician of enormous versatility who has had a huge influence on an astonishingly wide range of subjects.

Serre's initial work in algebraic topology and complex geometry made him the youngest recipient ever of the Fields Medal, in 1954. His application of algebraic methods to infinite-dimensional spaces was to become a major theme in all modern geometry. He transformed algebraic

geometry and commutative algebra through use of sheaf-theoretical and homological methods, constructed the first sheaf cohomology theory in characteristic p, created modern geometric class field theory, and made major contributions to Galois cohomology and to the theory of arithmetic groups. In number theory Serre's influence is inestimable. He introduced the notion of ℓ-adic representations and gave spectacular applications to elliptic curves, abelian varieties, and the theory of modular forms. His conjecture about the modularity of Galois representations was a key step toward the eventual proof of Fermat's Last Theorem.

Through his lectures, books, and courses, each of which is a gem of mathematical exposition and clarity, Serre has inspired generations of mathematicians.

Jean-Pierre Serre was born in 1926 in Bages, France. He studied at the École Normale Supérieure and received his D.Sc. in 1951 from the Sorbonne. After holding a position through the Centre National de la Recherche Scientifique, he was a professor at the Université de Nancy. In 1956 he assumed the position of professor at the Collège de France; he has been an honorary professor there since 1994. Serre is a member of a number of honorary scientific societies in various nations, including the Académie des Sciences de Paris and the National Academy of Sciences of the USA. In addition to receiving the Fields Medal, Serre also won the Balzan Prize in 1985. In 1995 he received the AMS Steele Prize for Mathematical Exposition.

About the Wolf Prize

The Wolf Foundation was established by the late German-born inventor, diplomat, and philanthropist Ricardo Wolf (1887–1981). A resident of Cuba for many years, he became Fidel Castro's ambassador to Israel and held this position until 1973, when Cuba severed diplomatic ties. Wolf decided then to stay on in Israel, where he spent his final years.

Five annual Wolf Prizes have been awarded since 1978 to outstanding scientists and artists "for achievements in the interest of mankind and friendly relations among peoples, irrespective of nationality, race, color, religion, sex, or political view." The prizes of $100,000 in each area are given every year in four out of five scientific fields in rotation: agriculture, chemistry, mathematics, medicine, and physics. In the arts the prize rotates among architecture, music, painting, and sculpture.

—From Wolf Foundation news releases

2000 JPBM Communications Award

Sylvia Nasar

The Joint Policy Board for Mathematics (JPBM) Communications Award was established in 1988 to reward and encourage those who, on a sustained basis, bring accurate mathematical information to nonmathematical audiences. This lifetime award recognizes a significant contribution or accumulated contributions to public understanding of mathematics.

At the Joint Mathematics Meetings in Washington, DC, in January 2000, the 2000 JPBM Communications Award was presented to SYLVIA NASAR. What follows is the award citation, a biographical sketch, and the recipient's response to receiving the award.

Citation

The Joint Policy Board for Mathematics presents its 2000 Communications Award to Sylvia Nasar for *A Beautiful Mind*, her biography of John Forbes Nash Jr. Based on extensive research, the vivid, beautifully written account of the life of the troubled mathematical genius provides rare insight into the world of academic research in mathematics. By portraying the mathematical culture at several leading institutions and explaining the significance of John Nash's contributions in game theory, geometry, and analysis, Sylvia Nasar has given the general public a glimpse into the world of mathematical research and an understanding of its impact on society.

Biographical Sketch

Sylvia Nasar, who was born in Germany and grew up in the United States and Turkey, was trained as an economist. She studied under William Baumol and Fritz Machlup at New York University and subsequently worked with Wassily Leontief, the 1973 winner of the Nobel Prize in economics for his invention of input-output analysis. Nasar has been writing about economics for many years, first at *Fortune* and *U.S. News & World Report*, and, in the past decade, at the *New York Times*. She is now working on her second book, about great twentieth-century economic thinkers, which picks up where Robert Heilbroner's classic, *The Worldly Philosophers*, leaves off and which will be published by Simon & Schuster in 2003.

A Beautiful Mind, the biography of John Nash, was Nasar's first book. It grew out of her *New York Times* article "The Lost Years of the Nobel Laureate", written right after Nash won the Nobel Prize in 1994. *A Beautiful Mind* won the 1998 National Book Critic's prize for biography and many other accolades.

Response

When John Forbes Nash Jr. won the Nobel Prize in economics in 1994, "the most remarkable mathematician of the second half century" was known around Princeton as "The Phantom of Fine Hall". He was not affiliated with any university, was not a member of the National Academy, was not listed in *Who's Who*. The "Nash equilibrium", "Nash bargaining solution", "Nash embedding", "Nash-De Giorgi result", "Nash-Moser theorem", and other of Nash's contributions from the 1950s had become famous in fields as disparate as geometry and game theory, but he himself was shrouded in obscurity. Thirty years of devastating mental illness had not only shattered Nash's life, they had also erased his personal history. Without the loyal support of his colleagues in the mathematical community and his wife, Alicia, Nash could not have survived those lost years, much less recovered from his illness and won worldwide acclaim. And without their recollections, letters, and photographs, I could not have reconstructed Nash's profoundly moving and inspiring story. For these gifts—as well as this wonderful award—I am profoundly grateful.

—From JPBM prize announcement

AWM Awards Presented in Washington, DC

The Association for Women in Mathematics (AWM) presented two prizes during the Joint Mathematics Meetings in Washington, DC, in January 2000.

Louise Hay Award

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

JOAN FERRINI-MUNDY of Michigan State University received the 2000 Hay Award. "Ferrini-Mundy is both a leader and a scholar," the citation states. "She is one of the leading intellectual authorities on the broad landscape of mathematics education in the United States, and a leading researcher in teacher education and development, and reform. Her knowledge, strong organizational skills, and ability to listen to and understand people from different intellectual communities have enabled her to lead, administer, and implement numerous organizational initiatives, at every scale."

Ferrini-Mundy is the chair of the Writing Group for *Standards 2000*, the update of the National Council of Teachers of Mathematics *Standards*. Prior to going to Michigan State she served as director of the Mathematical Sciences Education Board and associate executive director of the Center for Science, Mathematics, and Engineering Education at the National Research Council.

Alice T. Schafer Prize

In 1990 the Executive Committee of the AWM established the annual Alice T. Schafer Prize for excellence in mathematics by an undergraduate woman. The prize is named for former AWM president and one of its founding members Alice T. Schafer (emerita of Wellesley College), who has contributed a great deal to women in mathematics throughout her career.

MARIANA E. CAMPBELL, a senior at the University of California, San Diego, received the 2000 Schafer Prize. The citation states: "After distinguishing herself ('best in the class') as a junior in both undergraduate and graduate classes at UCSD, Ms. Campbell participated in the Mount Holyoke REU program, where the faculty described her as 'astonishing'." At the program she wrote a paper entitled "The Igusa local zeta function for the different reduction types of the special fiber of an elliptic curve", which is currently being revised for publication. In addition to her mathematical achievements, Campbell is a talented violinist. The citation concludes, "The consensus is that Ms. Campbell has 'the drive, intellect, and creativity to become a leading mathematician.' She is 'remarkable' and 'someone who will make a difference in the lives of those around her down the line.'"

—From AWM prize announcements

MAA Prizes Presented in Washington, DC

The Mathematical Association of America (MAA) presented a number of prizes during the Joint Mathematics Meetings in Washington, DC, in January 2000.

Gung-Hu Award for Distinguished Service to Mathematics

The Yueh-Gin Gung and Dr. Charles Y. Hu Award for Distinguished Service to Mathematics is the most prestigious award made by the MAA. This award, first given in 1990, is the successor to the Award for Distinguished Service to Mathematics, awarded since 1962, and has been made possible by the late Dr. Charles Y. Hu and his wife, Yueh-Gin Gung. Hu was not a mathematician but a retired professor of geology at the University of Maryland. He had such strong feelings about the basic nature of mathematics and its importance in all human endeavors that he felt impelled to contribute generously to the discipline of mathematics.

The 2000 Gung-Hu Award was presented to PAUL R. HALMOS. The citation states in part: "No mathematician alive today has influenced American mathematics more than Paul Halmos. He has written important research papers in operator theory, ergodic theory, and logic. He has edited major journals and served on many committees for the AMS and MAA. He has written textbooks and expository articles. His lectures always give us new insights."

Halmos came to the United States from Hungary as a teenager. He graduated from the University of Illinois in 1934 and received his Ph.D. there in 1938, working with J. L. Doob. Halmos has held faculty and visiting positions in a number of institutions around the world and is currently professor emeritus of mathematics at Santa Clara University. He is especially well known for the clarity of his mathematical exposition, which earned him the MAA Chauvenet Prize, the MAA Pólya Prize, and two MAA Lester R. Ford Awards; the AMS has awarded him the Steele Prize for mathematical exposition.

The citation concludes: "With his extraordinary energy and exceptional talent for exposition, Paul Halmos has been an invaluable asset to the mathematical community."

Haimo Awards for Distinguished Teaching

The Deborah and Franklin Tepper Haimo Awards for Distinguished College or University Teaching of Mathematics recognize teachers who have been widely recognized as extraordinarily successful and whose teaching effectiveness has been shown to have had influence beyond their own institutions. Deborah Tepper Haimo was president of the MAA during 1991–92.

There are three recipients of the 2000 Haimo Award. ARTHUR T. BENJAMIN was cited for "widespread recognition as a truly extraordinary teacher, his passionate dedication to mathematics and its pedagogy, and his nationwide reputation as one of the most successful ambassadors for mathematics." Benjamin is known as a scintillating lecturer as well as a magician and "lightning mental calculator." Benjamin is an associate professor of mathematics at Harvey Mudd College.

The citation for DONALD S. PASSMAN calls him "a mathematician of exceptional intelligence, keen insight, extraordinary mathematical ability, and keen sensitivity, who has a deep and natural

understanding of the learning process in mathematics. He brings all these attributes to bear on both his teaching and research." The author of more than 140 research publications and 5 books, Passman is the Richard Brauer Professor of Mathematics at the University of Wisconsin.

According to the citation for GARY W. TOWSLEY, "[t]he hallmarks that set [him] apart from other excellent teachers are versatility, creativity across many disciplines, and personal qualities of integrity, helpfulness, and caring." Truly a "Renaissance man", Towsley has taught a wide range of mathematics courses as well as a medieval studies course for English majors, history and philosophy of science as an interdisciplinary offering, and "Roots of 20th Century Science" for the college honors program. Towsley is the Lockhart Professor of Mathematics at the State University of New York in Geneseo.

Beckenbach Book Prize

The Beckenbach Book Prize is awarded for distinguished, innovative books published by the MAA. DAVID M. BRESSOUD of Macalester College has received the prize for his book *Proofs and Confirmations, the Story of the Alternating Sign Matrix Conjecture* (MAA Spectrum Series, jointly published with Cambridge University Press, 1999).

The prize citation states: "This book has several outstanding features. First and foremost, it carefully presents a significant chapter of mathematics. Moreover, it demonstrates how mathematics is actually created. It brings out the interplay among several seemingly unrelated branches, and also discusses unsolved problems ... Bressoud's book is a model of how a mathematics book should be written."

Chauvenet Prize

The Chauvenet Prize for expository writing is given for an outstanding expository article on a mathematical topic by a member of the MAA. DON B. ZAGIER of the Max-Planck-Institut für Mathematik has received the prize for his paper "Newman's short proof of the prime number theorem", which appeared in the *American Mathematical Monthly* **104** (1997).

The article, which Zagier dedicated to the prime number theorem on the occasion of its 100th birthday, gives a completely self-contained yet concise analytic proof of the theorem. The prize citation says that the article "is a masterpiece of excellent mathematical exposition and is accessible to anyone with a minimum background in complex analysis."

Certificates of Meritorious Service

Certificates of Meritorious Service are presented for service to the MAA at the national level or for service to an MAA section. Those recognized for 2000 are: STANLEY ELIASON of University of Oklahoma (Oklahoma-Arkansas Section); MARIO MARTELLI of California State University at Fullerton (Southern California Section); SISTER M. STEPHANIE SLOYAN, emerita of Georgian Court College (New Jersey Section); KATHLEEN TAYLOR of Duquesne University (Allegheny Mountain Section); and ELIZABETH J. TELES of Montgomery College and the National Science Foundation (Maryland-District of Columbia-Virginia Section).

—From MAA prize announcements