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New Titles from the AMS

Advances in Mathematical Sciences: CRM’s 25 Years
Luc Vinet, Centre de Recherches Mathématiques, Université de Montréal, PQ, Canada, Editor

This volume commemorates the 25th anniversary of the Centre de Recherches Mathématiques (CRM)—a national institute for research in the mathematical sciences in Canada. It includes contributions by eminent scientists who have been closely involved with the CRM. Various topics in pure and applied mathematics, statistics, theoretical physics, and mathematical biology are covered. Original research papers, reviews, as well as historical notes and reminiscences are included in the volume.
CRM Proceedings & Lecture Notes, Volume 11; 1997; 401 pages; Softcover; ISBN 0-8218-0808-6; List $99; Individual member $59; Order code CRMP/11NT711

Applications of Computational Algebraic Geometry
David A. Cox, Amherst College, MA, and Bernd Sturmfels, University of California, Berkeley, Editors

This book introduces readers to key ideas and applications of computational algebraic geometry. Beginning with the discovery of Gröbner bases and fueled by the advent of modern computers and the rediscovery of resultants, computational algebraic geometry has grown rapidly in importance. The fact that “crunching equations” is now as easy as “crunching numbers” has had a profound impact in recent years. At the same time, the mathematics used in computational algebraic geometry is unusually elegant and accessible, which makes the subject easy to learn and easy to apply.

This book begins with an introduction to Gröbner bases and resultants, then discusses some of the more recent methods for solving systems of polynomial equations. A sampler of possible applications follows, including computer-aided geometric design, complex information systems, integer programming and algebraic coding theory. The lectures in the book assume no previous acquaintance with the material. Proceedings of Symposia in Applied Mathematics, Volume 53; 1998; 173 pages; Hardcover; ISBN 0-8218-0750-1; List $35; All AMS members $28; Order code PSAPM/53NT711

Featured Reviews in Mathematical Reviews 1995–1996
Donald G. Babbitt, Publisher, American Mathematical Society, Providence, RI, and Jane E. Kister, Associate Executive Editor, Mathematical Reviews, Ann Arbor, MI, Editors

This collection of reprinted Featured Reviews published in Mathematical Reviews (MR) in 1995 and 1996 makes widely available informed reviews of some of the best mathematics published recently.

All of the papers reviewed here contain interesting new ideas or applications, a deep synthesis of existing ideas, or any combination of these. The volume is intended to lead the user to important new research across all fields covered by MR.

Featured Reviews from Mathematical Reviews, 1995, 380 pages; Softcover; ISBN 0-8218-0771-4; List $39; All AMS members $31; Order code FREV/1NT711

Mathematics and Mathematicians
Mathematics in Sweden before 1950
Lars Gårding, Lund University, Sweden

This book is about mathematics in Sweden between 1630 and 1950—from S. Klingenstierna to M. Riesz, T. Carleman, and A. Carling. It tells the story of how continental mathematics came to Sweden, how it was received, and how it inspired new results. The book contains a biography of Gösta Mittag-Leffler, the mathematicians who introduced the

Watersteinian theory of analytic functions and dominated a golden age from 1880 to 1910.

Important results are analyzed and re-proved in modern notation, with explanations of their relations to mathematics at the time. The book treats Backlund transformations, Mittag-Leffler’s theorem, the Painlevé–Lindelöf theorem and Carleman’s contributions to the spectral theorem, quantum mechanics, and the asymptotics of eigenvalues and eigendunctions. Other important features include sketches of personalities and university life.

Co-published with the London Mathematical Society. Members of the LMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners.

Number Theory
V. Kumar Murty, University of Toronto, ON, Canada, and Michel Waldschmidt, Université Pierre et Marie Curie, Paris, France, Editors

To observe the tenth anniversary of the founding of the Ramanujan Mathematical Society, an international conference on Discrete Mathematics and Number Theory was held in January 1996 in Trivandrum, India. This volume contains proceedings from the number theory component of that conference. Papers are divided into four groups: arithmetic algebraic geometry, automorphic forms, elementary and analytic number theory, and transcendental number theory. The work deals with recent progress in current aspects of number theory and covers a wide variety of topics.

Contemporary Mathematics, Volume 210; 1997; 399 pages; Softcover; ISBN 0-8218-0709-8; List $69; Individual member $41; Order code CONM/210NT711

Partial Differential Equations
Harold Levine, Stanford University, CA

The subject matter of partial differential equations (PDEs) has a long history dating from the 18th century and an active contemporary phase. An early phase (with a separate focus on taut string vibrations and heat flow through solid bodies) stimulated developments of great importance for mathematical analysis, such as a wider concept of functions and integration, the existence of trigonometric or Fourier series representations. The direct relevance of PDEs to all manner of mathematical, physical and technical problems continues. This book presents a reasonably broad introductory account of the subject, with due regard for analytical detail, applications and historical matters.

Titles in this series are co-published with International Press, Cambridge, MA.

AMS/IP Studies in Advanced Mathematics. Volume 6; 1997; 706 pages; Hardcover; ISBN 0-8218-0775-7; List $69; All AMS members $55; Order code AMSIP/6NT711

Studies on Composition Operators
Farhad Jafari, University of Wyoming, Laramie, Barbara D. MacCluer, University of Virginia, Charlottesville, Carl C. Cowen, Purdue University, West Lafayette, IN, and A. Duane Porter, University of Wyoming, Laramie, Editors

This book reflects the proceedings of the 1996 Rocky Mountain Mathematics Consortium conference on “Composition Operators on Spaces of Analytic Functions” held at the University of Wyoming. Readers will find here a collection of high-quality research and expository articles on composition operators in one and several variables. The book highlights open questions and new advances in the classical areas and promotes topics which are left largely untreated in the existing texts.

Contemporary Mathematics, Volume 213; 1997; approximately 256 pages; Softcover; ISBN 0-8218-0704-4; List $49; Individual member $31; Order code CONM/213NT711

All prices subject to change. Charges for delivery are $3.00 per order. For air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P. O. Box 8936, Providence, RI 02907-0836. For credit card orders, (401) 385-2737 or call toll free 800-321-4AMS (4267) in the U.S. and Canada, 401-455-4000 worldwide. Or place your order through the AMS bookstore at http://www.ams.org/bookstore/. Residents of Canada, please include 7% GST.
Mathematical Essays in Honor of Gian-Carlo Rota
B. Sagan, Michigan State University & R. Stanley, MIT, Cambridge, MA

This volume is dedicated to Gian-Carlo Rota, one of the great enumerators of our time, in honor of his 60th birthday. The contributors are leaders in the fields of combinatorics, invariant theory, combinatorial geometry, special functions, commutative algebra, representation theory, and statistics. Rota himself has co-authored one paper on the umbral calculus.

Contributors include: Andrews, Bailey, Billera, Bogart, Bucurianco, Buchsbaum, Diaconis, Ehrenborg, Eisenbud, Freiman, Garzia, Ismail, Krattenthaler, Kung, Loeb, Mendez, Oliveira, Ram, Ray, Ready, Remmel, Rota, Schwartz, Stanley, Stanton, Sturmfels, Taylor, Whiteley, Wimp, Yang

New!

Stochastic Processes and Related Topics
A Volume in Memory of Stamatis Cambanis, 1943-1995
I. Karatzas, Columbia University; W.S. Raajj, University of Tennessee, Knoxville & M.S. Taqqu, Boston University, MA

In the last 20 years there has been extensive research devoted to a better understanding of the stable and other closely related infinitely divisible models. The late Stamatis Cambanis, a distinguished educator and researcher, played a special role in the development of these research efforts, particularly related to stable processes, starting from the early seventies until his untimely death in April '95. This commemorative volume consists of a collection of research articles devoted to review this and other rapidly related developing research and also explores new directions of research in these fields.


New!

Geometry and Representation Theory of Real and p-Adic Lie Groups
D. Vogan, MIT, Cambridge, MA; J. Wolf, University of California, Berkeley & J. Tirro, University of Cadiz, Argentina (Eds.)

The representation theory of Lie groups plays an important role in both classical and recent developments in mathematics and physics. The expository articles here provide a fast and thorough introduction to the more active parts of representation theory and to some of its ongoing applications.

The expositions were written for a mixed audience of graduate students and established researchers in related areas, for example, number theory and physics.

New!

Non-vanishing of L-Functions and Applications
M.R. Murty, Queen's University, Kingston, Canada & V.K. Murty, University of Toronto, Canada

This book systematically develops some methods for proving the non-vanishing of certain $L$-functions at points in the critical strip. Researchers in number theory, graduate students who wish to enter into the area, and non-specialists who wish to acquire an introduction to the subject will benefit from this book.

Contents: 1: The Prime Number Theorem and Generalizations • 2: Artin L-Functions • 3: Equidistribution and L-Functions • 4: Modular Forms and Dirichlet Series • 5: Dirichlet L-Functions • 6: Non-vanishing of Quadratic Twists of Modular L-Functions • 7: Selberg's Conjectures • 8: Suggestions for further reading • Author Index • Subject Index

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Articles

The Stability of Matter Interacting with Fields
Michael Loss

It is both a remarkable fact and an important result in mathematical analysis that quantum theory can explain the stability of ordinary bulk matter. This article describes recent developments when the interaction of matter with fields is also taken into account.

Paul Wolfskehl and the Wolfskehl Prize
Klaus Barner

The story of a German physician's fascination with Fermat's Last Theorem, and the famous (and ultimately valuable) prize he established for the solution.

Communications

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The Myth of the Young Mathematician

When I was a budding scholar, my fellow students and I would pore over biographies of the famous mathematicians, imbuing the rules by which the game was played. We learned that mathematics was a young person’s game. Some set the limit for one’s best research being done by 30 or 35; others, as low as 25. To a young person this was quite intimidating; we all faced several more years of college and graduate school, and it was doubtful that we would be proving real theorems before we were 30. Our best years would be close to over. Such was the daunting edifice of mathematics under which we were (mathematically) raised.

Now, older and with some grey hairs of my own, I know that this tower was erected on false principles. True it is that Galois did his first-rate original work before he died at the age of 20, and Ramanujan made enormous contributions before his death at 32. But while Newton invented the calculus and discovered the theory of gravitation during his early 20s, the English mathematician was in his mid 40s when he fully developed the theory that comprises the Principia. Euler, despite the blindness that afflicted him, was prolific to the end of his days. His introduction to analysis appeared during the comparative youth of his early 30s, his tome on differential calculus in his late 30s, and his three volumes on integral calculus when he was in his 60s.

Gauss published Disquisitiones Arithmeticae at 24; at 34 he developed the theory of analytic functions; at 48, the arithmetic of Gaussian integers. In more recent times, Cartan, Poincaré, Carl Ludwig Siegel, Kolmogorov, and Erdős have all provided examples that age need not be a barrier to mathematical creativity.

Nor need mathematical creativity blossom early. Fermat and Weierstrass are examples of mathematicians whose talent first showed when they were well past the bloom of youth. Fermat’s initial mathematical work—on tangents, not number theory—appeared when the lawyer was in his late 20s; Fermat’s foray into number theory did not occur until several years after that. Similarly, although Weierstrass published a paper in his late 20s, his first important work, on abelian integrals, did not appear until the mathematician was in his late 30s. He was a schoolteacher at the time.

Examples do not prove a theorem, and anecdotes are not the sole evidence that mathematical insight and ability can be part of later life. Nancy Stern studied the relationship between age and mathematical productivity and observed that while mathematicians aged 35-39 were most prolific, they were closely followed by mathematicians 40-44, who edged out the under-35 group. As Stern notes, such simple number counting can mistake quantity for quality, but other measures (including a careful analysis of citation count) indicate that older mathematicians rate well on the quality scale.

The myth of the young mathematician, like those of David and Goliath, and St. George and the Dragon, has appeal, but it also has costs. This myth discourages those whose mathematical ability blossoms late, and it creates a barrier for those whose mathematical careers do not follow the pattern of youthful achievement.

Why does the myth endure? I believe it is because the tale is romantic: the mathematician as young knight on a quest for truth. I think that we as mathematicians should lay the false tale aside and acknowledge that mathematical talent is not a blazing star that burns out at 29 or 39, but functions on a variable scale, and for many endures even to the edge of time.

—Susan Landau

Acknowledgement

I am indebted to Claudia Henrion, who has written several compelling articles on this subject, including a chapter in her book Women In Mathematics: The Addition of Difference, Indiana University Press, 1997.
Letters to the Editor

The California Math Wars, Part II—August 1997

Margaret DeArmond, president of the California chapter of the National Council of Teachers of Mathematics, is quoted as saying that IMP works for her students. Those objecting to IMP ask what does it mean “to work”? Apparently it does not include some usual measures of student success.

East Bakersfield High School, with Ms. DeArmond as chair, has been an IMP school since 1991, one of the first to pilot the curriculum, while rival Bakersfield High has been able to resist the subtle pressure to move to IMP, CPM (the two California favorites), or the like because of its strong indicators of student performance. The situation was described in an excellent full-page discussion of current reform versus traditional programs at the two high schools in the Bakersfield Californian on August 4, 1996. The country needs more such objective reporting. The contrast in student performance levels between the two schools contradicts the words of Dr. Julian Weissglass, also quoted in the Notices article, but here [taken] from his testimony on June 24 before the California Academic Standards Commission in opposition to their draft of grade-level mathematics standards: “The Interactive Mathematics Program shows that secondary students studying a curriculum rich in problem solving and context-based mathematics pursue mathematics longer and learn more than in the traditional school curriculum.” The student performance numbers are so different between the two schools that it is surprising that the school board has not chosen to intervene on behalf of unknowing students at East Bakersfield.

- At the top end mathematically, East Bakersfield had only 2 students who took the AP Calculus exam last year and only 1 who passed, with a score of 3, the minimum passing grade. By contrast, Bakersfield High had 29 students who took the exams, of whom 25 passed, 18 with a score of 4 or better.
- At the top end overall, over the last five years Bakersfield High has had 32% of the National Merit Scholar semifinalists of Kern County with only 9% of the county’s student population.
- Still looking at the academically better-prepared students, the percent of the seniors at East Bakersfield taking the SAT has dropped from 30% to 23% from 1992 to 1996, while Bakersfield High has risen a couple of points to 40% and still manages to maintain a 37-point lead in the mathematics average over East Bakersfield, to rank in the top third of all high schools in California versus the bottom third for East Bakersfield.1
- At the opposite end of the performance spectrum, the Title 1 students at Bakersfield High more than doubled the one-year growth of students at East Bakersfield on the district’s pretest/posttest assessment.

The Notices article also made strong reference to the MathLand self-study that supposedly verifies one year of mathematical growth at or above national averages based on 30,000 students. It avoids pointing out that, at least in some cases, the “growth” is really “recovery” from a disastrous first year of MathLand itself. That is clearly the case at the only school that I have been able to identify in the study. Despite repeated requests, Creative Publications refuses to release the information that would allow their analysis of the data to be independently confirmed. Even more damning than the “recovery” factor—and with negative ethnic implications as well—they ignored a full 80% of the student body at that school, those

1 No IMP school in California exceeded 70% in contrast to the 83% from the IMP evaluation study of the Wisconsin Center for Education Research referenced in the Notices article.
students who were tested in Spanish. (The MathLand materials are available in Spanish.) Those students experienced continuing severe decline in the second year as well. Above are those missing numbers for the fourth grade at which the evaluation was made, along with the preceding years' numbers. The test used was Aprenda, and the numbers are national percentiles.

These numbers are reality, not rhetoric, and we need more of the former and less of the latter. Don't kill the messengers; start listening to the message. Performance matters.

Wayne Bishop
California State University, LA
(Received July 18, 1997)

Final Comment on California Math Wars
Wayne Bishop's letter is full of errors and misrepresentations. I am not the chair of the mathematics department at my school. The August 4, 1996, local newspaper's mathematics discussion was written by two teachers and appeared on the "Opinion" page. He attempts to compare two schools that have vastly different student populations. Calculus students at my school have not taken the Interactive Mathematics Program courses. Students in the Title I program are not enrolled in IMP. The mathematics community should be discussing the mathematics content to be taught, the best instructional practices, and national research. There is no reason to focus on two very different schools in Bakersfield, California.

Margaret DeArmond
President, California Mathematics Council
(Received August 16, 1997)

Author's Correction
Regarding my piece on "Rigor in Calculus" in the September issue: In the last paragraph on page 933, the second sentence was to include a helpful parenthetical remark, as follows: "It is equivalent to (e, δ) (as it states that the oscillation of the function is zero) yet is expressed in low-key, familiar terms." The fault is mine, as the remark was missing from the text I submitted; apparently it got lost during last-minute cutting and pasting. I regret the slip-up.

Leonard Gillman
University of Texas
(Received August 16, 1997)

"Bible Code" Author Responds
I generally don't reply to reviews, but the comments by Shlomo Sternberg on my book The Bible Code that appeared in your September 1997 issue were shameful.

I would note the following:
(1) It is an outrage for a scientist of Dr. Sternberg's standing to accuse a respected scientist like Eliyahu Rips of perpetrating a "hoax" without offering any evidence.

Dr. Rips, a recognized authority in group theory at Hebrew University, told me that Dr. Sternberg never communicated with him in any way, never gave Dr. Rips a chance to respond to inquiries.

And, of course, Dr. Sternberg has not found any evidence of fraud. If he had merely spoken to Dr. Rips, he would know what everyone else who has met or talked to Dr. Rips knows — Ilya Rips is a totally honest man.

(2) Had Dr. Sternberg actually checked the Bible code himself, he also would know that the kind of accurate, coherent information found in the Bible has not been found in any other text.

Of course, it is possible to find "Yitzhak Rabin" encoded in any sufficiently long text, but I am certain Dr. Sternberg will not find the words "assassin that will assassinate" crossing Rabin's name in any text other than the Bible. He certainly would not have found it anywhere else a year before Rabin was killed.

(3) I found those words crossing "Yitzhak Rabin" the only time his full name is encoded in the Bible more than a year before the prime minister was assassinated.

And I personally warned Rabin through his closest friend, a well-known Israeli writer. He confirmed that to the New York Times, and the chief scientist at Israel's Ministry of Defense also confirmed it to the Times.

It is this simple reality that Dr. Sternberg simply ignores: the Bible code did accurately predict Rabin's murder a year in advance.

(4) It also accurately predicted in advance the exact date of the first Scud missile attack on Israel in the Gulf War.

It also accurately predicted in advance the exact date that a comet named Shoemaker-Levy would strike Jupiter.

No one has found anything like that, in advance, in Moby Dick or War and Peace or the Manhattan telephone directory.

(5) Perhaps this offends Dr. Sternberg's religious views. Perhaps it confounds him as a mathematician. But it is nonetheless the truth.

I cannot account for the reality of the Bible code, because I am not religious. I do not believe in God and therefore cannot identify the encoder. But I do know that however many human hands wrote down the words of the Torah over however many years, some other intelligence was involved.

Because there is simply no doubt that the Bible code does reveal the details of events that took place long after the Bible was written.

It seems odd that any religious man would doubt the ability of an all-seeing, all-knowing, all-powerful God to encode the Torah in any way he chose. Surely it would not matter if such a God did it through one man or many men, through one version or many versions of a text that is holy, that transcends its human scribes.
In reading Dr. Sternberg’s commentary, I am reminded of the scientists who joined the Church in condemning Galileo for daring to suggest that the Earth circles the Sun. They too were offended on both religious and scientific grounds.

In years to come I think Dr. Rips’s work will be recognized as revelatory, and Dr. Sternberg’s attack will be forgotten. For the moment, however, Dr. Sternberg — not the brave mathematicians who supported Dr. Rips — has shamed himself and the world of science.

In reply to Allyn Jackson’s review, I will note only two things:

(a) Ms. Jackson has been taken in by the real hoax: Brendan McKay’s silly effort to confuse people who don’t understand what the Bible code is.

There’s a difference between looking for one name, “Yitzhak Rabin”, and finding it encoded only once in the Bible and finding his assassination plainly encoded in the same place in advance, as I did, and McKay’s search for many past assassinations in many texts until he found one random pattern in Moby Dick.

(b) Rabin’s assassination was hardly expected. No Israeli prime minister had ever been assassinated.

In any event, even were it expected, that would hardly account for it being encoded in a text 3,000 years old.

Michael Drosnin
New York, N.Y.
(Received August 17, 1997)

_Notices Shouldn’t Have Reviewed “Bible Code”_

I think it is a disgrace that the Notices printed what appeared to be a serious review of _The Bible Code_. Isn’t it clear enough that this book is total, utter NONSENSE? Why didn’t you say so? Do you have doubts?

Anybody who respects the Bible and/or mathematics should be outraged. Look long enough and you find the “prediction” “Clinton-will-get-third-term” in the Bible, _War and Peace_, and the U.S. tax code. Will you also print a review of a book _Pi Equals 22/7, After All_, devoted to several proofs of this statement, if it only makes some bestseller list?

M. Dugas
Baylor University
(Received August 25, 1997)

About the Cover

The figure shows a simulation of a metallic alloy after it has been rapidly cooled through a symmetry-breaking (cubic to orthorhombic) solid-solid phase transformation. The computation performs a gradient flow on an appropriate nonconvex free energy surface. The blue and red represent the two solid phases, which are separated by a white interface. One observes needle-like textures evolving from a tweedy precursor phase. Computation performed at Los Alamos National Laboratory by Pieter Swart (swart@lanl.gov, LANL), Matthew Killough (Courant Institute-New York University), and William Kerr (Wake Forest University).

_Addendum to September 1997 cover description:_ Substitution tilings are certain hierarchichal structures in a geometric space (cf., Radin, Notices, April 1996). Instead of placing these tilings in Euclidean or affine space, as is usual, we may consider far more general settings, as this image suggests. Relevant preprints can be found at http://www.geom.umn.edu/~strauss/.

—Addendum courtesy of Chaim Goodman-Strauss

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George Grätzer, University of Manitoba, Winnipeg, Canada

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The Schrödinger equation occupies a central and, at the same time, peculiar place in physics. It is central in the sense that it is acknowledged to be universal; it explains all facts about nonrelativistic matter such as superconductivity. Peculiar it is, since we rarely derive any material properties ab-initio from the Schrödinger equation. Overwhelmed by its mathematical complexity which, of course, reflects the unlimited forms of matter, theoretical physicists dig out the salient bits of mathematics associated with the phenomena and try to deal with those.

There are, however, a number of facts about bulk matter that can be derived rigorously from the basic principles of quantum mechanics. The one phenomenon at the heart of it all is that the physical size of bulk matter and its energy content are proportional to the number of particles involved or, in short, that matter is stable. Matter consists of electrons and nuclei that interact with each other through electrostatic forces, i.e., Coulomb's $1/r^2$ law repelling particles with like charges and attracting particles of opposite charges. Clearly, stability cannot be explained on the basis of classical physics alone, since there is nothing that resists the infinite attraction of Coulomb's law whose lowest energy is reached when particles of opposite charge sit on top of each other. In fact, the development of quantum mechanics was to a certain extent driven by the desire to estimate the size of atoms. While the bulkiness of atoms was understood early on, it was not until the mid-sixties through the work of Fisher, Ruelle, and others in statistical mechanics that a mathematical formulation of the stability of matter problem was even given. A many-particle system is stable if its ground-state energy is proportional to the number of particles involved. This was proved in the late sixties by Dyson and Lenard for a system of nuclei and electrons interacting with each other through electrostatic forces. The foundations on which stability ultimately rests are the uncertainty principle (that enters via the Schrödinger equation) and the Pauli exclusion principle. The first quantifies the cost of kinetic energy when localizing a quantum mechanical particle and explains successfully the size of hydrogen and helium. The second, which introduces some kind of “repulsion” among electrons, comes into play when dealing with many particles. That it is necessary for stability of bulk matter to hold was shown by Dyson [8].

It is difficult to overstate the importance of these two principles. They seem to be true universal principles that explain facts about nature from the smallest distance scales up to objects of astronomical size (ignoring the somewhat annoying fact that we have not found a true relativistic quantum theory as of yet). For example, they yield the correct magnitude for the Chandrasekhar radius of white dwarfs. For further details, quotes, and more examples about the astonishing range of validity of quantum mechanics the reader should consult the lucid exposition [13], which can also be found in [14] along with many of the articles mentioned in the references.

The goal of this note is to explain a few of the latest developments not covered in [13], and this is stability of matter interacting with fields. First,
we give in a telegraphic style the ingredients necessary to formulate the stability result of Dyson and Lenard.

A piece of matter consists of charged particles, \(K\) nuclei, and \(N\) electrons interacting with each other according to Coulomb's law. We shall treat the nuclei as classical particles or, what is the same, as particles of infinite mass that are located at the positions \(R_1, \ldots, R_K\). The state of \(N\) electrons is described by a complex-valued wave function \(\Psi\) of the space and spin coordinates of each electron; i.e.,

\[
\Psi = \Psi(x_1, \sigma_1; \ldots; x_N, \sigma_N).
\]

The important point is that nature allows two kinds of \(\Psi\)'s: the symmetric ones (bosons) or, as in the case of electrons, antisymmetric ones (fermions), the latter being the precise formulation of the Pauli exclusion principle. We denote the Hilbert-space of all \(N\)-electron wave functions by

\[
\mathcal{H} = \Lambda^N L^2(\mathbb{R}^3; \mathbb{C}^2),
\]

the \(N\)-fold antisymmetric tensor product of \(L^2(\mathbb{R}^3; \mathbb{C}^2)\). That the wave function of a single electron has values in \(\mathbb{C}^2\) is related to the spin of the electron. This will be important later.

The Hamiltonian that describes that system is given, in suitable units, by

\[
H = \sum_{j=1}^N \tau_j + V_c.
\]

The standard choice for the kinetic energy \(\tau\) is

\[
\tau = p^2 = -\Delta,
\]

which is the kinetic energy operator of a nonrelativistic electron. The symbol \(p = -i\nabla\) stands for the physical momentum, and the subscript \(j\) reminds us that \(\tau_j\) acts on the coordinates of the \(j\)-th particle.

\(V_c\) is the Coulomb interaction among the particles and is given by

\[
V_c = -\sum_{i=1, j=1}^{N,K} \frac{Z_j}{|x_i - R_j|} + \sum_{i<j}^N \frac{1}{|x_i - x_j|} + \sum_{i<j}^K \frac{Z_i Z_j}{|R_i - R_j|},
\]

The three terms describe, in succession, the attraction of the nuclei and electrons, the repulsion among the electrons, and the repulsion among the nuclei. For simplicity we shall assume that all the nuclei have the same charge \(Z\).

The ground-state energy \(E(N, K, Z, R)\) of the system is defined to be the lowest element of the spectrum of the operator \(H\) as an operator on \(\mathcal{H}\), i.e., on the wave functions that obey the Pauli exclusion principle. As indicated, this number depends on the number of nuclei, their charges and their positions, and the number of electrons.

The main theorem is now:

**Theorem 1 (Stability of Matter).** The ground-state energy \(E(N, K, Z, R)\) of the system defined by (1)-(3) satisfies the estimate

\[
E(N, K, Z, R) \geq -C(Z)(N + K),
\]

where the constant \(C(Z)\) is independent of \(N, K\) and the position of the nuclei \(R_1, \ldots, R_K\).

This theorem was first proved by Dyson and Lenard [9] and later simplified and considerably improved by Lieb and Thirring [18].

Various extensions of this fundamental result have been investigated. There is a "relativistic" version due to Conlon [6] where \(\tau = \sqrt{p^2 + m^2} - m\), the relativistic kinetic energy. His results were later improved by Fefferman-de La Llave [11] and Lieb-Yau [19]. For a discussion of these results the reader may consult [13] and [15] for a particularly simple approach. The main feature we have to mention is that stability of matter for relativistic systems poses bounds on the fine structure constant \(\alpha\). This constant is a dimensionless combination of the elementary charge \(e\), Planck's constant \(h\), and the speed of light \(c\) and is given by \(\alpha = 2\pi e^2 / hc\) with an approximate value of 1/137.04. It measures the effective strength of the electromagnetic interaction. This constant will recur in the discussion below.

Now let us turn to the recent developments where matter is coupled to magnetic fields and start with some introductory observations. A static magnetic field is a divergence-free vector field in \(\mathbb{R}^3\). We can always find a "vector potential" \(A(x)\) such that

\[
\text{curl} A(x) = B(x).
\]

Clearly, \(A\) is only specified up to a gauge transformation \(A \rightarrow A + \nabla \chi\) for some function \(\chi\).

The electron interacts with the magnetic field through "minimal coupling"; i.e., one replaces the momentum \(p\) by \(p - A\) and hence obtains for the kinetic energy

\[
|p - A|^2,
\]

where the vector potential \(A\), as in the case of a scalar potential, acts as a multiplication operator. Recall that \(p\) is a shorthand for \(-i\nabla\). This Hamiltonian describes the interaction of a charged particle with a magnetic field. For a single particle the addition of a magnetic field leads to a raising of the ground-state energy, as can be seen from the pointwise "diamagnetic" inequality

\[
|\psi(x)\rangle \geq |\nabla |\psi(x)\rangle|.
\]
It was shown in [1, 7] that as a consequence of this inequality the estimate of Theorem 1 holds with a constant that is independent of the magnetic field. In general, the field will lower the energy but not by so much as to violate the bound of Theorem 1. The real dependence of the ground-state energy on the magnetic field is an important physical problem that is not very well understood.

A special case that can be solved explicitly is an otherwise free electron in the \( x - y \) plane that moves in a constant magnetic field \((0, 0, B), B > 0\). The lowest energy state of this problem is given by the function

\[
\psi(x, y) = \left( \frac{B}{2\pi} \right)^{1/2} e^{-B(x^2 + y^2)/4},
\]

with an energy \( B \). For an electron moving in three space the kinetic energy is raised by adding \(-\partial^2 / \partial z^2\), and hence the energy of the electron is again bounded below by \( B \). The wave functions with energies close to \( B \) tend to be localized perpendicular to the field lines.

The spin of the electron introduces an additional complication. The electron behaves to some extent like a magnetized needle; i.e., it has a magnetic moment \( \mu \). The coupling between this moment and the magnetic field is given by \(-\mu \cdot B\). Recall that the wave function of a single electron has spin as an additional variable; i.e., it is an element of \( L^2(\mathbb{R}^3 ; C^2) \). It is convenient to think of it as a "spinor", i.e., a two-component wave function

\[\Psi = \begin{pmatrix} \psi_1 \\ \psi_2 \end{pmatrix} .\]

The "magnetic moment" is now given by the vector \( \langle \Psi, \sigma \Psi \rangle \), where \( \sigma \) are the three Pauli matrices

\[\sigma_1 = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}, \quad \sigma_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \quad \sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\]

and \( \langle , \rangle \) is the standard inner product on \( C^2 \). The part of the energy that describes the interaction of the electron with the magnetic field is given by

\[\tau = |p - A|^2 - \sigma \cdot B = [\sigma \cdot (p - A)]^2 ,\]

which is a positive matrix-valued operator called the Pauli-Hamiltonian.

If we again consider the case where the magnetic field is constant pointing in the \( z \)-direction, we see that the \( \sigma \cdot B \) term cancels the ground-state energy \( B \) of \( |p - A|^2 \). The operator is still positive but considerably weakened. An uncertainty principle measures the cost of localizing the wave function; i.e., strong localization is only possible for large kinetic energies. In the present example we see that the cost of localizing the electron is paid in part by the magnetic field; the kinetic energy measures only localization in the \( z \)-direction.

Our model for bulk matter is now the many-body Hamiltonian given by (1) and (3), with \( \tau \) given by (4). We shall refer to this model as the nonrelativistic model. Its ground-state energy \( E(B, Z, R, N, K) \) will be a complicated function of the magnetic field. A disturbing fact is that by choosing large magnetic fields but keeping all the other parameters fixed, \( E(B, Z, R, N, K) \) can be made arbitrarily negative. According to what was mentioned above this may not come as a great surprise, due to the weakening of the kinetic energy. In fact, it is shown in [2] that for hydrogen in a strong constant magnetic field \( B \) the ground-state energy behaves as \(-\ln(B)^2\) to leading order as \( B \to \infty\).

Matter is constantly surrounded by magnetic fields; in fact, one knows from quantum electrodynamics that the fluctuations of the electromagnetic field are quite large but are apparently of no concern. Certainly it never happens that matter becomes unstable through a spontaneous fluctuation of the field. The energy cost for creating a magnetic field is measured in terms of the field energy given in suitable units by

\[
\frac{1}{8\pi\alpha^2} \int_{\mathbb{R}^3} |B(x)|^2 dx .
\]

It is therefore physically reasonable that the field energy stabilizes \( E(B, Z, R, N, K) \). More precisely, we expect that

\[
E(B, Z, R, N, K) + \frac{1}{8\pi\alpha^2} \int_{\mathbb{R}^3} |B(x)|^2 dx \geq -C(Z)(N + K)
\]

uniformly in \( B \).

Let us emphasize again that the constant \( C(Z) \) should not depend on the number of particles, the position of the nuclei, or the magnetic field.

We usually think of a magnetic field as external; i.e., the magnetic field acting on a piece of matter is produced by some external currents and not by that piece itself. Note, however, that in the above inequalities we did not constrain the magnetic field to be external. Thus one may view the above model as a semiclassical caricature of nonrelativistic quantum electrodynamics, i.e., a "theory" that incorporates the fields as dynamical quantities that fully interact with matter, and (3) amounts to stability of that theory—certainly a first, albeit a small, step toward the full problem with a quantized electromagnetic field.
A surprising fact is that even (5) cannot hold without qualifications; a collapse occurs if $Z\alpha^2$ is large enough. It is instructive to sort this out in the case of a hydrogenic atom [12]. The energy functional for this system is

$$\mathcal{E}(\Psi, A) = (\sigma \cdot (p - A)\Psi, \sigma \cdot (p - A)\Psi) - Z\left(\frac{1}{|x|}\Psi\right) + \epsilon \int_{\mathbb{R}^3} |B(x)|^2 \, dx. \tag{6}$$

Here $\epsilon = 1/(8\pi\alpha^2)$ and $\langle \cdot, \cdot \rangle$ denotes the inner product in $L^2(\mathbb{R}^3; \mathbb{C}^2)$. Recall that $B = \text{curl} A$ and that we minimize over $A$ as well as the spinor $\Psi$. Also recall that we have used (4) to display the interaction of the electron with the magnetic field as a complete square. The catastrophic features of this model come in through the possibility of zero modes of the three-dimensional Dirac equation

$$\sigma \cdot (p - A)\Psi = 0. \tag{7}$$

The point about this equation is that the solution $\Psi$ should be square summable and the field $B$ associated with $A$ should have finite energy. A simple exercise in scaling then shows that if we set

$$\Psi_\lambda(x) = \lambda^{\frac{1}{2}}\Psi(\lambda x)$$

and

$$A_\lambda(x) = \lambda^{-\frac{1}{2}}A(\lambda x),$$

then $\Psi_\lambda$ and $A_\lambda$ still satisfy the three-dimensional Dirac equation (7). If we choose $\Psi_\lambda$ and $A_\lambda$ as trial functions in (6), then

$$\mathcal{E}(\Psi_\lambda, A_\lambda) = \lambda[-Z\left(\frac{1}{|x|}\Psi\right) + \epsilon \int_{\mathbb{R}^3} |B(x)|^2 \, dx],$$

which becomes arbitrarily negative provided

$$8\pi Z\alpha^2 > \frac{8\pi Z\alpha^2}{\int_{\mathbb{R}^3} |B(x)|^2 \, dx \left(\frac{1}{|x|}\Psi\right)}.$$

The following example, discovered in [21], shows that zero modes exist. Set

$$A(x) = \frac{3}{(1 + x^2)^2} \left((1 - x^2)w + 2(w \cdot x)x + 2w \times x\right)$$

and

$$\Psi(x) = \frac{1 + i\sigma \cdot x}{(1 + |x|^2)^{3/2}} \phi_0,$$

where the vector $w$ is given by $w = (\phi_0, \sigma \phi_0)$ and $\phi_0$ is a constant spinor of length one. A straightforward computation shows that (7) is satisfied. The magnetic field $B$ that belongs to $A$ is given by

$$B(x) = \frac{12}{(1 + x^2)^3} \left((1 - x^2)w + 2(w \cdot x)x + 2w \times x\right).$$

The pattern of its field lines is given by the Hopf-fibration on $S^2$ viewed on $\mathbb{R}^3$ via stereographic projection. Thus the field lines are Euclidean circles winding around a family of nested tori.\(^1\)

In physical terminology we see here a breakdown of the uncertainty principle; that is, the kinetic energy does not get large if the wave function is squeezed (although the field energy does, but in an insufficient fashion for $Z\alpha^2$ big enough).

Even if $Z\alpha^2$ is small, another collapse can occur. We give here a heuristic reason that can be turned into a rigorous proof quite easily [17]. The constants we get are not correct but serve the purpose of illustration.

Consider a single electron in a field of $K$ nuclei all having the same charge $Z$. Pick again a field $B$ and a spinor $\Psi$ such that (7) is satisfied—i.e., there is no kinetic energy. For a fixed length scale $L$ the field energy is of the order $(\alpha^2L)^{-1}$, the interaction energy of the electron with the nuclei is of the order $-ZKL^{-1}$, and the repulsive energy of the nuclei is of the order $(ZK)^2L^{-1}$. Thus the total energy is of the order

$$L^{-1}(\alpha^2 - [ZK - \frac{1}{2}\alpha^2 - \frac{1}{4}]).$$

If we forget for the moment that $Z$ is an integer and allow arbitrarily small values for it, we can set $ZK = 1/2$ by choosing a large number of nuclei. If $\alpha$ is larger than 2, then the total energy can be made arbitrarily negative as $L$ tends to zero. We thus see that the smallness of $Z\alpha^2$ and the fine structure constant $\alpha$ are required for stability.

The full estimate (5) was proved by Fefferman [10] for $\alpha$ sufficiently small, and shortly thereafter the following theorem was proved by Lieb, Loss, and Solovej [16]:

**Theorem 2.** Estimate (5) holds provided that $Z\alpha^2 \leq 0.041$ and $\alpha \leq 0.06$. Moreover, if we fix $\alpha = 1/137$, then we have stability for $Z$ up to 1050.

The fact that $Z = 1050$ is far outside the physical range indicates that it is safe to apply perturbation theory for all physically reasonable $Z$'s.

One should emphasize that the above model is of a very rudimentary nature. The electromagnetic field should be quantized; after all, excited atoms can emit radiation spontaneously. The electrons should be treated in a relativistic fashion; after all, in heavy nuclei, electrons acquire relativistic speeds, and the Dirac equation is the true equation that governs a single relativistic electron. Finally, electron-positron pair production can occur that requires the electron "field" to be quantized too. So far a consistent theory of quantum electrodynamics has eluded us. Humbleness requires

\(^1\)See the cover of the May 1997 issue of the Notices for a picture.
that we limit ourselves to caricatures, with the hope that they contain certain features that will persist in the theory to be; here is a recent one due to Lieb, Siedentop, and Solovej [20].

The Dirac-Hamiltonian of a relativistic electron interacting with a magnetic field can be written as

\[ \tau(A) = \alpha \cdot (-i \nabla + eA) + m\beta, \]

with four-by-four matrices

\[ \alpha = \begin{pmatrix} 0 & \sigma \\ \sigma & 0 \end{pmatrix} \]

and

\[ \beta = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}. \]

This operator, which acts on four spinors, has the obvious problem that it is unbounded below, and it is difficult to make sense of the notion of stability in this context.

The following approach due to Brown and Ravenhall [4], also Bethe and Salpeter [5], yields a model of matter that looks reasonable for energies that are below the electron-positron pair production threshold. In this model one restricts the electron wave function to lie in the positive energy subspace of the operator (8). Call this A-dependent Hilbert space \( H_A \), and define the \( N \)-electron space by the antisymmetric tensor product

\[ H_A = \wedge^N H_A. \]

If we denote by \( P_A \) the projection onto \( H_A \) and by \( h_A \) the many-body Hamiltonian given in the usual way by (1) and (3) with the kinetic energy given by (8), then the operator of interest is

\[ H(A) = P_A h_A P_A. \]

The stability problem is now formulated in complete analogy with the nonrelativistic version (5); i.e., we consider the ground-state energy of this system with a fixed field, add the field energy, and ask whether there is a lower bound to this expression that is proportional to the total particle number with a proportionality constant that is independent of the position of the nuclei, the magnetic field, and the number of particles. In fact, since all the terms have the same dimension, the constant better be zero, because otherwise we could drive the energy easily to \(-\infty\) by scaling.

It was proved in [20] that this is indeed the case provided \( Z\alpha \) and \( \alpha \) are small enough.

**Theorem 3.** Define \( \alpha_c > 0 \) to be the solution of

\[ 1 - (\alpha_c/\beta)^2 = (16\pi L\alpha_c)^{2/3}, \]

where

\[ \frac{1}{\beta} = (\pi/2)Z + 2.80Z^{2/3} + 1.30, \]

and \( L \approx 0.06 \). Then \( H(A) \) is stable provided \( \alpha \leq \alpha_c \).

The operator \( H(A) \) is a nonlocal operator, and the dependence on \( A \) is rather worrisome. Note that the operator (10) is not gauge invariant, but rather gauge covariant; the Hilbert-space has to be transformed too.

An alternative would be to repeat the same procedure but to choose as our one-particle Hilbert space the positive spectral subspace of the free Dirac operator, i.e., (9) without the \( A \)-field. Note that formally the kinetic energy operator stays the same, but we have restricted the states in a different fashion. This procedure can be rejected on the grounds that it destroys any form of gauge covariance. But things are worse. It was shown in [20] that for any \( \alpha > 0 \) and for any \( Z > 0 \) there exist \( N, K \) sufficiently large such that \( H(A) \) restricted to the positive energy states of the free operator is unbounded below. Thus the stability criterion decides which of the two possible restrictions is the correct choice.

Where to go from here? The main drawbacks of the above models are that neither the electromagnetic field nor the electron field are quantized. There has been some progress in that direction. In [3] the nonrelativistic model is considered with a quantized electromagnetic field. In order that the theory makes sense, however, the field variables have to be cut off for high momenta. As a result, the stability constant depends on this cutoff.

There is usually a sharp division between mathematical rigor and physical intuition. Exponents of both areas are only too willing to attest to that. The division, of course, is artificial, and the research area that I just described makes a good case for that. We now have a clear picture of why matter is stable, and this has been achieved by a combination of physical ideas and nontrivial mathematical concepts. It has to be emphasized that mathematics is vital to the whole enterprise and is not merely a “rigorization” of physical ideas.

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**References**


To the question often posed to Andrew Wiles in interviews—namely, what fascinated him so greatly in the Fermat conjecture—he seldom refrained from answering by emphasizing the long history of this problem. When I asked him the same question in Boston in 1995, he answered, “Because of its romantic history.” When I then went further and asked him to explain to me in more detail what he meant by romantic, he answered merely, “Because Fermat said he had a proof, but none was found.” That Wiles avoided answering in detail what is so romantic about the history of Fermat’s Last Theorem reflects the fact that he also has a particularly romantic part to play in this story. The first time that I became aware of this was on October 28, 1995, the day after the awarding of the Prix Fermat to Wiles in the Salle des Illustres in the town hall in Toulouse. It was the last true day of autumn, with striking blue skies and temperatures worthy of summer, when Andrew Wiles visited the house in which Fermat was born in Beaumont-de-Lomagne. There he found the people in the highest of spirits on account of his mastering of this ancient enigma, and he was truly the man of the hour in this small relaxed town in the south of France, whose character had scarcely changed since the time of Fermat himself: Andrew had met Pierre.

Wiles also met the romance in the history of Fermat’s Last Theorem on June 27, 1997, in Göttingen, where he was presented with the Wolfskehl Prize by the Academy of Science. Gerhard Frey gave the closing lecture, “On the Fermat problem, the conjecture of Taniyama and the theorem of Wiles”. Since so much nonsense has been written about this prize and also about its donor Paul Wolfskehl, even by respected authors, and taken up blindly by other authors, I now see, through the presenting of this prize and the public awareness that goes with it, the last opportunity to do Paul Wolfskehl and his donation the justice they deserve.

Klaus Barner

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Paul Friedrich Wolfskehl was born on June 30, 1856, in Darmstadt as the younger of two sons to the wealthy Jewish banker Joseph Carl Theodor Wolfskehl (1814–1863). Paul’s mother, Johanna Wolfskehl, was the daughter of the Stuttgart Hofbankier1 Nathan Wolf Kaulla. Paul’s elder sister, Fanny Marie, died in 1855 at the age of only fifteen. His elder brother, the jurist Wilhelm Otto Wolfskehl (1841–1907), took over the bank in 1865 following the death of their father and ran it as an independent company until 1881.

Paul Wolfskehl, on the other hand, studied medicine in Leipzig, Tübingen, and Heidelberg from 1875 to 1880, where he gained his doctorate in medicine, probably in 1880. The theme of his dissertation is unknown, yet a paper by Dr. P. Wolfskehl [29] dealing with the characteristics of horizontal slit-shaped pupils in calves and the corresponding vertical pupils in cats, from the laboratory of the Heidelberg eye clinic, appeared in the Journal of Comparative Ophthalmology in 1882. This could be an excerpt of his thesis. The photo on page 1294 shows Paul Wolfskehl around 1880. It is probable that at this time the symptoms of multiple sclerosis first showed themselves in him. As a physician it soon became clear to him that he would not be able to practice as a doctor in the long term. He then decided, one may presume, due to this handicap, to study mathematics. Mathematics was certainly a subject in which he would be able to work, even if bound to a wheelchair.

Initially he studied in Bonn in 1880 and then switched in 1881 to Berlin. It was there until 1883 that he attended lectures given by, amongst others, the then seventy-one-year-old Ernst Eduard Kummer (1810–1893). Kurt-R. Biermann reports ([5], p. 26) that Kummer did not cease giving lectures until the winter term 1883–1884 at the age of seventy-three. Under the influence of Kummer, Paul Wolfskehl turned to number theory, in particular algebraic number theory. It is obvious that he learned about the Fermat conjecture in this time. It is also a fact that he studied in depth Kummer’s relevant papers. That Kummer succeeded even at this age to arouse interest for number theory and the Fermat problem in his students can also be proved through the activities of another of his pupils from that time ([4]). The Jewish doctor Albert Fleck (1861–1943), who was from Berlin, studied mathematics and physics initially (1881–1885) and medicine later (1886–1891), all at the University of Berlin. Dr. Fleck, blessed with many children, later earned his living as a medical doctor. His free time, however, he devoted to mathematics, in particular to his love for number theory. I shall talk later of the important and highly original role he played in the context of others’ attempts to prove the Fermat conjecture. It is somewhat improbable that fellow students Albert Fleck and Paul Wolfskehl did not know each other personally.


The house where Fermat was born in Beaumont-de-Lomagne—preparations for signing the “golden book” of the town.

On whether Wolfskehl himself attempted to prove Fermat’s Last Theorem we can only speculate, but it is natural to think that this was the case. In his book Mathematical Cranks Underwood Dudley writes ([10], p. 109): “Somehow the eye of Dr. Paul Wolfskehl was caught by the FLT (that Fermat’s Works were published in Paris in 1891 may have had something to do with it), and when he died in 1908 his will provided a prize of 100,000 marks to be given to the first person to prove the theorem.” Disregarding the fact that the year of Paul Wolfskehl’s death is wrongly given, Dudley does not seem to know that Wolfskehl studied in Berlin under Kummer and gave lectures on number the-
ory at the Technische Hochschule\textsuperscript{2} Darmstadt from 1887 to 1890. Erhard Heil reports [14] that Wolfskehl received his habilitation\textsuperscript{3} in Darmstadt in 1887, possibly with the paper [30] from algebraic number theory that is also mentioned in Hilbert's celebrated "Zahlbericht" ([15], p. 227). This, however, seems to me improbable, since this paper is at the approximate level of a Staatsexamensarbeit\textsuperscript{4} and therefore an extremely thin basis for a habilitation, keeping in mind the fact that his doctorate was not even in mathematics, but rather in the field of communication. Paul Wolfskehl's great-nephew, the Diplomphysiker\textsuperscript{5} Otto Wolfskehl, writes in an essay "Vorfahren und eigene Familie"\textsuperscript{6} ([28], p. 146): "His papers caused the Faculty of Sciences at the Technische Hochschule Darmstadt to ask him to give special lectures on number theory." This does not sound like a habilitation, but rather like a lectureship. Admittedly, Paul's brother Otto had, in those years, done great service for the TH Darmstadt. It is perhaps the case that the act of conferring the habilitation was an act of gratitude to the Wolfskehl family.

Through his ever-worsening multiple sclerosis Paul Wolfskehl became increasingly and eventually completely paralyzed, so that by 1890 he had to give up his lectures. In the time that followed he did, however, publish a few brief mathematical papers ([31, 32, 33, 34]). Since he was in need of constant care, his family persuaded the bachelor to marry. An oldish spinster, the fifty-three year old daughter of the Steuerrat\textsuperscript{7} August Frölich, was sought out for him, and he married Susanne Magarette Marie Frölich on October 12, 1903, in Darmstadt. Fate, however, was not on the side of the long-suffering Paul. His wife, Marie, revealed herself as an evil Xanthippe, who made the last years of his life a living hell. In January 1905 he altered his last will and testament in favor of "whomsoever first succeeds in proving the Great Theorem of Fermat." For the correct solution of the prize task he laid down the sum of 100,000 marks and decided that the Royal Society of Sciences\textsuperscript{8} in Göttingen should hold in trust this money and serve as judge for the awarding of the prize. Paul Wolfskehl died on September 13, 1906. His widow lived, rolling in money, together "with an evil maid and an equally evil Doberman"\textsuperscript{9} in the Wolfskehl villa in Darmstadt until her demise on August 18, 1923.

In 1969 Philip J. Davis reported in ([7], pp. 1-6) a strange story about Paul Wolfskehl, which he had learned from the renowned mathematician Alexander Ostrowski. Professor Ostrowski himself, remarks Davis, had heard the story many years before and claimed that there is more to it than mere legend. Since Alexander Ostrowski died in 1986, unfortunately nothing more can be revealed about his source of information. The core of the story reads as follows:

From Kummer to Wolfskehl is not long in time nor far in distance. As a young student of mathematics, Paul Wolfskehl was attracted to the theory of numbers. The theory is pretty and the methods are difficult. The combination appealed to him. Fermat's Last Theorem was in the air, for the sensation caused by Kummer's near miss had not yet settled down. Wolfskehl tried to prove it. He failed. After all, better mathematicians before him had failed. But it nagged him. He went back to it time and again. He read the works of the masters to see what tools they used and what they were able to accomplish. He made no progress with his own attempts.

In the course of this, he formed a romantic attachment to a young lady. He was disappointed there as well. Now that mathematics and romance were both out of the window, he began to feel that life could offer him very little else. He decided to commit suicide. Having made the decision, he went about carrying it out very methodically. He settled his affairs and arranged all important matters. He wrote his will. He fixed upon the method and the very hour of taking his own life. On the last day, he wrote final letters to his friends. Everything was now prepared. A few hours remained till the appointed time. He went into his library, wondering what to do. He took down some mathematical pamphlets from the shelf and fingered them idly.

By pure chance, he opened one of them. It was Kummer's work on Fermat's Last Theorem. As he read the article, he thought he spotted an error in Kummer's work. As a matter of fact, the article begins with a remark that contains a gap in logic. Wolfskehl sat down to check this doubtful point. After all, Kummer was a man with great reputa-

\textsuperscript{2}Institute of Technology
\textsuperscript{3}became qualified as an independent university lecturer
\textsuperscript{4}initial teacher examination thesis
\textsuperscript{5}one holding a degree equivalent to a master's in physics
\textsuperscript{6}"My ancestors and own family"
\textsuperscript{7}title of a senior tax officer
\textsuperscript{8}It was renamed Academy of Science in 1919.
\textsuperscript{9}taken from a letter to the author, from Charlotte Köhner-Wolfskehl, August 1996.
tion, but in the past he had made a very subtle, but crucial, mistake. It was of vital importance to know whether the present argument was correct. One hour passed, two, three hours, while Wolfskehl checked the mathematics. Finally, he was forced to admit that Kummer's argument was completely sound!

When Wolfskehl was through with this job, he reminded himself of his momentous decision to take his own life. But the appointed hour was past. Somehow, he no longer saw the necessity for suicide. From Fermat's Last Theorem had come not only postponement, but a renewed interest in mathematics and a decision to live. He tore up his last letters and his will.

I have since shown the story to members and friends of the Wolfskehl family and people acquainted with their history. Nobody could remember having ever heard of an abandoned suicide plan. Several people were of the opinion, however, that such a plan could well have existed. Paul Wolfskehl is reported to have been incredibly depressed at times due to his serious illness and the foreseeable course thereof. Had he had a motive to commit suicide, then it was rather due to this illness than to lovesickness or lack of success in solving the riddle of the Fermat conjecture. It can be taken for granted that the occupation with number theory and specifically with Kummer's papers played an extremely important role in the last years of Paul Wolfskehl's life. The motive for the founding of the prize for proving the Fermat conjecture probably had less to do, as Davis believes, with Wolfskehl's gratitude to the problem that saved his life, than to the fact that number theory, the only true love in his life, had given his last years some meaning. Perhaps the desire not to leave his entire fortune to his loveless wife, Marie, also had a part to play?

On June 27, 1908, the day exactly eighty-nine years prior to the presentation of the prize to Wiles, the conditions for the Wolfskehl Prize endowment were laid down by the Göttinigen Royal Society of Science. These were published in several journals, for instance in the "Jahresbericht der D MV" 17 (1908), 111-113 (with commentary by Felix Klein); the "Mathematische Annalen" 66 (1909), 143-144; and the "Acta Mathematica" 31 (1908), at the end of the volume. The prize was, according to the testament, to be valid until September 13, 1907. This date has occasionally led to the assumption that Paul Wolfskehl died on September 13, 1908. This is, however, wrong. The date of his death is, according to official documentation, unequivocally September 13, 1906. The contents of the publication of June 27, 1908, are available in the above-mentioned references and do not need to be repeated here. Only two things are to be emphasized: Wolfskehl explicitly refers to the two most important of Kummer's papers [19, 20] regarding the Fermat conjecture, and he also provides for the case that a counterexample to the Fermat conjecture is found. In the case of a counterexample, an acceptable solution must provide a necessary and sufficient criterion for those exponents $A$ for which the Fermat equation is insoluble in natural numbers. The opinion which can occasionally be read, that if a counterexample were found the prize would then become invalid, is therefore erroneous.

There is no shortage of accurate reports and anecdotes regarding the deluge of supposed proofs of Fermat's Last Theorem which have been handed in and are still being handed in to the Göttingen Academy since the publication of the prize conditions. In the first year alone, 621 supposed solutions were sent to the Academy. For many years now, however, the statistics have no longer been kept on file, although the Sekretär of the Academy, the physicochemist Heinz Georg Wagner, estimates the total to be "over 5,000". If the paper received fulfills the formal criteria of the prize conditions, it is then archived in a filing cabinet at the Academy. First, however, it is handed over to the Institute of Mathematics at Göttingen University to be examined, where either one or two Wis senschaftliche Assistenten read it, remark upon the mistakes, and reply to the author. Even today roughly four papers arrive per month. An impressive description of his related activity is given by F. Schlichting in a letter dated March 23, 1974, which Paulo Ribenboim quoted in ([26] pp. 15-16).

Only Schlichting's information that the prize was at that time "worth a little bit more than 10,000 DM" is without doubt false. It could have amounted to some 27,000 DM. The reason behind Schlichting's incorrect estimation lies in the (understand-
The Fermat filing cabinet of the Göttingen Academy.

Some typical pamphlets from the filing cabinet from 1912.

The Fermat filing cabinet of the Göttingen Academy, the consequence of which was that other authors also made incorrect claims regarding the sum. It starts with Eric Temple Bell, who is notorious for his books, which are brilliantly written yet at loggerheads with the facts. As early as 1937 in Men of Mathematics [2] he claims that the inflation after the First World War had caused the Wolfskehl Prize to melt away into a fraction of a pfennig. This sad tale was told again and again. Even Derrick Henry Lehmer wrote in 1961 in the “aftermath” of [3]: “The prize money was never awarded and disappeared in inflation.” In the same vein, Davis reports in 1969 ([7], p. 6): “A disastrous inflation swept away all value to the prize.” Therefore it is no surprise that Dudley assures us in 1978 ([9], p. 136): “Even though there is no longer a prize for the solution, mathematical amateurs still attempt proofs.” Even in the revised version of his number theory textbook of 1988, David M. Burton informs his readers ([6], p. 254) that “… the German inflation of the 1920s wiped out the monetary value of the prize.” Following the appearance of Ribenboim’s book [26] in 1979, word spread slowly of Schlichting’s estimation, and in 1990 Davis “knowingly” reports ([8], p. 199): “… the current prize being fixed at just over 10,000 deutschemarks.” In 1993 Dudley had also noticed something, namely ([10], p. 109): “The prize is now worth only $10,000 or so, but word of that has not gotten around.” The exchange rate of the U.S. dollar against the German mark was at that time rather weak. According to my observations the first realistic sum appeared in Uwe Jannsen’s paper ([18], p. 12): The “Wolfskehl prize”, donated by the “Göttinger Professor Wolfskehl” (ibid, p. 9) “will then, due to interest and compound interest, amount to DM 70,000”. This, indeed would have been the correct sum in 1995. Since the terms of the prize stipulate that a period of two years must pass between the appearance of a proof in print and the awarding of the prize, to allow experts time to review the proof, the prize could have been awarded in 1995 at the earliest, if Wiles’s proof, announced on the 23rd of June 1993, had been correct and had appeared in print in 1993. But, as is well known, the proof contained a gap, which was filled in September 1994 by Taylor and Wiles. The proof was published in May 1995. Finally, in September 1995, when it was as good as certain that the published proof was correct, the Göttingen Academy of Science announced in a press release ([1], p. 2), “that the sum of roughly DM 70,000 could, after all, be awarded.” By the time the Wolfskehl Prize was conferred on Wiles on June 27, 1997, the prize money had increased to DM 75,000.

In 1906 the Wolfskehl Prize amounted to 100,000 (gold-)marks, which at that time could have been exchanged for 35.8423 kg of gold. This would today have a worth of approximately DM 600,000. The relative value of gold before the First World War, however, was, in comparison with other goods, some five times higher than today. That is to say, the prize would have had a purchasing power of about $1,700,000 today. In terms of the then average income, this was much more than a master craftsman could expect to earn in his entire life. The money was laid down in “safe” securities in accordance with Wolfskehl’s will. After the hyperinflation in the Weimar Republic at the beginning of the 1920s, the Reichsmark (RM) was introduced to Germany in 1924 and the remaining value of the Wolfskehl shares set at RM 20,000. Through interest and compound interest the value of the prize rose to RM 75,000 in 1948. This represents an annual interest rate of approximately 5%. With the introduction of the Deutsche Mark (DM) in the currency reform of 1948, the Wolfskehl Prize was devalued by a ratio of 10:1 to DM 7,500. An approximate annual interest rate of 5% meant that the sum of the prize money had increased tenfold in the previous forty-nine years. This is little in comparison with $1,700,000, but a great deal when one considers the common notion that the prize money had vanished. Out of the numerous prizes which Andrew Wiles has received, only the Wolf Prize, sponsored by the Wolf Foundation and presented by Israel’s president Ezer Weizman, has offered a higher reward. Compared with the National Academy of Sciences Award ($5,000) or the AMS Cole Prize in algebra ($4,000), the sum of DM 75,000 is still a nice little earner!
Many derogatory remarks have been written concerning the significance of the Wolfskehl Prize for the development of the Fermat problem specifically and of mathematics generally. It is considered good form for a mathematician who conforms with the perceived image of his profession to emphasize that the prize has done more harm than good to mathematics. On this theme, Oystein Ore's comment of 1948 is typical ([24], p. 207): "The prize probably added little or nothing to the interest of the mathematicians in the problem, but an immediate consequence was a deluge of alleged proofs by laymen eager to gain money and glory. The interest of the dilettanti in the problem has since never quite ceased, and Fermat's problem has without question the distinction of being the mathematical problem for which the greatest number of incorrect proofs have been published." Burton (ibid) and Eves ([11], p. 120) use almost exactly the same formulations. Dudley even brought himself to make the following remark ([10], p. 109): "The main result of Dr. Wolfskehl's prize has been to add to the total of human unhappiness, which is not what he intended."

Admittedly, for the Göttingen Academy of Science the endless flow of incorrect proofs of the Fermat problem was something of a burden, and the Wissenschaftliche Assistenten of the Göttingen University Institute of Mathematics, who on average had one "solution" to analyze per week, had an unenviable task, since many submissions evolved into a brisk correspondence. According to an oral communication from the persons currently concerned with this matter, the record-holding "Fermatist" has to date submitted more than sixty letters to the Göttingen mathematicians. Since the Fermatists like to distribute their "solutions" widely, there is scarcely a single number theorist who, during his lifetime, has not set eyes on a dozen or more pamphlets of this kind. Even in the case of the young Kassel University approximately one "solution" per year is sent in, which then lands on my desk, normally with pretty stamps from China or Kazakhstan.

The Royal Society of Science in Berlin was also especially hard hit after 1908, since numerous Fermatists sent their papers there. The aforementioned Albert Fleck is to be praised highly here for taking on the Herculean labor of examining the articles. Kurt-Reinhard Biermann reports ([4], p. 26): "Not only Göttingen was overwhelmed with 'proofs'. Also in Berlin the mathematical institutions received hundreds of manuscripts on the Fermat problem. There it was Albert Fleck who took it upon himself to look after the works. To every sender he highlighted briefly yet concisely their mistake. He informed the experts about this in Archiv für Mathematik and the public about it pictorially under the title 'Die Jagd nach dem Wolfskehlschen Preise' in the Sunday supplement of the Vossische Zeitung of the 1st of June 1913, in which he also, incidentally, disproved Eugen Dühring's claim of being in possession of the proof." It is also seldom mentioned that it was Dr. Fleck who discovered the fatal error in a well-known and highly regarded mathematician's supposed proof of the Great Fermat Theorem. Carl Louis Ferdinand von Lindemann (1852–1939), who became famous through his 1882 proof of the transcendence of \( \pi \), which Carathéodory characterized as "a highlight amongst the mathematical achievements of modern times," had, as early as 1901, published a flawed proof of the Fermat conjecture [21], which he shortly afterwards withdrew [22]. In 1908 another sixty-six page treatise [23] by

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12'The hunt for the Wolfskehl prize'
Lindemann appeared, in which he newly claimed to have proven the Great Fermat Theorem. Albert Fleck showed him a harsh error on pages 23–24 of his paper, which made everything that followed worthless, as well as a number of less significant inaccuracies [12]. "Here lies a grossly false conclusion which renders the otherwise extremely astute method inapplicable," writes Fleck. He adds at the close of his criticism, with apparent regret: "In this way, unfortunately, even this laborious work has, in none of its parts, led to an effective furthering of the problem."

Dr. Fleck was indeed an amateur, but in no way a dilettante, and I can only agree with the much reviled Marilyn vos Savant when she writes ([27], p. 27): "... I feel that no 'amateur' who ever worked on F.L.T. should be called a crank for that reason alone." I trust myself to add: The ten-year-old boy who visited the Milton Road Lending Library in the north of Cambridge in 1963, and borrowed a book titled The Last Problem [3], the boy who "devoured" this book and decided to become a mathematician in order to solve the "Last Problem" described in the book was also an amateur. The fact that he also studied Kummer's papers during his school years is quite a different matter. Underwood Dudley is of the opinion that "the theorem might never have attracted the attention of amateurs." Had Dudley been right, the Wolfskehl Prize would probably never have been presented by September 13, 2007.

The three Academy members from Berlin and Ordinarien [14] of mathematics—Frobenius, Schottky, and Schwarz—proposed Albert Fleck for the "Silberne Leibniz-Medaille" on January 14, 1914, with which he was presented the following year on "Leibniz Day", July 1, 1915. The laudation, composed by Frobenius, reads [4]: "As an active member of the Berlin Mathematical Society he published an entire series of smaller papers on various number theory problems. In most detail, however, he studied the elementary theory of the Fermat equation and rendered outstanding services through the revelation of the mistakes in countless papers in which laymen had undertaken to prove the Great Fermat Theorem since the founding of the Wolfskehl prize. Through the mastery which this doctor had made his own by diagnosing these unfortunately incurably ill papers, his name became well known to all arithmeticians." Dr. Fleck's "one-man operation" was named the "Fermat Clinic" in mathematical circles in Berlin. "It consisted of Dr. Fleck and his desk; in the clinic, a kind of psychotherapeutic distant treatment was undertaken" [4].

In fact, none of the papers which are kept in the filing cabinet of the archives of the Göttingen Academy have contributed in the slightest to furthering the solution of the Fermat conjecture. For a psychiatrist interested in mathematics, however, they must represent a fascinating wealth of investigation material. Even for the history of elementary mathematics and its advancement in the schools of the world, these entries could be of interest, since they offer a glimpse into the mathematical knowledge of well-educated mathematical laymen from practically every country across the globe over a time span of ninety years. They also offer us an impression of the degree to which the Fermat conjecture is known. For instance, after the conclusion of the East-West conflict and the fall of the Iron Curtain, the number of papers sent in from the countries of the former Eastern Block, whose citizens previously had not been allowed any correspondence with the West, increased sharply. In total they demonstrate impressively how far the tiding of Fermat's Last Theorem penetrated even the most distant corners of the earth.

Without the huge degree of awareness of this open mathematical problem in countless educated mathematical laymen, the enormous world wide resonance of Andrew Wiles's success would be unthinkable. As emphatic a free advertisement for mathematics as this is hardly imaginable. We live in a world where public interest in basic research and the willingness of politicians to finance it is increasingly weak, a world in which the senior writer of Scientific American, John Horgan, proclaims not only "The End of Science" [17] but also "The Death of Proof" [16] and banishes the proof of the Fermat conjecture to outlandishness, calling it a "splendid anachronism". In such a world we mathematicians ought to be thankful for the public appreciation that has come about not insignificantly due to the Wolfskehl Prize.

In this context one should consider that the "mathematical cranks" in the midst of the Fermatists who have been made into a target by Dudley, amongst others, represent only the tip of the iceberg. The proportion of those attempting to find a proof for the Great Theorem of Fermat who rec-
The first traceable Wolfskehl was the cattle dealer Jehuda Löb from the village Wolfskehlen in the Hessische Ried, which today belongs to Riedstadt. After the Thirty Year War he immigrated to Darmstadt. His son, Moses Wolfskehl, like his grandson of the same name, was a butcher. Moses’s son, Pinchas Wolfskehl (died 1783), was a tradesman in Darmstadt; Pinchas’s son, Heyum Wolfskehl, was born in 1776. Heyum Wolfskehl did a salesman’s apprenticeship in Paris and fled from there and from the French Revolution in 1792. Before the turn of the century he founded the Bankhaus Heyum Wolfskehl und Söhne, which existed until 1881. Heyum Wolfskehl (died 1866) also became court banker to the Grand Dukes Ludwig I and Ludwig III from Hessen-Darmstadt and with this entered the circle of the Hofjuden, those financial experts who above all, in the time of Absolutism and in particular in the German princely courts, contributed decisively to the development of the modern system of public finances. Several hoarded great fortunes through high provisions, taxes, fines for late payment, and securities. Heyum Wolfskehl was one of them.

In 1798 Heyum married Karoline Braunfels from Frankfurt, whose nephew was the solicitor Ludwig Braunfels, who also became well known as a poet and one of the founders of the Frankfurter Zeitung. Heyum’s son, Joseph Carl Theodor Wolfskehl (1814–1863), likewise became a banker and played a significant role in the economic life of the town of Darmstadt. In 1839 he married, “as befitted his social status”, Johanna, the daughter of the Stuttgart Hofjude and banker Nathan Wolf Kaulla. Their son, Wilhelm Otto Wolfskehl (1841–1907), the elder brother of Paul Friedrich Wolfskehl, studied law in Heidelberg and Paris. After the premature death of his father, however, Otto had to enter into the banking house of his grandfather. He wed in 1868 Paula Simon, the daughter of the former Hanover Hofjude Israel Simon, who in 1866, when Hanover had become Prussian, moved to Vienna and rebuilt his banking house there. When Paula died from tuberculosis in 1876, Otto Wolfskehl married Lilli Schulz, a pianist and chamber music virtuoso and the daughter of a Hessian colonel.

Otto Wolfskehl was a banker, politician, and friend of the arts. As a long-term member of the Hessian state parliament (1884–1897) and town councillor in Darmstadt (1875–1907) as well as financial advisor to the Grand Duke Ernst Ludwig, he was active in numerous honorary positions for his hometown and did a lot of good through charitable acts and donations. Perhaps his most significant achievement for Darmstadt, however, was the rescuing in 1875–1876 of the Technical College

15 honorary title for a medical doctor of outstanding merit
16 Magdeburg Cathedral School

No other pages available for this document.
in Darmstadt, which was threatened with closure (or relocation to Giessen) and its subsequent conversion into a Technische Hochschule in 1877. Its generous extension in the 1890s was also essentially his doing. In this context it is also worth considering the information that Paul Wolfskehl received his habilitation in Darmstadt in 1887. It seems to me, considering the fact that a habilitation thesis is not known to exist, more plausible to assume that it was a show of gratitude to the Wolfskehl family that the already seriously ill brother of the great patron of the university was given a chance to lecture for a few more years in his favorite field of number theory at the Technische Hochschule. An in-depth portrait of the great Jewish patriot Otto Wolfskehl is given by Eckhart G. Franz in [13], pp. 240-244.

Three children came from Otto Wolfskehl's marriage to Paula Simon: Karl Joseph (1869-1948), Margarethe Stephanie (1871-1904), and Eduard Wolfskehl (1874-1943). The most well-known (with an entry in every encyclopedia) Wolfskehl of all is Karl Wolfskehl. He was a journalist, lyricist, and Germanist and belonged to the circle of poets around Stephan George, to whom he was the most faithful adherent. Karl Wolfskehl lived and worked initially in Munich, fled in 1933 first to Switzerland and Italy and then, in 1938, to Bayswater near London, where he died in poverty in 1939, two in Piaski, and one each in Minsk, and homesickness. The most comprehensive documentation on Karl Wolfskehl is to be found in the anthology [28] which appeared on the occasion of his one-hundredth birthday. Manfred Schlosser's essay in Juden als Darmstädter Bürger (13), pp. 252-258 offers a good overview.

Karl's brother Eduard was a civil engineer and from 1898 Regierungsbauführer and from 1903 Regierungsbaumeister of the Railway Administration in Mainz. Under his leadership the Darmstadt main train station was constructed and brought into service in 1914. After this he left the civil service. During the First World War he was a leading member of the Hessian Red Cross. Eduard Wolfskehl lost his life in the Frankfurt-Heddernheim concentration camp in 1943.

The documentary volume [13] includes the widely branching genealogical table of the Wolfskehl family of Darmstadt. All other Jewish members of this family who had not emigrated by 1939 were killed in concentration camps: five in Auschwitz, two in Piaski, and one each in Minsk, Riga, and Theresienstadt. In Darmstadt the only reminders of the great Jewish patriots and benefactors Wolfskehl are a street, Wolfskehlstrasse, and a public park laid out by the family itself, the Wolfskehl'sche Garten.

The appalling crimes against the descendants of this family, in my mind's eye, puts the prize, endowed by the unfortunate Paul Wolfskehl, in a different light. As early as the end of the nineteenth century these future events had already announced themselves, even in Hessen-Darmstadt. Due to constant anti-Semitic attacks against his person, Paul's brother gave up not only his position as vice-president but even his seat in the state parliament. Persecution and humiliation of the extent that the Jewish doctor Albert Fleck had to endure were at least spared Paul Wolfskehl as a result of his untimely death. "If one day the Fermat problem is finally resolved," wrote Kurt-R. Biermann in 1987, "and one writes the history of its overcoming, the name Albert Fleck cannot be left out." One may well add: and neither the name Paul Wolfskehl.

References


[19] Ernst Eduard Kummer, _Allgemeiner Beweis des Fermatschen Satzes, dass die Gleichung_ \( x^3 + y^3 = z^3 \)

_durch ganze Zahlen unlösbar ist, für alle diejenigen_ \( \lambda \), welche ungerade Primzahlen sind und in den Zählern der ersten \((\lambda - 3)\)


[20] __, Einige Sätze über die aus den Wurzeln der Gleichung_ \( \alpha^3 = 1 \)

_gebildeten komplexen Zahlen, für den Fall, dass die Klassenzahl durch \( \lambda \) teilbar ist, nebst Anwendung derselben auf einen weiteren Be­


[22] __, _Ueber die Gleichung_ \( x^n = y^n + z^n \), Sitzungs­

_ber. der Akad. der Wiss. München Jg. 1901 31 (1902),

495.

[23] __, _Über das sogenannte letzte Fermatsche Theo­

rem_, Sitzungsber. der Akad. der Wiss. München Jg. 1907 37 (1908), 287-352.


[25] Alf van der Poorten, _Notes on Fermat's Last The­


[26] Paulo Ribenboim, _13 lectures on Fermat's Last The­


[28] Manfred Schlösser and Erich Zimmermann, _Carl

Wolfskelh 1869-1969_, Leben und Werk in Dokumen­

_ten, Agora, Darmstadt, 1969.

[29] Paul Wolfskelh, _Ueber Astigmatismus in Thieraugen

und die Bedeutung der spalt-förmigen Pupille, Zeitschrift für vergleichende Augenheilkunde 1

(1882), 7-16.

[30] __, Beweis, dass der zweite Factor der Klassenzahl

für die aus den eiften und dreizehnten Ein­

heitswurzeln gebildeten Zahlen gleich Eins ist, J.


[31] __, _Réponses. 1636 (1899,243), L’intermédiaire
des mathématiciens 7 (1900), 254.

[32] __, _Über eine Aufgabe der elementaren Arith­


[33] __, _Über einen Satz von Hermite in (3) 1, 25, Arch.
der Mathematik und Physik 4 (1903), 179.

[34] __, _Österreichung nach gregorianischem Kalen­
der_, Arch. der Mathematik und Physik 4 (1903), 350.
Fermat's Enigma

Reviewed by Allyn Jackson

Fermat's Enigma: The Epic Quest to Solve the World's Greatest Mathematical Problem
Simon Singh
Walker and Company, New York
$22.00 hardcover
288 pages

Despite the increased interest in Fermat's Last Theorem since Andrew Wiles announced his proof in 1993, there have been few popular books on the subject. In the months immediately following his announcement, one book capitalized on the moment: The World's Most Famous Math Problem, by newspaper columnist Marilyn vos Savant. That book suffered from many problems, the worst being a woefully wrong-headed attempt to discredit Wiles's proof. The only other popular book to appear in the U.S. was fortunately much more serious. Fermat's Last Theorem: Unlocking the Secret of an Ancient Mathematical Problem by Amir D. Aczel, an associate professor of statistics at Bentley College, was published in 1996 by Four Walls Eight Windows. The book received favorable reviews in the popular press (for example, see the New York Times review, available at http://www.nytimes.com/books/home/) and was for a short time distributed by the AMS. However, complaints about some mathematical inaccuracies in the book led the Society to stop selling it. (A review of this book will appear in a future issue of the Notices.)

Another popular book about Fermat will appear in bookstores this month. On October 28 Walker Books will publish Fermat's Enigma: The Epic Quest to Solve the World's Greatest Mathematical Problem by Simon Singh. The publication is timed to coincide with the broadcast in the United States of The Proof, a BBC documentary about Fermat's Last Theorem directed by Singh. (Those interested in seeing the program should consult their local public television stations for broadcast times or check the Public Broadcasting System Web site, http://www.pbs.org/. The program was reviewed in the Notices by Andrew Granville, January 1997, pages 26-28.)

Wiles's proof, which makes use of some of the deepest and most technically difficult mathematics of the twentieth century, presents a formidable challenge to any nonexpert who would write about it. Singh, who has a Ph.D. in particle physics from Cambridge University, has done an admirable job with an extremely difficult subject. He has also done mathematics a great service by conveying the passion and drama that have carried Fermat's Last Theorem aloft as the most celebrated mathematics problem of the last four centuries. The book landed in the #1 spot on the bestseller list of the Times of London, proving that "useless" mathematics can have a primal fascination for people.

The book begins with a brief look at that historic day, June 23, 1993, when Wiles delivered the last of his three lectures about the proof at the Isaac
Newton Institute in Cambridge, England. He concluded by writing Fermat's famous statement on the blackboard and saying, "I think I'll stop here"; those words provide the title for the first chapter. Singh then largely leaves Wiles behind and goes into five chapters' worth of history about Fermat's Last Theorem. His discussion of the life and work of Pythagoras makes for absorbing reading and offers the opportunity to fix in the reader's mind the idea of proof, using simple examples such as the Pythagorean theorem. Singh has a knack for ferreting out interesting historical tidbits and portraying colorful personalities. However, at times the book is unclear about what is fact and what is not. For example, Singh writes that there are no first-hand accounts of Pythagoras's life and work, and yet a few pages later one finds what is purported to be a direct quotation of Pythagoras. A sentence about the origin of the quotation would have been helpful.

There are other problematic moments in the book. In discussing the deep connection that the Shimura-Taniyama conjecture proposed between the world of elliptic curves and that of modular forms, Singh comments on the way that such "bridges" in mathematics help mathematicians in different areas to share insights. "Mathematics consists of islands of knowledge in a sea of ignorance," as he eloquently puts it. Caught up in the imagery, he carries it too far: "The language of geometry is quite different from the language of probability, and the slang of calculus is meaningless to those who speak only statistics." Not only does this statement err in implying that statisticians do not know calculus, it also implies that calculus and geometry are distinct fields. Under some interpretations, geometry could be said to encompass calculus.

Such small problems occur throughout the book, but Singh is such an enthusiastic guide that it is easy to forgive them. The best parts of the book intertwine history, personalities, and mathematical ideas. Especially effective is the discussion of Euler's work with complex numbers, which brings a sense of naturalness and inevitability to an idea that can seem strange and arbitrary. Singh is equally effective in getting across the difficult notion of different "sizes" of infinity, especially in his appeal to the device known as "Hilbert's Hotel". Some of the digressions—such as the description of public-key cryptography and Gödel's work on undecidable statements—demonstrate the way that mathematics has influenced nearly every aspect of human endeavor.

The book handles elementary mathematical ideas well, but becomes increasingly vague as the material becomes more sophisticated. When it comes to elliptic curves, Singh does a good job getting at the idea of the $L$-series (which is defined in terms of the number of solutions to the elliptic equation mod $p$, for every prime $p$), though I think it is not especially helpful that he decides to call it the $E$-series instead. (One needs to keep in mind that the series discussed in the book are power series, although the book treats them essentially as numerical sequences consisting of the coefficients of the power series.) He has found a wonderful way to communicate the importance of this series: "In the same way that biological DNA carries all the information required to construct a living organism, the $E$-series carries the essence of the elliptic equation."

Not surprisingly, such compelling imagery gets progressively rare as the book wades into the deeper waters of Galois theory, modular forms, Iwasawa theory, and the other ingredients of Wiles's proof. Despite a spectacular description of the life of Galois and an attempt to describe his work, the book leaves the reader with little understanding of the power and elegance of Galois theory as it blossomed after its creator's death, and there is little indication of the role it played in Wiles's work. Modular forms are a struggle: Singh talks about their "inordinate level of symmetry," but never gets sufficiently specific and vivid to give the reader something to carry in mind for the rest of the book. He creates more of his own terminology for modular forms: the series that defines a modular form, which mathematicians might call the Dirichlet series or the $L$-series of the form, Singh dubs the $M$-series. The book does not say much about this series, except to say that it is the list of "ingredients" of the modular form and to liken it also to DNA.

Despite the difficulty of explaining these technical points, the discussion of the roots of the Shimura-Taniyama conjecture is the best part of the book. Yutaka Taniyama's assertion of a connection between modular forms and elliptic curves perplexed mathematicians because it was so far ahead of its time. After Taniyama's tragic death in 1958, Goro Shimura took Taniyama's brilliant but unfinished ideas and built them into what is now generally known as the Shimura-Taniyama conjecture, which says that the $L$-series of an elliptic curve can be paired with a modular form. This story has more poignant drama than many of the other historical tales in the book: Singh clearly benefited from having Shimura as a primary source. Indeed, from that point on many present-day characters—Ken Ribet, Barry Mazur, John H. Conway, John Coates, and of course Wiles himself—feature prominently.

As the book explains it, Wiles's strategy for proving the Shimura-Taniyama conjecture is to use induction on both the set of elliptic curves and on the set of modular forms—a sort of "double" induction. There is a clever discussion of proof by induction, which is likened to toppling dominoes by knocking over the first one and then proving that if the $n$th one goes over, all the rest will fol-
The University of Canterbury invites applications for the above tenured position. The appointee must possess a strong continued record of internationally recognised research in any branch of Pure Mathematics and will be expected to provide academic leadership and participate actively in the affairs of the Department. Applicants should have a strong background in both undergraduate teaching and postgraduate supervision as well as senior administrative experience. The minimum qualification on appointment is the Ph.D. degree or equivalent. Current research areas within the Department include classical analysis, approximation theory, combinatorics, finite geometry, Fourier analysis, functional analysis, global optimization, non-commutative algebra, partial differential equations, potential theory and topological geometry.

The title of Professor is the most senior academic rank in New Zealand universities. The salary for Professors is within the range NZ$85,000 to NZ$105,000 per annum, which is in the top 2% of salaries for New Zealand.

Applications close on 31 January 1998.

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Mathematicians and the Market

Geoff Davis

Introduction
Young mathematicians have been facing dismal job prospects throughout the nineties. The fall unemployment rate for new Ph.D.s in the U.S., as measured by the AMS-IMS-MAA Annual Survey (Second Report), rose from 2.5% in 1990 to a peak of 13.2% in 1994.¹ Unemployment rates have fallen moderately since to the current level of 9.5% in 1996. This is not the first time that labor market problems have plagued mathematics. The early seventies saw a similar situation. The Ph.D. glut of the seventies had far-reaching consequences. It led to drastic cutbacks in funding for graduate education from which it took nearly fifteen years to recover. The effects of the present labor market woes are already visible and dramatic, and they will certainly be damaging to mathematics in the long term. As I document below, the high unemployment rates facing recent Ph.D.s are only the tip of the iceberg.

A variety of external factors have contributed to the present situation. Changes in funding levels, recent immigration legislation, and the finances of higher education have all played a role in the present problems faced by Ph.D.s. It is all too easy to blame outside forces beyond our control for our troubles, however. The truth is that we in the mathematics community share the responsibility for the current employment crisis. Our community has dramatically expanded production of Ph.D.s without questioning whether there was sufficient demand for our product. Even after five years of serious and sustained employment problems, we have done little to adapt to the changes in the market for mathematicians.

Our community has failed to provide answers to the problems facing recent graduates. What is more, after five years we have barely begun to ask the right questions in a systematic way. What are the effects of the current labor market problems on the mathematics community as a whole? What forces have contributed to these problems? What are effective remedies? I address each of these questions below, providing partial answers when data exist and pointing out the key gaps in our current understanding. I conclude by describing some specific steps that the mathematical societies can take to improve the current labor market situation for mathematics Ph.D.s.

How Have Employment Problems Affected the Mathematics Community as a Whole?
The high unemployment rate for new Ph.D.s in the fall after graduation is a familiar fact in our community. However, the current labor market problems have had pernicious effects on all levels of mathematics, and these are considerably less well known. I first examine these effects to show just how damaging the labor market problems have been.

¹ The unemployment rate reported in the Notices is biased downward because it excludes non-U.S. citizen Ph.D.s looking for work in their country of citizenship. We describe in the article a method for correcting this problem. All numbers come from the Annual Survey, Second Report, unless otherwise noted.

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NOTICES OF THE AMS

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Unemployment and Underemployment

Consider the unemployment information presented in the AMS-MAA-IMS Annual Survey. The 8.1% unemployment rate reported for 1996 is an important measurement, but it hides as much as it reveals. First of all, the Annual Survey figures systematically underestimate total unemployment rates by not taking into account a substantial fraction of the unemployment among new Ph.D.s residing outside the U.S. The number of doctorates still seeking employment reported in the Notices excludes non-U.S. citizen Ph.D.s looking for work in their country of citizenship. We make the simplifying assumption that nearly all unemployed Ph.D.s are residing either in the U.S. or in their country of citizenship, i.e., we assume that the reported still-seeking-employment number is the number of unemployed Ph.D.s looking for work in the U.S. We obtain a more relevant U.S. unemployment rate of 9.5% by computing the ratio of unemployed doctorates in the U.S. to the total number of doctorates known to be in the U.S.[1].

The reported unemployment rate is distorted by a second factor as well. Some departments provide a form of welfare for Ph.D.s, offering temporary positions to graduates who are unable to find work elsewhere. It is not known how widespread this practice is, but the fact that nearly one quarter of Ph.D.s hired by U.S. doctoral-degrees-grant-were in 1996 (6.5% of all Ph.D.s known to be in the U.S.) were hired by the departments that granted them their degrees is telling. Furthermore, 3.8% of the employed Ph.D.s were working part-time, with at least 20% of these part-time employees still looking for full-time work. Even in the improved conditions of 1996, on the order of 16% of Ph.D.s in the U.S. were either unemployed, working less than they would like, or working for the same institution that granted them their degree.

The decrease in the U.S. unemployment rate from 12.8% in 1995 to 9.5% in 1996 is certainly encouraging. However, the simplest explanation for the fact that 38 fewer Ph.D.s were still looking for work in the U.S. in the fall of 1996 than in 1995 is that there were 73 fewer Ph.D.s granted in 1996 than in 1995.

Little is known about what happens to Ph.D.s beyond the first year after obtaining their degrees. The AMS conducted a study of the employment status of the class of 1991 two years after they obtained their degrees [2]. In the fall after their graduation, 6.1% of the 1991 Ph.D.s in the U.S. were unemployed. Those who obtained short-term positions had a much harder time during their second round of job seeking. Of the 1991 Ph.D.s employed in U.S. academic institutions who changed jobs, 20% were unemployed in the fall of 1993. There has been no follow-up on this disturbing finding.

Erosion of Opportunities

One hundred seventy-five years ago economist David Ricardo observed, "Labor is dear when it is scarce and cheap when it is plentiful." Not surprisingly, an 8% decline in real 9-month teaching and research salaries for new Ph.D.s has accompanied the increase in Ph.D. supply between 1989 and 1996. Moreover, a more subtle change is occurring. There is a hidden downward trend in total compensation for new Ph.D.s that is occurring as the types of jobs held by new Ph.D.s change. New Ph.D.s in academia are increasingly employed as temporary rather than tenure-track employees. Between 1990 and 1995 the number of full-time non-tenure-eligible faculty in traditional math departments (Groups I-III) increased by 37%. At the same time the number of tenure-track faculty fell by 27%. Temporary faculty now comprise 56% of all
nontenured faculty in traditional math departments [3].

In addition to having no job security, temporary workers receive fewer benefits than tenure-track employees do. Furthermore, temporary employment delays entry onto the tenure-track salary ladder. Each year on postdoctoral-level wages delays the transition to assistant professor salary levels by one year and results in one less year as a full professor. Thus, total lifetime earnings of new doctorates have been depressed.

An increase in the amount of time required to earn a Ph.D. represents a second form of reduction in lifetime earnings. National Research Council
data show that the median time to degree for math Ph.D.s\(^2\) has increased from 6.5 to 8.0 years between 1982 and 1993 [4]. The current Ph.D. over-supply aggravates this problem by providing strong incentives for students to remain in graduate school for longer and longer periods of time in the hope that additional time for research will make them more marketable.

At present no information is available on the average amount of time that new doctorates spend in temporary positions. Little is known about average total compensation for postdoctoral researchers or the effect of temporary positions on the time to tenure. Such information is essential for obtaining a true measure of the health of the profession.

**Declining Enrollments**

The opportunity costs of graduate school have become increasingly difficult for prospective students to justify as the prospects and compensation for Ph.D.s decline and the time to degree increases. The median salary this year for new math Ph.D.s in 9-month teaching and research positions, the most common type of academic position held by new Ph.D.s, is $36,000. This is less than the $37,500 to $41,400 starting salaries commanded by 1996 bachelor’s degree recipients in electrical, computer, or chemical engineering [5]. To our most talented students the mere $6,000 difference in starting salary over that for mathematics bachelor’s degree holders [5] does not make a strong economic case for years of intensive postbaccalaureate training amidst deteriorating employment conditions.

There is considerable evidence that labor market considerations play a strong role in determining educational and career choices for young people. In the words of Ed David, author of the David Reports, “That [mathematics education is one of the best preparations for almost any career] may very well be true, but the students must believe that, or we won’t have any students. And at the moment they don’t appear to believe it.” [6] A recent AMS study bears this out. Applications to graduate programs in mathematics fell by 30% between the fall of 1994 and the fall of 1996 [7]. Moreover, the number of first-year full-time graduate students in traditional math departments (Group I, II, and III schools) declined by roughly 23% between 1991 and 1996 [1]. The students we are losing are those with sufficient breadth of talent to pursue other opportunities. We are driving out intellectual diversity at precisely the time we need it most.

An anecdote of Harvard labor economist Richard Freeman puts these trends into perspective. Freeman was invited to speak to the physics department at the University of Chicago during the height of the physics employment crisis in the seventies. He writes,

> When I finished the presentation, the chairman shook his head, frowning deeply... "You've got us all wrong," the chairman said gravely. "You don't understand what motivates people to study physics. We study for love of knowledge, not for salaries and jobs." "But..." I was prepared to give... arguments about market incentives operating on some people on the margin, when the students—facing the worst employment prospects for graduating physicists in decades—answered for me with a resounding chorus of boos and hisses. Case closed. [8]

What Freeman does not mention is his response to assertions such as those made by the chairman, something to the effect of, “Terrific. If that’s true, a 5% voluntary pay cut by senior scientists should be enough to prop up the market for entering physicists.” This may have made his point [9].

**Loss of Departmental Autonomy?**

University administrators are under considerable pressure to cut costs in the current climate of fiscal retrenchment in academia. In the past, cost-cutting mechanisms such as departmental downsizing, faculty wage freezes, and increased teaching loads have carried with them the risk of the loss of top faculty members and the inability to recruit new talent. Might long lines of talented, inexpensive, and job-hungry new doctorates standing ready to fill any available position embolden institutions to employ such measures? The recent actions by the Regents of the University of Minnesota regarding tenure and by the University of Rochester to eliminate their mathematics doctoral program are certainly suggestive.

**What Forces Have Contributed to the Present Labor Market Problems?**

The current job crunch for math Ph.D.s has two basic causes: a rapid increase in supply accompanied by a large decrease in demand. Both are important for understanding the present situation.

**Increased Supply**

In 1985 769 mathematics Ph.D.s were conferred. Ten years later that number had grown to 1,226, an increase of nearly 60%. The factors influencing departmental determinations of Ph.D. production levels have been examined in a series of faculty interviews conducted by William Massy of the Stan-

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2 The NRC measure of time to degree is the total number of years between starting graduate study and obtaining a Ph.D. This number includes time spent in masters programs at institutions other than the doctoral granting one as well as time off from graduate study.
ford Institute for Higher Education Research. Massy and co-author Charles Goldman report that

...faculty express concern about the labor market for Ph.D.s and will do what they can to place their own students—but their concern does not lead to adjustments in doctoral student intakes. Faculty tend to believe that more scientifically-trained manpower is better than less, and that job opportunities will materialize somehow. In any case, the department’s short-run requirements for inexpensive research and teaching labor, and the desire of faculty to replicate their own skills, is of stronger relevance to admissions decisions than the more abstract and distant concept of labor market balance.

[10]

Massy and Goldman found that the primary factors used to determine Ph.D. program size are the number of faculty advisors available, the number of teaching assistants needed for staffing classes, the amount of research money available for funding assistantships, and the quality of the applicant pool. The recent increase in Ph.D. production has been driven by increases in two of these factors: funding levels and the size of the foreign applicant pool.

• Increased Funding for Graduate Education

Federal support for the mathematical sciences increased by 34% in constant dollars between 1984 and 1989 following the release of the David Report [11] in 1984. A substantial fraction of these new resources was used for funding graduate education [12]. The David Report sought to reinstate funding for graduate education that was cut during the Ph.D. job crisis of the seventies. Ironically, in so doing it has contributed to a repetition of the oversupply of Ph.D.s that led to the loss of funding in the first place.

• Increased Immigration

A sizable increase in the foreign student population has also contributed to the expansion of Ph.D. production. The number of Ph.D.s granted to noncitizens nearly doubled between 1985 and 1995, and this increase has accounted for roughly two-thirds of the growth in Ph.D. production over this time period. The presence of a large foreign student population in and of itself is no cause for concern. Indeed, a wide variety of international educational exchange programs have been designed to build ties between the scientific communities in the U.S. and other countries, to promote cultural exchange, and to provide valuable training to the scientific work force of less developed countries. Foreign exchange students who leave the U.S. after graduation have no impact on the U.S. labor market. The relevant question here is not how many noncitizen Ph.D.s are granted, but how many of these students remain in the U.S. after graduation.

The Annual Surveys do not provide data on the postgraduation statuses of noncitizen doctorates. However, we can obtain a lower bound on the number in the U.S. in the fall after graduation by assuming that all new Ph.D.s known to be outside the U.S. are noncitizens. Figure 4 below compares the number of noncitizen Ph.D.s granted each year to the number of Ph.D.s known to be outside the U.S. in the fall after earning their degrees. At least 44% of noncitizen Ph.D.s were known to be in the U.S. in the fall after graduation in 1985. In contrast, the 1995 figure was 67%. Although the number of Ph.D.s granted to noncitizens has increased substantially over the past decade, the total number of new Ph.D.s employed outside the U.S. has remained nearly constant.

The influx of foreign Ph.D.s does not appear to be the sudden result of one-time political events such as the breakup of the Soviet Union and the post-Tiananmen Square exodus from China. On the contrary, as Figure 4 shows, the increase in the graduate noncitizen population has taken place gradually since the early eighties, well before these events. The Immigration Act of 1990 contains provisions, included at the behest of such organizations as the Association of American Universities to counteract projected Ph.D. shortages [13], which give university employers special privileges in hiring noncitizen faculty members. This legislation may well have contributed to an increase in immigration. Our community needs to better under-

![Figure 4. Estimated post-graduation addresses of non-citizen Ph.D.s. All Ph.D.s known to be outside the U.S. after graduation are assumed to be non-citizens (Annual Survey, Second Report).](image-url)
stand these trends if we are to bring Ph.D. supply in line with demand, and we need to examine their long-term implications.

- **The Quest for Prestige?**

  Data collected by the National Research Council (NRC) show that perceived program quality, as measured by NRC faculty quality ratings, is strongly linked with program size [4]. Out of seventeen objective departmental criteria measured, the study found the quantity most strongly correlated with perceived faculty quality was a measure of annual Ph.D. production ($r = 0.73$). The correlation between faculty quality and the total number of students in the program is also relatively large ($r = 0.63$). The precise reason for this link is unknown. Perhaps a large program size, a "critical mass", is necessary to attract high-quality faculty members. Having graduate students is viewed by faculty as a necessary condition for research productivity (and therefore program quality), and as a result faculty express strong resistance to the idea of decreasing enrollments within their own programs [10]. Alternatively, perhaps having high faculty quality leads to expansion through increased access to grant money for funding students. In either case, the link between program size and perceived quality suggests that the drive for increased program quality may result in a system-wide tendency to expand Ph.D. production regardless of job market conditions.

**Decreased Demand**

- **Decreased Funding for Faculty Positions**

  While the supply of Ph.D.s continued to increase through the early nineties, demand fell. The number of positions offered in math departments declined by a third between 1989 and 1994. Much of this decrease can be attributed to rapidly rising costs for higher education accompanied by cuts in government funding during that time period. Combined federal and state support for public higher education fell by 8.8% between 1980 and 1993. Federal support for private institutions fell by 4% during the same period [14].

  The science community tremulously follows every nuance of the annual National Science Foundation (NSF) budget negotiations. To be sure, these negotiations are important ones: NSF funding levels determine the availability of research assistants, summer salaries, and the speed of our computers. Even more important to our community is the financial health of the overall higher-education system, yet to this central issue we pay relatively little attention.

- **Faculty Demographics**

  Examination of the age distributions of mathematics departments shows a demographic bulge due to the large cohort of mathematicians hired during the late sixties and early seventies [15]. The presence of this large cohort of mathematicians in their late fifties and early sixties, the recent elimination of mandatory retirement, and the current reduced hiring of junior tenure-track faculty all suggest that mathematics departments are aging. What are the effects of these shifting demographics? In a recent book, Professor Andrew Hacker puts it bluntly: "Every full professor who refuses to retire is preventing several young scholars from beginning their careers." [16] We need to understand how departmental demographics are evolving and what the consequences of any changes will be.

**Delayed Market Feedback**

Why have market forces not corrected the present job market problems? Market forces do appear to be in operation: first-year enrollments in graduate programs have fallen substantially since the current job market woes began. The problem is one of timing. There is a lengthy delay between changes in first-year enrollments and the resulting changes in the Ph.D. supply. This type of delayed feedback system, called a "cobweb supply model", is commonly used in economics for studying markets for agricultural commodities [8]. The result of the delay is oscillatory behavior in the system. When market conditions are good, enrollments increase. Many years later these increased enrollments lead to an oversupply of Ph.D.s. The resulting poor market causes enrollments to fall, which leads to shortage conditions years later, and so on.

The period of the oscillation that results from the delayed feedback system is twice the amount of time between the decision to attend graduate school and the completion of a doctorate. Estimates of the median amount of time required to obtain a doctorate in mathematics range from 6.9 years [17] to 8.0 years [4]. There is an additional lag since the decision to attend graduate school must be made at least a year before enrollment to allow time for applying to schools. Hence this delayed feedback model predicts an oscillation in Ph.D. supply with a period of roughly 16 to 18 years. This is consistent with recent history: the Ph.D. supply peaked in the early seventies, bottomed out in the mid-eights, and peaked again in the early nineties.

**First Steps Toward Solving Our Chronic Labor Market Problems**

**Assessing Supply and Demand: A "State of the Union" Report for Mathematics**

The discussion above suggests that an important factor in the current labor market problems is the way the supply of doctorates is currently regulated. The mathematical societies do not have the power to impose production quotas. Even if they did, such quotas would most likely create many more problems than they would solve. An important
step that the societies can take instead is to provide sufficient information for prospective students, departments, and funding agencies to make more rational decisions regarding enrollments.

1. The mathematical societies should commission an annual report that analyzes trends affecting the supply of and demand for Ph.D.s five to ten years into the future.

If departments, students, and funding agencies are to make rational enrollment and funding decisions, they will need information about anticipated market conditions. The societies can help all three parties to make informed choices by providing an annual report outlining major trends affecting the supply and demand for Ph.D.s. This report should include a discussion of the effects of current and proposed legislation, demographic changes, political events abroad that affect immigration, trends in industry, and so on. The effort in preparing the report could be shared with scientific societies in other disciplines.

The report should be supplemented with projections of Ph.D. supply and demand. The time frame of the projections should be such that prospective students will have an idea about market conditions at the time of their graduation. Projecting supply over such a limited time frame is relatively straightforward given up-to-date information on current enrollment levels, attrition rates, and time to degree. Given the relatively strong historical correlation between the supply of Ph.D.s and the unemployment rate (r = 0.82), it is likely that supply estimates would prove to be quite valuable in assessing future market conditions.

Projecting demand is much more difficult than projecting supply. The point, however, is not to provide a perfect forecast, but rather to provide informed estimates of the effects of various demand-side forces. For example, an estimate of the effects the recently passed five-year, $48 billion dollar tax incentive package for higher education will have on the demand for Ph.D.s in research-intensive versus teaching-intensive institutions [18] would be quite valuable in assessing the need for training in teaching skills. The societies should draw upon outside expertise, especially that of labor market economists, in assessing the market conditions that will face new doctorates.

1(a). All analyses of supply and demand should be formulated in conjunction with a stringent review process to avoid potential conflicts of interest.

The notion that the supply of and demand for scientists and mathematicians can be predicted at all has been called into question by an infamous NSF study that projected a cumulative shortfall of 567,000 scientists and engineers between 1991 and 2006 [19]. A follow-up article by one of the study’s authors predicted a cumulative shortfall of 153,600 science and engineering Ph.D.s between 1995 and 2010 [20]. Despite strong criticism of the study’s methodology from experts both inside and outside the NSF, the study was broadly distributed to policymakers. Howard Wolpe, chairman of a 1992 congressional investigation into the release of the study, writes, “In 1987 the NSF adopted a plan to double its budget in five years. There is no doubt in my mind that this shoddy science was knowingly disseminated by the federal government’s premier scientific agency to further the attainment of this goal.” [21] Wolpe’s subcommittee found that criticism of the study “was ignored and even suppressed within the Foundation... The NSF publications office...prevented the study from being printed as an official NSF document for over two years because of questions about credibility, until the director finally forced its publication.” [22] The lesson to be taken from the NSF study is not that the future is completely unforeseeable. Rather, it is that great care must be taken in light of the potential for serious conflicts of interest involved in projecting Ph.D. supply and demand.

1(b). The mathematical societies should re-evaluate the type of information collected in their annual departmental surveys. They should update assessments of future supply and demand regularly as new data become available.

In 1990 the David II Report [12] recommended substantial expansions in mathematics Ph.D. production just months before the bottom fell out of the job market for new Ph.D.s. The report justified its recommendations using projections made by Bowen and Sosa [23]. The trouble with the Bowen and Sosa projections is that although they were carefully constructed and well documented, they relied on data and assumptions that were out of date. Several assumptions about Ph.D. production rates and immigration levels used by Bowen and Sosa were clearly wrong by the time of the David II Report’s release. For example, the 1987 Ph.D. production figures used for projecting future Ph.D. supply were old data, reflecting enrollment decisions made some five to eight years earlier. First-year graduate enrollment figures reveal future changes in Ph.D. supply much more quickly than do graduation numbers. Had Bowen and Sosa had access to such enrollment data, their projections for the nineties may well have been quite different.

The lesson is that assessments of supply and demand need to be made on an ongoing basis, and these assessments should be revised as new information becomes available. Projections of future market conditions will require much more detailed data on attrition rates, time to tenure, departmental demographics, and the hiring of noncitizen doctorates than is currently collected. The societies should determine the data needs of supply and demand models and should adjust their data gathering accordingly. These data should be made
public to facilitate research on the labor market for scientists.

Assessing Program Effectiveness

The oversupply of Ph.D.s is not the only problem facing recent doctorates as they seek employment. A recent Board of Mathematical Sciences study of graduate programs found that "Many doctoral students are not prepared to meet undergraduate teaching needs, establish productive research careers, or apply what they have learned in business and industry." [24] Furthermore, higher education is changing rapidly as student bodies become more heterogeneous in terms of ethnicity, income, age, and levels of preparation. In a recent essay in the New York Times Magazine about these changes on campus, Professor Louis Menand writes:

The academic job market is bad everywhere, but the reason often given by elite universities—which is that there are too many "lesser ranked" doctoral programs—is disingenuous. In many cases, the top-ranked programs are the ones having trouble placing their graduates. The reason may be that their students' training is perceived as too specialized, and their teaching experience as too narrow, by many of the schools where jobs are available. [25]

What kinds of training programs are effective for various types of departmental missions? What is the best way to prepare students for careers at small liberal arts colleges? For careers at research universities? For careers in industry? If mathematics doctorates are to obtain employment of the type that they seek in the rapidly changing workplace, it is imperative that they receive the proper training. "My experience convinces me that graduate education can be changed to reflect the real needs of the profession, and the changes would not even have to be far-reaching. But we will have to be prepared to give up the idea that departments and schools have only minimum collective responsibility for the outcome," writes former Stanford president Donald Kennedy. [26]

2. The mathematical societies should collect and make publicly available information on graduate placement rates for all Ph.D. programs.

A recent National Research Council report [27] recommends that information on graduate placement rates for individual programs be gathered by the research community and made available on the Internet. Publicly available placement data would provide an invaluable measure of program effectiveness in preparing students for a wide variety of careers.

The outcome data collected for the new ratings would make it possible for the first time to evaluate program characteristics based on empirical considerations. For example, increasing the breadth of doctoral education has been widely advocated as a method for improving the job prospects of Ph.D.s. However, a number of mathematicians have raised concerns about the tradeoff between breadth and depth. Is breadth or depth more important, and in what contexts? These are questions best answered by looking at data on outcomes. Outcome data would serve to highlight a broad range of program characteristics that contribute to students' preparation for successful careers.

Public outcome data would enable prospective students to make more informed choices about which graduate school to attend. They would steer students toward programs with graduate outcomes closely matching students' own career aspirations. Outcome data would also provide students with realistic career expectations. Outcome data are but one factor among many for students to consider in choosing a graduate program. Other information that would be helpful includes data on time to degree, degree completion rates, and financial aid.

A key issue in the gathering of placement data is that of how to assess graduate outcomes. The fact that a program's graduates are employed does not indicate whether they are employed in jobs appropriate for their level of training. Who decides what is a positive graduate outcome? The answer is simple: we should turn to the graduates themselves for answers. Measures of the success of graduate outcomes should be based on responses of recent graduates to questions regarding their job satisfaction, the degree to which their training prepared them for their current positions, and the extent to which they use skills acquired in graduate training in their current positions. No value judgment needs to be made on the relative merits of industrial versus academic employment except by the doctorates themselves.

Conclusion

The environment in which mathematicians operate is changing rapidly. If our community is to govern itself in a responsible manner, it is imperative that we understand and adapt to these changes. Our reluctance to examine difficult issues such as the determination of enrollment levels, immigration, changing faculty demographics, and the effectiveness of various types of training programs neither makes these issues disappear nor alters their effects. The mathematical societies have the opportunity to take a strong leadership role here. Better information on the market for Ph.D.s and an assessment of the effectiveness of different types of training programs are not a cure-all prescription, but they do represent an important first step. We in the mathematics community need to take a more active role in solving our current labor market problems and in preventing fu-
ture ones. The future of the profession and the next generation of mathematicians depend upon it.

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References
[26] Donald Kennedy, Another century's end, another revolution for higher education, Change (May 1995), 8–15.
Book Review

The Mathematical Experience, Study Edition
Reviewed by Kenneth C. Millett

The Mathematical Experience, Study Edition
Philip J. Davis, Ruben Hersh, Elena Anne Marchisotto
Birkhäuser, Boston, 1995
487 pages, hardcover

In the fifteen years since the first edition of *The Mathematical Experience* there have been many important efforts to enlarge the public understanding of and support for contemporary mathematics. Despite these efforts little if any progress is apparent. Why? First, the effectiveness of many mathematics teachers, including college and university mathematicians, in advancing this goal of a wider understanding has been limited by an understanding and experience of mathematics that is far too narrow in scope. These limitations are passed on to their students, who quickly become the next generation of teachers, corporate and public leaders, and parents. One result is an educational system that is not preparing students for the mathematical challenges that they encounter. A second consequence is that even “the experts”, mathematicians employed within and outside education, are unprepared for the wide range of educational and mathematical problems on which the public expects them to provide expert advice. For many people, including far too many teachers, mathematics is more a matter of memorization and mimicry than one of thinking, creating, or puzzling out quantitative meaning. *The Mathematical Experience* is an effort to provide a robust encounter with a wide range of mathematics from which a stronger understanding and appreciation can grow.

In this new edition Elena Marchisotto has joined Philip Davis and Ruben Hersh in, quoting from Gian-Carlo Rota’s introduction, “a treacherous navigation between the Scylla of professional contempt and the Charybdis of public misunderstanding.” They have tried to provide a book usable in a course for liberal arts students and for future secondary teachers. They have done much more! This course should be required of every undergraduate major employing the mathematical sciences. It differs from the “mathematics appreciation” courses—courses that are merely a collection of amusing puzzles and toy problems giving an illusion of a mathematical encounter—presently found in many institutions. Students of this course are introduced to the context in which mathematics exists and the incredible magnitude of words devoted to communicating mathematics (hundreds of thousands of theorems each year). How much mathematics can there be? they are asked. Instructors in a *Mathematical Experience* course must

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be prepared to respond to questions from students concerning the fundamental nature of the whole mathematical enterprise. Stimulated by their reading of the text, students will ask about the underlying logical and philosophical issues, the role of mathematical methods and their origins, the substance of contemporary mathematical advances, the meaning of rigor and proof in mathematics, the role of computational mathematics, and issues of teaching and learning. How real is the conflict between “pure” mathematics, as represented by G. H. Hardy’s statements, and “applied” mathematics? They may ask. Are there other kinds of mathematics, neither pure nor applied? This edition of the book provides a source of problems, collateral readings, references, essay and project assignments, and discussion guides for the course. I believe that it is likely that this course would be a challenge to many teachers and students alike, especially those teachers and students who are willing to follow their curiosity beyond the confines of this book and follow up on the many references that are provided. For example, students meet the mathematics of number mysticism, hermetic geometry, astrology, and religion. Few of us, I suspect, are well prepared to respond to our students’ questions about the recent statements of mathematicians concerning coded predictions hidden in biblical texts.

However, there is much more that will significantly enrich the subsequent study of mathematics than connections to current recent newspaper and magazine articles. Discussions of the role and power of symbols, abstraction, generalization, normalization, existence, and proof are reflected in the titles of a chapter devoted to inner issues. To make concrete the varieties of mathematics, there are sections dedicated to finite simple groups, the prime number theorem, non-Euclidean geometry, non-Cantorian set theory, Fourier, and nonstandard analysis. These are later followed by a discussion of the Riemann hypothesis and four dimensions. In other chapters students look at the nature of teaching and learning from several perspectives that encourage them to consider critically the nature of the mathematical experience in their own classes. To further enrich their reflections on the nature of mathematics, they are introduced to Platonism, formalism, constructivism, and other “isms” relating to its foundation. What is the meaning of proof with today’s use of the computer? They are asked. Why should I believe a computer? These are questions that concern mathematicians, and they should concern our students as well. I believe that mathematical, life, and physical science majors and engineering majors will have a far deeper and more useful understanding of mathematics and its role in their own areas of interest if they have had a first-year college course based upon a text such as The Mathematical Experience. They will approach other mathematics courses quite differently. The interlocking nature of mathematics as a single intellectual enterprise will become more visible. The traditional artificial barriers between analysis, geometry, algebra, statistics, and so on will shrink in contrast to the strong unifying principles that run through the mathematical sciences.

To be sure, some mathematicians may find The Mathematical Experience lacking. Choices have been made. “Where is the discussion of the quadratic formula?” some will ask. “The treatment of the Pythagorean Theorem and geometry, in general, is not sufficient,” others might assert. “The book is inconsistent in viewpoint and contains errors that detract from it,” they may say. Indeed, such concerns are legitimate. But the fact is that, while not perfect, this book does provide what is required to initiate students into a wider, more meaningful exploration of the world of mathematics. Most mathematicians seem to agree that to understand mathematics you must do mathematics, and indeed there are many opportunities to do just that in connection with each of the chapters.

This is a book about the human experience of mathematics, connecting with each person’s own experience doing mathematics. However, as a collection of essays about mathematics from these different perspectives it is not entirely consistent. Asking for a definition or description of “mathematics” is comparable to asking physicists for a definition of “particle” or seeking the meaning of “love” from your neighbors. In the latter case, for example, you may hear biblical references, or the perspectives in Shakespeare, a quotation from “Peanuts” or “Calvin and Hobbes”, or a verse from the Spice Girls’ latest song. What we understand seems to depend on our individual experience and the experiences of others with whom we interact. Often what we understand is altered by how we say it and by how it is heard. Is not mathematics much the same? The authors state, “Most writers on the subject seem to agree that the typical working mathematician is a Platonist on weekdays and a formalist on Sundays.” The substance of the mathematics appears to change with experience and depends on the person recounting the story. But it has an objective reality that is independent of the person. Alas, when precision is required, it is common to retreat to the formalist position that mathematics is only a created structure of axioms, definitions, and their consequences. For students of mathematics the lack of attention to and acknowledgment of these and other fundamental issues and questions leads to their anemic understanding of the science of mathematics.

In a chapter entitled “Mathematical Reality” there is a discussion of the human aspect of mathematical proof, the impact of computers (the four-color problem, the distribution of primes, the Rie-
In the mathematics education arena the authors try to expand the range of discussion, to provoke questions of educational goals, to stimulate reflection upon and expansion of the range of teaching strategies, and to encourage teachers to develop honest measures of the degree to which educational goals have been achieved in their classes. They challenge us to consider whether we have only to “transmit” mathematical information in a clear and complete manner or whether we have some responsibility to ensure that learning is actually taking place; what is our standard against which we measure student accomplishment or performance? Consider the question of “learning for whom?” Is there a responsibility to all students or only to “the mathematically able”? If the former, how might this influence interactions with students? Does “dumbing down the course” or “grade inflation” inevitably follow? In this book it is impossible to devote much space to these questions. This is a place where one might choose to supplement the book in a course. More likely, as in my own situation, it gives an opportunity to establish links to other courses devoted to these questions. I try to focus on the foundational paradigms that define an area and provide a solid bridge to further study. For students interested in our mathematics education program, a discussion of how students learn (in the context of a course) helps students raise their personal standards for mathematical performance and establishes a link to our introductory course on problem solving and mathematics teaching.

This is a people-centered book about mathematics, and as such it provides an opportunity to explore fundamental issues that are typically absent from the experience of most college and university students (as well as their teachers). This new edition provides an excellent initiation of students into some of the more challenging aspects of mathematics. It can help bring them from a vision of mathematics as arithmetic and memorization to an understanding of mathematics as an intellectually challenging and creative experience—one in which there are surprises at every turn, one in which today’s understanding is never sufficient but more like a foundation upon which to build. The more one learns, the more one knows how little is known. An appreciation for the accomplishments of the past is important if one is to understand the potential for the future. But mathematicians must also work to develop a public appreciation for the challenges and the opportunities provided by new mathematics, for explorations beyond our current knowledge. Mathematics defines and lights the road ahead. Mathematics will move us from today to beyond tomorrow. The study edition of The Mathematical Experience will help its readers acquire a real understanding of mathematics.

The Mathematical Experience describes mathematics as a complex multidimensional system whose nature and direction is no longer possible to confine or to predict. The challenges are enormous for an instructor faced with discussing the nature of computer results whose origin is a program or system that never stops and while still running is correcting, updating, or extending itself. Described to me by Louise Moser, a colleague in computer science, this concept of “eternal” programs or systems demands the consideration of calculations or computer studies whose structure changes over time. If the object of study does not conform to a simple fixed set of rules, how do we describe its correctness to our students? Such questions are a natural constituent of the discussions growing out of this chapter.

The authors' treatment of questions about teaching and learning is similarly challenging. They note that the first edition was published in 1981 prior to the publication of the “Curriculum and Evaluation Standards” by the National Council of Teachers of Mathematics in 1989. The Mathematical Experience’s attention to the “thinking” and “problem-solving” dimensions of mathematics is one example of how this book tried to raise some critical aspects of mathematics teaching before they were more widely popular. They feel that they were a bit out of sync with their time. But, referring to the NCTM Standards, in the present edition the authors note that, “To a large extent, they validated our enterprise.”

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MAA Mathfest Held in Atlanta

The summer of 1996 was witness to a sad occasion—the last regularly scheduled AMS summer meeting, held in Seattle. The sadness was a little hard to perceive between sips of the legendary Seattle cappuccinos and the cracking of Dungeness crab legs, but it was there nonetheless. However, those who appreciate this kind of nonspecialized meeting were happy this year to attend the MAA Mathfest, held in Atlanta August 1–4. Atlanta in August—not only can you fry an egg on the sidewalk, you can poach it, as they say. But even the weather cooperated on these few unseasonably cool days, as 850 participants turned out to hear a wonderful selection of talks and to visit with their colleagues.

"I found the Mathfest an exemplary showcase of how to make mathematics interesting," said Frank Morgan of Williams College. "Ron Graham gave relatively simple combinatorial problems equivalent to the twin prime conjecture, the four color theorem, and the Riemann hypothesis. Denis Weaire described his counterexample to the Kelvin Conjecture with entertaining history and humor. Dave Witte used analogy and utter clarity to make the topic of superrigid subgroups understandable."

Morgan also found a Special Session talk about minimal surfaces by Helen Moore to be captivating. Moore spoke in a session on research sponsored by Project NExT, which is a program to help young mathematics faculty members get their research and teaching careers under way. With about 125 Project NExT fellows in attendance, the meeting had a larger number of young people than usual, leading John B. Conway of the University of Tennessee to remark that this was the "most youthful" meeting he could remember. Elizabeth Allman, a NExT fellow from the University of North Carolina, Asheville, was glad to meet up with the other second-year NExT fellows with whom she had been communicating by e-mail during the school year. "Last year in Seattle it seemed that the new Project NExT fellows were green and untested teachers," she remarked. "This year the crowd seemed seasoned, competent, and still very excited about teaching." Allman also found the Short Course on epidemiology "very interesting and informative."

In addition to the Project NExT fellows, there were over 80 undergraduates presenting papers and a smattering of high-schoolers wearing "Math Camp" T-shirts. "Such a strong turnout of younger mathematicians must bode well for the future of the MAA and mathematics," remarked Dana Mackenzie, a mathematician who is launching a career as a science writer, "but one has to wonder if the AMS is missing a chance to introduce these mathematicians to its activities." He noted that for years the American Physical Society and the American Association of Physics Teachers had joint winter meetings, but no longer do. The reasons are similar to the reasons for the AMS pullout from summer meetings: increased specialization and decreased money for travel, which forces
The School of Mathematics at Korea Institute for Advanced Study (KIAS) invites applications for several positions at the level of postdoctoral research fellows in the mainstream areas of pure and applied mathematics. KIAS, incepted in 1996 as a subsidiary organization of Korea Advanced Institute of Science and Technology (KAIST), is committed to excellence of research in basic sciences (mathematics, physics, chemistry, and biology) through high-quality research programs and a strong faculty body consisting of distinguished scientists and visiting scholars.

Applicants are expected to have demonstrated exceptional research potential, including major contributions beyond or through the doctoral dissertation. Salary for 12 months ranges approximately from US$20,000 (18,000,000 Korean Won) to US$33,000 (W30,000,000) with additional funds of $6,600 (W6,000,000) to defray expenses related to research activities. The initial appointment for the positions is for two years and is renewable up to one or two additional years, depending on research performance and the needs of the program at KIAS. The positions will be appointed all year around on a continuous basis. However, those who wish to be appointed this year may apply as soon as possible. Applications must include a complete vita with a list of publications, a summary of research plan, and three letters of recommendation, and should be mailed to:

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researchers to choose meetings directly related to their work.

AMS Associate Executive Director James Maxwell attended the meeting, not on AMS business, but simply as a regular participant. Without any administrative or governance obligations, he could just attend talks, visit with colleagues, "and catch up on a little professional gossip." "I especially enjoyed Elliott Lieb’s Hedrick Lectures on the stability of matter," Maxwell said. "I felt he did an excellent job of exposition, and, judging from the reaction of the audience, others agreed." Lieb, who is from Princeton University, called his audience "extremely warm and receptive." "It was a pleasure giving these lectures, because I felt people were trying to listen," he remarked. "The material was not especially easy, and there were three lectures in all. This is not easy to sustain, but the MAA members seemed to have made a real effort." He also praised the MAA organizers and officers for smoothly running the meeting.

Next summer, with ICM98 taking place, many mathematicians are planning to be in Berlin, Germany, in August. The MAA currently plans to hold Mathfest98 jointly with the Society for Industrial and Applied Mathematics in Toronto in mid-July. As a special event for World Mathematical Year 2000, the AMS is planning a meeting for August 2000. Otherwise, the AMS is out of the business of summer meetings, but the MAA is continuing to carry the banner with a great deal of success.

— Allyn Jackson
This article highlights recent trends in the composition of faculty within departments of mathematics at four-year institutions in the U.S. The most striking trends are the sizable cumulative decline in tenure-track faculty across all mathematics departments—more than a one-quarter reduction between 1990 and 1996—and the constant or slightly declining numbers of part-time faculty. The former trend points to a significant factor in the difficult job market faced by those receiving their doctorate in the 1990s. The latter trend is somewhat surprising, as it runs counter to anecdotal reports of a significant increase in the use of part-time faculty within mathematics departments. In the Ph.D.-granting mathematics departments, the decline in tenure-track faculty was largely offset by an increase in non-tenure-track faculty, many of whom hold postdoctoral positions. For the remaining mathematics departments the decline in tenure-track faculty resulted in a comparable decline in the total full-time faculty.

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The trends reported here became apparent during a retrospective analysis of the data gathered in the AMS-IMS-MAA Annual Surveys since 1990. The term "Groups I-III" denotes the 176 mathematics departments with doctoral degree programs during the 1995-96 academic year, and the term "Groups M&B" denotes those remaining mathematics departments at four-year institutions. The list of the departments in each of Group I, Group II, and Group III can be viewed at www.ams.org/committee/profession/groups_des.html.
The number of tenure-track faculty in Groups M&B is three times the number in Groups I-III. Unfortunately, the trend in the number of these positions is similar to that for Groups I-III. Figure 1b shows a steady decline in the number of tenure-track faculty between fall 1990 and fall 1996. The cumulative decline in tenure-track positions was approximately 1,100, a 30% decline from the fall 1990 level. Unlike Groups I-III, the number of (full-time) non-tenure-track faculty was essentially constant. Furthermore, the total number of full-time faculty in Groups M&B declined by 8% between fall 1990 and fall 1996, virtually all of the decline coming from the reduction in the tenure-track faculty.

Figure 2 shows the number of part-time faculty in Groups I-III was essentially constant between fall 1990 and fall 1996. In addition, other data show that a significantly larger fraction of the part-time positions was occupied by doctorate-holding faculty in fall 1996 than in fall 1990: 40% compared to 25%. Figure 2 also shows that for Groups M&B there was a small decline in the number of part-time faculty from fall 1990 to fall 1995, with a rebound indicated for fall 1996.

Within Groups M&B there is a significant number of tenure-track and (full-time) non-tenure-track faculty without a doctorate. Inspecting Figures 3a and 3b, one can see that the number and proportion of nondoctoral faculty declined within each of these two faculty categories, reflecting the ready availability of recent doctoral recipients. One should keep in mind that in many instances nondoctoral faculty subsequently earn a doctoral degree, particularly those in tenure-track positions.

For further perspective on the impact of the preceding trends on the employment situation, consider the following two observations. In the five years preceding July 1990, a total of approximately 4,300 new doctorates were awarded by math-
The number of tenure-track faculty in Groups I, II, III, M, and B combined declined by approximately 1,400 between 1990 and 1996. During the same time the cumulative turnover in faculty due to deaths and retirements was approximately 2,600, based on figures reported in previous Annual Survey reports. This suggests that approximately half of the positions that were vacated due to deaths and retirements went unfilled or were converted to non-tenure-track full-time positions.

The reader should keep in mind that survey responses and the proportional projections of faculty counts are potentially biased due to (i) selection bias of the responding departments and (ii) inhomogeneity of departments within the survey groups. Over the six years studied, survey group response rates have remained relatively stable, but they do vary significantly among survey groups. Response rates range from a relatively high overall rate of 80% or better for Groups I, II, and III down to 40% for Group B. In analyzing the data collected between 1990 and 1996, effort has been made to eliminate the extraneous effects of some small changes in the survey methodology.
Professor Mumford’s arguments in “Calculus Reform—For the Millions” (May 1997 Notices) are typical of those who support calculus reform. They create a “straw man”—a fictitious model of a calculus course which they claim has played a significant role in our math education problems—and then give the generic solution: wholesale elimination of proofs and definitions.

Professor Mumford, with perhaps intentional hyperbole, ends his article with a plea not to alienate the 99 percent of students who will not need to see rigorous proofs for their future careers. At our school, “business calculus” and “calculus for biology majors” have far more students than our calculus sequence for math, engineering, and physical science majors. Traditional texts for the former two courses have never emphasized rigor, and the word problems are tailored for the respective majors. From conversations with colleagues at other institutions, we surmise this is also the case nationally. Professor Mumford need not worry about overexposure to proofs for these students, with or without “reformed” calculus. Overexposure never existed.

The main battle is whether reform approaches—such as Harvard Calculus—that eliminate virtually all rigor should be used for math, engineering, and physical science majors, as is being done at many colleges and universities. Reform advocates typically justify this with unsupported characterizations of traditional texts as consisting of “drill and kill” and/or an incomprehensible chain of rigorous proofs. But, for this group of students, who ever said that their first collegiate exposure to calculus should be inundated with deltas and epsilons? When reform fails, as it often does, reformers claim that the reform pedagogies were not properly implemented or that teachers lack sufficient knowledge. But it is axiomatic that no such explanations may be given for traditional approaches. Multi-million-dollar grants would collapse without this axiom.

The calculus reform movement was a facile response to a real problem: the declining performance of American students in college calculus courses. Without any credible scientific study, many reformers put forth “solutions” such as eliminating theory, making more conceptual problems, decreasing the reliance on algebra, and increasing the use of computers and calculators. But what if the reformers were wrong about the causes of the problem?

The traditional calculus books we used as students and have taught out of as professors contained a fairly even mix of computation, conceptualization, and theory. Most math professors taught using similar mixtures. Useful topics such as related rates, partial fractions, L’Hospital’s rule, infinite series, and many others are abridged or missing from the Harvard Calculus text. The “proofs” and “definitions” in the Harvard Calculus text are often incorrect. This means that Harvard Calculus is virtually useless as a reference for later courses. The traditional books have correct proofs and definitions. This does not mean that the courses using these books cover all the rigorous material. Every calculus teacher we know avoids trying to cover all material available in a traditional calculus book.

Traditional texts give the student the opportunity to delve more deeply into the subject if (s)he chooses and to “look up” formulas and their justifications later in life as the need arises. The Harvard Calculus text gives less opportunity for motivated students to look further on their own. Worse still, it mandates “knowing things” that are not even true. If there is lack of balance in this debate, it is clearly on the reform side of the fence.

We agree with Professor Mumford’s explicit support for learning the rules of algebra and the multiplication tables as “the rules of a game.” Many reform advocates do not. Even the memorization of the multiplication tables is a debatable issue in education circles these days [4]. Harvard Calculus ac-
commodates these trends by minimizing the need for algebra. This phenomenon is not surprising and could even be predicted by simply observing the impact of reform math at the K-12 level. Widely used K-12 reform pedagogies do not systematically develop what used to be high school algebra. This creates powerful economic and cultural pressures to lower standards for new students.

Rather than succumb to these destructive trends, university math departments should maintain realistic standards, even if it means high failure rates for incoming students. Universities are the last line of defense against the reform-inspired corrosion of standards. This is the only real way to send the message to the public schools—and equally importantly, the nation's colleges of education—that high school algebra must be learned and cannot be supplanted by button pressing of calculators and computers.

Mathematics has the unique distinction of being the only subject which is expected to apologize for being what it is. Imagine a large proportion of history professors pointing out that very few people will ever need to know even approximate dates for important historical events. Imagine these history professors then calling for the elimination of all dates in history classes. It would be virtually impossible to have an intelligent historical discussion without such basic information. Professor Mumford and many others ask how we can justify teaching logical deduction and proofs in math classes when so few people will need that in future employment. Professor Mumford does concede that it is useful for future lawyers, and considering the huge number of attorneys in the U.S., this is a major concession. Abraham Lincoln, once an attorney, wrote of himself in his Short Autobiography:

He studied and nearly mastered the six books of Euclid since he was a member of Congress.

He began a course of rigid mental discipline with the intent to improve his faculties, especially his powers of logic and language. Hence his fondness for Euclid, which he carried with him on the circuit till he could demonstrate with ease all the propositions in the six books.... [3]

What about nonmathematicians and nonattorneys? Surely others such as electrical engineers, physicists, chemists, and many others benefit in subtle ways from judicious exposure to mathematical proofs. Even popular accounts of science designed for the layperson require limited exposure to mathematical rigor. For example, a short introduction to relativity theory written by Einstein, widely available now in popular bookstores for the nonscientific reader, requires previous exposure to the logic of Euclidean geometry [2].

It is especially important for prospective high school math teachers to see some theory in calculus and to learn most of the important topics omitted by the Harvard Calculus text. An ominous trend in reform math is the over-use of calculators. Calculus students are being pushed into numerical solutions when easily derived closed-form solutions are better. Part of the problem is that many high school math teachers are not even aware of traditional topics.

One way to improve the mathematics performance of college students is to set higher standards for future teachers. Jaime Escalante (immortalized in the movie Stand and Deliver) demonstrated that a well-educated high school teacher who loves the subject can teach mathematics to large numbers of students [1]. It is no secret that his students were Hispanic and working class. Many went on to universities and successful careers. These successes stem from well-taught traditional calculus courses.

We agree with E. D. Hirsch's thesis [5] that the failures in mathematics education have been caused partly by the very reform programs that were supposed to improve student performance. In addition, we suggest that by minimizing arithmetic and algebra in K-12, leaders in mathematics education have underestimated the innate abilities of the nation's youth. Students are meeting these low expectations. It will take years to undo the damage caused by the math reform movement, all the more so when prominent mathematicians maintain the fiction that the hard work required by traditional curricula can be successfully avoided.

We are sure that Professor Mumford and all reformers would not want to deny minority students and working-class white kids the type of math education that the best universities demand. Unfortunately, while the privileged few can find the means for genuine education, much of "reform" is closing the door on opportunities for those who depend the most on public education as a vehicle for success.

References
[4] Formulas for Math Problems, Los Angeles Times, Column One, (January 5, 1997). "One missionary in the Reform cause is consultant Ruth Parker, who rejects long division and multiplication tables as nonsensical leftovers from a pre-calculator age. She urges audiences to 'let kids play with numbers,' and they will figure out most any math concept. Parker has spoken before 20,000 people over the last six months at the behest of school districts."
Willard Miller Named IMA Director

On September 1, Willard Miller Jr. became director of the Institute for Mathematics and its Applications (IMA) at the University of Minnesota. He succeeds Avner Friedman, who had held the post since 1986. Friedman is presently director of the Minnesota Center for Industrial Mathematics, a component of Minnesota's School of Mathematics with close ties to the IMA.

Miller has had a long association with the IMA. As head of the School of Mathematics from 1978 until 1986, he helped to craft the original proposal for the IMA. "I remember in the summer of 1979 putting the finishing touches on our proposal to the National Science Foundation and mailing it off," he recalls. The IMA was established in 1982, with Hans Weinberger as director. He was succeeded by Friedman, and in 1987 Miller was appointed associate director of the IMA. Miller served in that post until 1994, when he became associate dean for finance and planning for the university's Institute of Technology. He has since left that post to take over as director of the IMA.

A mathematical physicist, Miller works in the areas of Lie groups and algebras, special functions, and q-series. He received his Ph.D. in applied mathematics from U.C. Berkeley in 1963, under the direction of Bernard Friedman. He has held visiting positions at the Courant Institute, the Centre de Recherche Mathematique (CRM) in Montreal, and Institute of Research in Applied Mathematics and Systems at the National University of Mexico. His experience with mathematics institutes extends beyond the IMA, as he has served on site-visit panels for CRM and for The Fields Institute in Toronto.

The main role of the IMA is to bring sophisticated mathematics to bear on important problems in other areas of science and industry—problems, as Miller puts it, that require "the entire arsenal of mathematical tools, not just those that are associated with traditional applied mathematics." Some IMA programs focus on a particular area of science; for example, the 1998-99 year will be devoted to the use of mathematics in biology. Others focus on a branch of mathematics that finds application in many different areas; in the current academic year the IMA is hosting a program called "Emerging Applications of Dynamical Systems", which will emphasize the use of dynamical systems techniques in chemical and physiological processes.

While these kinds of programs form the core of the IMA, the Institute has probably become best known for its work in the use of mathematics to solve industrial problems. "I think that's been a trailblazing activity of the IMA," Miller remarks. Miller—as well as many others in the mathematici-
veloping long-term industrial projects with major commitments by industry and major commitments from industry to attend meetings and make presentations at the IMA, Miller plans to devote moderate amounts of attention to these areas.

As with MSRI, the core funding for the IMA comes from the NSF, which this year opened a new competition for the grants for the institutes (see “Recompetition of NSF-funded Institutes,” Notices, January 1997, pages 33–36). This means that Miller’s first task as director will be to write a new proposal for the IMA. He anticipates some changes, but “they won’t be drastic changes, because we feel we have a very successful program,” he says. The organization of the IMA includes an annual theme program, which attracts about 700 to 800 visitors a year, as well as smaller workshops and the industrial mathematics program, which bring the total number of visitors to about 1,000 per year. There are also programs that the IMA runs for its approximately thirty participating institutions.

One of the areas in which Miller plans to introduce some changes is the structure of the postdoctoral program. “There will be more emphasis on improving the mentoring of postdocs,” he remarks. “We think we’ve done a pretty good job of that in the past, but we believe we can improve.” Postdocs will be assigned a faculty mentor and will receive two-year rather than one-year appointments, with part of the second year devoted to the development of teaching skills. Another area Miller intends to pursue is scientific computation, including software benchmarking. “We want to make computation an integral part of each of our programs,” he says. When it comes to K–12 education and public outreach, the IMA has been less active than MSRI, which put considerable emphasis on these areas under the directorship of William Thurston. (David Eisenbud became director of MSRI in July; see Notices, June/July 1997, pages 688–689.) It appears that both the IMA and MSRI are planning in their new proposals to devote moderate amounts of attention to these areas.

Miller says that industrial programming will continue to be a “big emphasis” for the IMA. Rather than spending a lot of time trying to get people from industry to attend meetings and make presentations at the IMA, Miller plans “to work on developing long-term industrial projects with major commitments by industry and major commitments by the IMA.” This includes financial support from industry, as well as investment of the time of their personnel. Because it does not have a permanent faculty, the IMA has been limited in its ability to sustain long-term interactions with industry. Miller says that the IMA’s links to the Minnesota Center for Industrial Mathematics will help address this limitation. He also intends to improve the documentation and dissemination of the contents and results of IMA workshops, especially over the World Wide Web. Other means of communication are satellite broadcasting and interactive conferencing, facilities now available at the IMA. “We would like the IMA to be a world center for the preparation of mathematics faculty and graduate students for industrial interactions,” Miller declares.

The NSF has laid very few ground rules in the institute recompetition, saying that it will consider the possibility of funding more than two institutes—or even no institutes—and that the institutes could be in the mold of the existing institutes, “institutes-without-walls”, or conference centers. In such a wide open field, it is difficult to conjecture whether the IMA will be successful in its new bid. Certainly the university’s strong support of the work of the IMA, indicated in the special funding it provided to launch the Center for Industrial Mathematics, is an important asset. Miller also says that the university plans to strengthen its mathematics faculty in areas that will benefit the IMA.

“I’m very optimistic about the future,” Miller says. “I think we have a very good program and can make it better.” The new IMA proposal will contain some changes, but basically the vision set out in 1979 will not change. “That’s why I’m here,” Miller says. “I bought into the idea twenty years ago, and I’m not about to abandon it.”

— Allyn Jackson
Optimization Methods in Partial Differential Equations

Steven Cox, Rice University, Houston, TX, and Irena Lasiecka, University of Virginia, Charlottesville, Editors

This book presents a collection of papers written by specialists in the field and devoted to the analysis of various aspects of optimization problems with a common focus on partial differential equation (PDE) models. These papers were presented at the AMS-SIAM 1996 Joint Summer Research Conference held at Mount Holyoke College, South Hadley, MA, in June 1996.

The papers selected for this volume are at the forefront of research and point to modern trends and open problems. This book will be a valuable tool not only to specialists in the field interested in technical details, but also to scientists entering the field who are searching for promising directions for research.

Contemporary Mathematics, Volume 209; 1997; 349 pages; Softcover; ISBN 0-8218-0604-1; List $69; Individual member $41; Order code CONM/209RT711

Lipa's Legacy

Józef Dodziuk and Linda Keen, City University of New York, New York City, Editors

The mathematical works of Lars Ahlfors and Lipman Bers are fundamental and lasting. They have influenced and altered the development of twentieth century mathematics. The personalities of these two scientists helped create a mathematical family and have had a permanent positive effect on a whole generation of mathematicians. Their mathematical heritage continues to lead succeeding generations. In the fall of 1994, one year after Bers' death, some members of this family decided to inaugurate a series of conferences, the Bers Colloquium, to be held every three years. The theme was to be a topic in the Ahlfors-Bers mathematical tradition, broadly interpreted.

The first colloquium was held in October 1995 at the Graduate Center, CUNY in New York. It included roughly coinciding with the second anniversary of Bers' death. There were six lectures and much informal mathematical discussion. This volume contains papers by the speakers and many of the participants. The broad range of papers indicate how strong and far reaching Bers' influence has been.

Features:
- Twenty-seven very high-level papers on related topics
- Open problems
- Expository articles

Contemporary Mathematics, Volume 211; 1997; 488 pages; Softcover; ISBN 0-8218-0671-8; List $71; Individual member $45; Order code CONM/211RT711

Discovering Modern Set Theory. II: Set-Theoretic Tools for Every Mathematician

Winfried Just, Ohio University, Athens, and Martin Weese, University of Potsdam, Germany

This is the second volume of a two-volume graduate text in set theory. The first volume, Discovering Modern Set Theory. I, was addressed primarily to beginning graduate students. This second volume is intended as a bridge between introductory set theory courses and advanced monographs that cover selected branches of set theory, such as forcing or large cardinals. The authors give short but rigorous introductions to set-theoretic concepts and techniques such as trees, partition calculus, cardinal invariants of the continuum, Martin's Axiom, closed unbounded and stationary sets, the Diamond Principle (◊), and the use of elementary submodels. Great care has been taken to motivate the concepts and theorems presented.

Graduate Studies in Mathematics, Volume 18; 1997; 224 pages; Hardcover; ISBN 0-8218-0528-2; List $86; All AMS members $29; Order code GSM/18RT711

Some Points of Analysis and Their History

Lars Gårding, Lund University, Sweden

This book is a collection of short essays containing the history and the proofs of some important and interesting theorems of analysis and partial differential operators in this century. Most of the results in the book are associated with Swedish mathematicians. Also included are the Tarski-Seidenberg theorem and Wiener's classical results in harmonic analysis and a delightful essay on the impact of distributions in analysis. All mathematical points are fully explained, but some require a certain mature understanding from the reader. This book is a well-written, simple work that offers full mathematical treatment, along with insight and fresh points of view.

This book is co-published with Higher Education Press (Beijing) and is distributed worldwide, except in the People's Republic of China, by the American Mathematical Society.

University Lecture Series, Volume 11; 1997; 98 pages; Softcover; ISBN 0-8218-0757-9; List $16; All AMS members $13; Order code ULECT/11RT711

Elliptic Boundary Value Problems in Domains with Point Singularities

V. A. Kozlov, Russian Academy of Sciences, Moscow, V. G. Maz'ya, Linkoping University, Sweden, and J. Rossmann, Rostock University, Germany

This monograph systematically treats a theory of elliptic boundary value problems in domains without singularities and in domains with conical or cuspidal points. This exposition is self-contained and a priori requires only basic knowledge of functional analysis. Restricting to boundary value problems formed by differential operators and avoiding the use of pseudo-differential operators makes the book accessible to a wider readership.

Mathematical Surveys and Monographs, Volume 52; 1997; 414 pages; Hardcover; ISBN 0-8218-0754-8; List $99; Individual member $69; Order code SURV/52RT711

Homeomorphisms in Analysis

Casper Goffman, Purdue University, West Lafayette, IN, Togo Nishiura, Wayne State University, Detroit, MI, and Daniel Waterman, Syracuse University, NY

...The book is well written, packed with information and makes a noble contribution to the literature. Much of what is in the book is important material that is new for the first time readily accessible. ... readers will appreciate the many comments that provide historical or motivational perspectives.

—Professor Andrew Bruckner, University of California, Santa Barbara

This book features the interplay of two main branches of mathematics: topology and real analysis. The material of the book is largely contained in the research publications of the authors and their students from the past 50 years.

Features:
- Contains new results and complete proofs of some known results for the first time
- Demonstrates the wide applicability of certain basic notions and techniques in measure theory and set-theoretic topology
- Gives unified treatments of large bodies of research found in the literature.

Mathematical Surveys and Monographs, Volume 54; 1997; 216 pages; Hardcover; ISBN 0-8218-0614-9; List $69; Individual member $41; Order code SURV/54RT711
Fermat Prize Awarded to Talagrand

MICHEL TALAGRAND of the University of Paris VI and Ohio State University has received the Fermat Prize for Research in Mathematics for his fundamental contributions in various areas of probability.

The Fermat Prize is awarded every two years and carries a monetary award of 100,000 FF (approximately $16,000). The prize recognizes the work of a mathematician in the areas in which Pierre de Fermat worked: specifically, principles of variational theory, foundations of the calculus and probability, analytic geometry, and number theory. The sponsors of the prize are Université Paul Sabatier and Matra Marconi Space. The previous recipients are ABBAS BAHRI and KENNETH A. RIBET (1989), JEAN-Louis COLLIOIT-THÉLÈNE (1991), JEAN-MICHEL CORON (1993), and ANDREW J. WILES (1995).

—Allyn Jackson

Visiting Mathematicians

(Supplementary List)

Mathematicians visiting other institutions during the 1997–98 academic year were listed in the June/July 1997 issue of the Notices, pp. 715–717, and the September 1997 issue of the Notices, p. 945. The following is an update to that list (home countries are listed in parentheses).

MARTHA GUZMAN-PARTIDA (Mexico), New Mexico State University, Harmonic Analysis, 7/97–7/98.

WON SOK YOO (Korea), New Mexico State University, Functional Analysis, 8/97–6/98.

Deaths

ALFONSO G. AZPEITIA, of the University of Massachusetts at Boston, died on June 13, 1997. Born on February 22, 1922, he was a member of the Society for 40 years.

MARY K. BENNETT, of the University of Massachusetts, Amherst, died on March 15, 1997. Born on January 30, 1940, she was a member of the Society for 32 years.

RICHARD J. CRITTENDEN, of the University of Alabama at Birmingham, died on June 22, 1996. Born on February 28, 1930, he was a member of the Society for 34 years. He served as executive editor of Mathematical Reviews from 1968 to 1971.

DANIEL M. DRIBIN, retired from the University of Maryland, died on August 2, 1997. Born on December 10, 1913, he was a member of the Society for 63 years.

E. A. MAZIAZ, professor emeritus, Department of Philosophy, Loyola University of Chicago, died on July 11, 1997. Born on March 6, 1915, he was a member of the Society for 52 years.

BERNARD MORREL, of the Indiana University-Purdue University at Indianapolis, died on May 26, 1997. Born on November 28, 1940, he was a member of the Society for 34 years.
Mathematics Opportunities

American Mathematical Society Centennial Fellowships

Invitation for Applications for Awards for 1998-99

Deadline: December 1, 1997

The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. Recently the AMS Council approved changes in the rules for the fellowships. From 1984-96, the fellowship program was aimed at midcareer mathematicians. The changes adopted two years agoRedirected the fellowship program toward recent Ph.D.s. The eligibility rules are as follows.

Applicants must: (1) be citizens or permanent residents of a country in North America, (2) have held their doctoral degrees for at least two years at the time of the award, (3) not have permanent tenure, and (4) have held less than two years of research support at the time of the award. (Each year of a full-time teaching appointment with teaching load less than four (respectively, five) courses per year on the semester (respectively, quarter) system will count in this respect as one-half year of research support.) Recipients may not hold the Centennial Fellowship concurrently with other research fellowships (e.g., Sloan Foundation Fellowships or National Science Foundation Postdoctoral Fellowships), they may not use the stipend solely to reduce teaching at the home institution, and they are expected to spend some of the fellowship period at another institution that has a stimulating research environment suited to the candidate's research development.

The stipend for fellowships awarded for 1998-99 is expected to be approximately $36,000, with an additional expense allowance of about $1,500. Acceptance of the fellowship cannot be postponed. Fellowship holders may use the stipend as full support for a year or may combine it with half-time teaching and use it as half support over a two-year period.

The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Trustees have arranged a matching program from general funds in such a way that funds for at least one fellowship are guaranteed. Because of the generosity of the AMS membership, it has been possible to award two to five fellowships a year for the past ten years.

Applications should include a short research plan describing both an outline of the research to be pursued and a program for using the fellowship, including institutions at which it will be used and reasons for the choices. The selection committee will base its decision on both the research potential of the applicant, based upon track record and letters of recommendation, and on the quality and feasibility of the research plan.

The deadline for receipt of applications is December 1, 1997. Awards will be announced in February 1998 or earlier if possible.

For application forms write to the Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248, or send electronic mail to ams@ams.org, or call 401-455-4103. Application forms are also available via the Internet at URL http://www.ams.org/committee/profession/. Please note that completed
application and reference forms should not be sent to the AMS, but to the address given on the forms.

—AMS Announcement

News from the Institute for Mathematics and its Applications

University of Minnesota

The 1997–98 program at the IMA is Emerging Applications of Dynamical Systems. The winter 1998 term will be devoted to the topic, Dynamics in Physiology and Chemistry.

The first workshop will be a ten-day event on the overall topic of Computational Neuroscience (January 14–23, 1998). Of interest here are the roles of the highly nonlinear intrinsic properties of individual neurons and of coupling properties between cells that determine the dynamical activity of neuronal networks. Unique mathematical features of the cell-based neuronal models that underlie complex spatio-temporal patterns are the multiple and vast time scales of ionic currents and the circuit properties which include local as well as long-range coupling, possibly with random connectivity. The workshop will consist of a few intense two- to three-day periods, bringing together experimentalists and theorists to focus on specific systems, such as those on modelling vision and navigation.

The workshop February 9–13 will be on Calcium Dynamics in Cells. Dynamic changes in cellular free-calcium concentrations are essential for a great variety of cellular processes, including muscle contraction and cell motility. A number of complex signalling pathways which couple mechanisms such as voltage-gated ion channels, calcium exchangers, pumps and calcium release mechanisms have been uncovered in the laboratory, and realistic models of these processes are being developed. A special focus will be the new mathematical challenges that this area presents in dynamical systems theory. The workshop will be preceded by a two-day tutorial (February 5–6) that provides the necessary biological background for nonexperts and an overview of current models.

The last workshop of the winter term will address Cardiac Rhythms (March 9–14). Simplified models of heart electrical activity show normal wave propagation, as well as arrhythmias such as spontaneous spiral wave generation. Complicating factors for modelers include differing nonlinear properties in different regions, anisotropy in the conduction pathways, and branching in the Purkinje system which triggers the muscle electrical activity. Large scale 3-D computational models as well as reduced models based on singular-perturbation descriptions and kinematics of spiral cores have led to insights into cardiac physiology. The heart also focuses attention on mathematically interesting issues for the more general area of excitable media.

The spring term will be devoted to Symmetry and Pattern Formation. More detailed descriptions of the spring 1998 program appear in a future issue of the Notices. See the October 1997 issue for information about the fall 1997 program on Numerical Analysis of Dynamical Systems.

For more information about IMA activities and how to register, contact the IMA at staff@ima.umn.edu or through the World-Wide Web http://www.ima.umn.edu/.

—IMA Announcement

NRC Program for Collaborative Research

The Office for Central Europe and Eurasia of the National Research Council (NRC) offers grants to individual American specialists who plan to establish new research partnerships with their colleagues from Central/Eastern Europe (CEE) and the Newly Independent States (NIS) of the former Soviet Union. This program is designed primarily to prepare these new partnerships for competition in National Science Foundation (NSF) programs. Funding is provided by the NSF.

Applications from American specialists who possess or will possess Ph.D. degrees or equivalent research and experience at least six months prior to the requested beginning dates of their programs will be considered. U.S. citizens and permanent residents are eligible. Foreign specialists must possess CEE or NIS citizenship and must hold Ph.D. (kandidat) degrees or equivalent research training and experience at least six months prior to the requested beginning dates of their programs. U.S. Government employees generally are not supported under the program.

As the program is designed to support new collaborative efforts, no more than two grants will be awarded per applicant in a four-year period. Applicants who have received their doctoral degrees within the past six years will receive special consideration, as will applicants wishing to work with colleagues in less frequently represented countries and regions. Scientists and engineers who hold a current NSF grant and are eligible for an NSF international supplement should not apply to this program. The NSF’s Eastern Europe Program staff (telephone 703-306-1703) can advise regarding applications for NSF international supplements.

Short-Term Project Development Grants support American specialists who wish to host or visit their CEE or NIS colleagues for two-week periods in order to prepare collaborative research proposals for submission to the NSF.

Long-Term Grants support American specialists who wish to host or visit their CEE or NIS colleagues for collaboration on research for a period of one to six months. Significant publications jointly authored by program participants as a result of their long-term visits are expected.

Short-Term Project Development grants range from $2,200 to $2,500, and Long-Term Grants range from $3,000 to $15,300.
Organic Mathematics
J. Borwein and P. Borwein, Simon Fraser University, Burnaby, BC, Canada, and R. Corless, University of Western Ontario, London, ON, Canada, Editors

This volume is the hardcopy version of the electronic manuscript, "Proceedings of the Organic Mathematics Workshop" held at Simon Fraser University in December 1995. The book provides a fixed, easily referenced, and permanent version of what is otherwise an evolving document.

Contained in this work is a collection of articles on experimental and computational mathematics contributed by leading mathematicians around the world. The papers span a variety of mathematical fields—from juggling to differential equations to prime number theory. The book also contains biographies and photos of the contributing mathematicians and an in-depth characterization of organic mathematics.

Members of the Canadian Mathematical Society may order at the AMS member price.

Conference Proceedings, Canadian Mathematical Society, Volume 20; 1997; 412 pages; Softcover; ISBN 0-8218-0668-8; List $79; Individual member $47; Order code CMSAMS/20NA.

All prices subject to change. Charges for delivery are $3.00 per order. For air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248. For credit card orders, call (401) 455-4000; for credit card orders, call toll free 800-321-4AMS (4267) in the U.S. and Canada, (401) 455-4000 worldwide. Or place your order through the AMS book store at http://www.ams.org/bookstore/. Residents of Canada, please include 7% GST.

Mathematics Opportunities

The following deadlines apply: December 29, 1997 (Project Development only); April 6, 1998 (Project Development only); July 10, 1998 (Long-Term only); August 17, 1998 (Project Development only).

To obtain information and application materials, please contact: Office for Central Europe and Eurasia, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-3680; fax 202-334-2614; e-mail oceea@nas.edu. Information is also available at the Web site http://www2.nas.edu/oa/22da.html.

— NRC Announcement

NRC Associatehip Programs

The National Research Council (NRC) conducts the Research Associatehip Programs in cooperation with, and on behalf of, selected federal research agencies and organizations under contract. These programs have two objectives: (1) to provide doctoral scientists and engineers of unusual promise and ability opportunities for research on problems, largely of their own choice, that are compatible with the research interests of the sponsoring laboratories; and (2) to contribute to the overall research efforts of these laboratories and to the national scientific and technological welfare of the United States.

Each year, approximately 13,000 inquiries are received, about a thousand completed applications are received and processed, about 700 candidates are recommended for awards, and 400 new and renewal awards are offered. In a given year nearly 600 Research Associates hold tenure of these awards at more than 100 geographic locations throughout the United States, a few in U.S. Government laboratories overseas.

Postdoctoral Research Associatehip awards are offered to scientists and engineers who have held an earned research doctorate for less than five years at the time of application and carry stipends ranging from $27,750 to $45,500, depending on the program and the field of research. Senior Research Associatehip awards are offered to established scientists and engineers who have held a research doctorate five years or longer at the time of application and carry stipends that are individually determined, ranging from $35,000 to $83,000, exclusive of any sabbatical leave pay.

Applications submitted to the NRC are accepted on a continuous basis throughout the year. Those postmarked no later than January 15 will be reviewed in February, by April 15 in June, and by August 15 in October.

Information on specific research opportunities and participating federal laboratories as well as application materials may be obtained from: Associatehip Programs—TJ 2114, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2760; fax 202-334-2759; e-mail rap@nas.edu. Information may also be found on the World Wide Web at http://rap.nas.edu/.

— from NRC Announcement
New NSF Assistant Director Named

ROBERT A. EISENSTEIN has been appointed Assistant Director for Mathematical and Physical Sciences at the National Science Foundation (NSF). He oversees the directorate that includes the Division of Mathematical Sciences.

A nuclear and particle physicist, Eisenstein has served as director of the physics division at the NSF since 1992. He played significant roles both in the management of large-scale projects such as the Laser Interferometer Gravity Wave Observatory (LIGO) and in the establishment of physics division initiatives in biological physics and complex phenomena. He also led his division in an effort to involve undergraduate students in its supported research activities.

Prior to joining the NSF, Eisenstein was a professor of physics at the University of Illinois, where he also directed the Nuclear Physics Laboratory. Before that he was a professor of physics at Carnegie-Mellon University. He received his bachelor's degree from Oberlin College and his master's and doctoral degrees from Yale University.

Eisenstein replaces William Harris, who left the NSF a year ago to become president of Biosphere 2.

—Allyn Jackson

NSF Study Finds Decline in Immigrant Scientists and Engineers

The number of immigrant scientists and engineers entering the United States each year was stable throughout the 1980s, rose in the early 1990s, and then declined dramatically in 1994 back toward 1980s levels. The latest data indicate that what observers thought was a major, long-term rise in skilled immigrants was only a temporary surge, prompted by the 1990 Immigration Act. The numbers are analyzed in a new National Science Foundation (NSF) data brief, drawn on data from the Immigration and Naturalization Service.

According to the data brief, by 1993 the number of people with science and engineering degrees admitted to the U.S. on permanent visas with work certifications had almost doubled to 23,534. In 1994 the number of these immigrants admitted had dropped to 17,403, a decline of 26 percent. The one immigrant group that rose in 1994 was scientists entering the U.S. from the newly independent states of the former U.S.S.R. and Yugoslavia; their ranks increased from 1,165 in 1993 to 1,244 in 1994.

The data brief highlights findings in a forthcoming Science Resource Studies report on immigrant scientists, engineers, and technicians to be published in the fall.


—NSF News Release

AMS Acquires Chelsea Publishing Inventory and Rights

The AMS has acquired the rights to all inventory and publishing resources of Chelsea Publishing of New York. The acquisition involves over 300 titles published by Chelsea since the 1940s and will add to the more than 2,300 titles currently published and distributed through the AMS publications program.

Well known and respected within the mathematical community, Chelsea Publishing earned its reputation as a leading reprinter and publisher of classic mathematical texts, some of which were originally published in the early 1880s in Europe and elsewhere. The recent death of Chelsea
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For Your Information

owner and founder Aaron Galuten placed the future of the small press in question. The AMS and Chelsea had cooperated on publishing activities in the past, and it was this familiarity that prompted discussions and eventual agreement between the two organizations.

Over 40,000 books from the Chelsea inventory are being transferred to the AMS distribution center and can now be ordered directly from the AMS. The AMS plans to continue offering the books through retail bookstores in North America, as well as through selected distribution centers in Europe, Japan, and other regions of the world.

In addition to its AMS and Chelsea imprints, the Society's publications division also publishes and distributes titles from International Press in Cambridge, Massachusetts, and Science Press New York and Beijing, as well as publications from mathematical societies in Europe, Japan, China, Israel, and Russia.

For information on the Chelsea titles, contact the AMS Customer Services Department (800-321-4267, cust-serv@ams.org) or visit the AMS Bookstore at http://www.ams.org/bookstore/.

— AMS Announcement

American Mathematical Society

General Interest

Analysis, Geometry
and Probability

Rajendra Bhatia, Indian Statistical
Institute, New Delhi, Editor

This book is a collection of expository articles by well-known mathematicians. Some of them introduce the reader to a major topic, while others provide a glimpse into an active field of research.

The articles were written in honor of K. R. Parthasarathy, renowned mathematician, teacher, and expositor. Some of the articles by his coworkers are related to his work on probability, quantum probability, and group representations. Others are on diverse topics in analysis, geometry, and number theory.

Published by the Hindustan Book Agency (India) and distributed worldwide except in India by the American Mathematical Society

1997: 422 pages; Hardcover; ISBN-10: 81-85931-12-7; List $60; Individual member $36; Order code AGPNA

All prices subject to change. Charges for delivery are $3.00 per order. For air delivery outside of the continental U. S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P. O. Box 6248, Providence, RI 02906-0004. For credit card orders, see (401) 351-3542 or call toll free 800-321-4AMS (4267) in the U.S. and Canada, (617) 455-4000 worldwide. Or place your order through the AMS bookstore at http://www.ams.org/bookstore/. Residents of Canada, please include 7% GST.
The January 1997 Council

The Council of the Society met on Tuesday, January 7, 1997, at the San Diego Marriott Hotel and Marina, San Diego, CA. Thirty members attended the meeting. President Morawetz presided.

After introducing members and members-elect, the president recognized the secretary, who received unanimous consent to send thanks on behalf of the Council to departing members for sharing their wisdom with the Society and the Council and for their service to the mathematical community.

The newly elected members of the Council, who took office on February 1, 1997, who were present were granted privileges of the floor (but without voting privileges).

The minutes of the August 1996 Council meeting had been distributed by mail. They were approved as distributed.

The Society for Industrial and Applied Mathematics (SIAM) celebrated its forty-fifth anniversary in 1997. The Council approved the following resolution of congratulations.

The Society for Industrial and Applied Mathematics, founded in 1952, is celebrating its Forty-Fifth Anniversary at its annual meeting in the Summer of 1997.

The American Mathematical Society extends to SIAM its warmest congratulations on this very happy occasion.

The AMS works together with SIAM on many problems of joint interest, and we look forward to many years of continuing cooperation in helping the mathematical sciences.

The teller reported that the following individuals were elected in the election of 1996:

H. Blaine Lawson Jr. from SUNY Stony Brook was elected vice-president for a term of three years ending on January 31, 2000.

Andy R. Magid from the University of Oklahoma was elected a trustee for a term of five years ending on January 31, 2002.

Francis Bonahon from the University of Southern California, Frederick Gardner from City University of New York, Gail Ratcliff from the University of Missouri-St. Louis, Joel H. Spencer from New York University, and Karen Vogtmann from Cornell University were elected as members-at-large of the Council for three years, with terms ending on January 31, 2000.

The teller also reported on the elections to the Nominating Committee and the Editorial Boards Committee. John C. Polking from Rice University, Barbara L. Osofsky from Rutgers University, and James D. Stasheff from the University of North Carolina were elected to three-year terms on the Nominating Committee ending on December 31, 1999, while Eric Bedford from Indiana University and Richard S. Palais from Brandeis University were elected to the Editorial Boards Committee for three-year terms ending on January 31, 2000.

While sitting in Executive Session, the Council received recommendations for appointments of several editors from the Editorial Boards Committee. The Council appointed Steven Lichtenbaum to a three-year term on the Colloquium Series Editorial Committee. It also approved the appointments of Jean-Louis Loday and Joyce McLaughlin for three-year terms on the Mathematical Reviews Editorial Committee and the appointment of William Beckner as replacement for a resigning editor with term ending on January 31, 1999, on the Transactions and Memoirs Editorial Committee.

Also while sitting in Executive Session, the Council appointed several officers of the Society upon recommendation by the Executive Committee and Board of Trustees. The ECBT recommended and the Council approved the reappointments of Susan Friedlander as Associate Secretary of the Central Section and William Harris as Associ...
From the AMS

ate Secretary of the Western Section, both for terms of two years.

Marc Rieffel, chair of the ECBT Long Range Planning Committee, gave an oral report on activities of the committee. The Council filed reports of several of its standing committees. (Committees of the Council are expected to report annually to the Council. The reports are filed by the Council and are available from the Office of the Secretary. If a committee recommends action by the Council, it is presented as a separate item. Reports are not accepted or endorsed, nor do they contain Council or Society policy unless such policy is specifically adopted by the Council.)

The Committee on Meetings and Conferences (COMC) recommended policy procedures regarding co-sponsorship of meetings and conferences of other organizations that were adopted by the Council.

When the Society receives a request for co-sponsorship, this request will be referred to the Secretariat. The Secretariat will then determine whether the proposed co-sponsorship has mathematical merit and is otherwise in the best interests of the Society. If the request is a simple one, then the Secretariat can approve the request without further input; in more complicated cases (e.g., those requesting funding from the AMS), the Secretariat will forward the request to the ECBT and Council with a recommendation.

The Society reserves the right to appoint one or more members to appropriate program and organizing committees. Under normal circumstances the Society reserves the right of first refusal to any conference proceedings. This right should be exercised judiciously in light of the importance of maintaining goodwill between the Society and the organization requesting co-sponsorship; in all cases, the determination as to whether the Society will exercise its right to publish any proceedings should be made in a timely manner.

COMC also recommended to the Council procedural and policy items regarding international meetings, also adopted by the Council.

- That the AMS continue to develop its written guidelines concerning the handling of financial arrangements and other organizational aspects of the meetings.
- That the AMS continue to work towards coordination at international meetings, such as the involvement of people who already have contact with the country (e.g., who can speak the language and have substantial scientific contacts);

coordination between any AMS program committees and counterpart committees in the country involved.

When the Council established five policy committees, it also asked that a high-level review of their operation take place after three years. This review has taken place, and the report appears in the AMS Committee Report Book for 1997, report No. 970107-020. Early in 1996 President Morawetz appointed five committees, each to review one of the policy committees. The five chairs of these committees then served as a committee that consolidated the individual reviews and reported to the Council.

One suggestion that this review committee received and that appeared in the report but was not forwarded to the Council as an action item was that the chairs of the policy committees should form a "cabinet" together with the president. It was moved, seconded, and approved by the Council that the question concerning a "cabinet", which appeared in this report, be included in the April 1997 or January 1998 agenda.

There were several action items recommended in this review, which appear below.

The Committee recommended some revisions to the charge of the Committee on Publications. (Each committee of the Council has a "charge" that includes the members of the committee, how the members are appointed, what the terms are, how a chair is named, and what the committee is supposed to do. The charges for the committees of the Society are available from the Office of the Secretary. At some time in the future these charges will appear on the Web.)

The Council amended the charge of the Committee on Publications to read as follows:

The primary duty of the policy Committee on Publications (CPUB) is to keep itself informed on all facets of the AMS program for publishing monographs, primary research journals, translations, and the member publications (i.e., the Bulletin and the Notices), and to recommend to the Council ways that this program might be improved. Since policy recommendations formulated by CPUB may require commitments of staff and other resources which may not be immediately available, CPUB shall also recommend priorities for actions to the Council. The primary responsibility for making recommendations concerning Mathematical Reviews (MR) remains with the Math Reviews Editorial Committee; however, in the course of its other duties CPUB may occasionally find it expedient to make recommendations that involve MR in a secondary way.

The next decade is likely to be a time of rapid technological change in the publication and distribution of scientific literature, and CPUB should stay abreast of these developments and alert the Council to any actions needed to take best advantage of developing opportunities. Since carrying out this charge may require expert knowledge beyond that of its members, it is expected that CPUB will set up subcommit-
The report recommended the addition of language to the Council's overall policy. CPUB shall keep its attention fixed on long-term policy questions, and the committee as a whole should not allow itself to be diverted from this goal by getting involved with day-to-day operational details of the Society's publication program.

CPUB will conduct detailed periodic reviews of the various publication activities of the Society in a four-year cycle, as follows:

- **Year 1**: Paper journals (JAMS, PAMS, TAMS, ...)
- **Year 2**: Electronic journals and e-MATH
- **Year 3**: Monographs, textbooks, and translations
- **Year 4**: Member journals (*Bulletin, Notices, Abstracts*)

The results should be reported to the Executive Committee and to the Council.

- receive reports pertaining to meetings and conferences policy from committees of the Society, and forward analysis and recommendations to the Council;
- report regularly to the membership; maintain an awareness of the views of the membership on issues concerning meetings and conferences; this may involve surveys, focus-group discussions, individual communications and committee correspondence;
- fulfill the charges to all policy committees included in Council resolutions as they may pertain to the area of responsibility of COMC.

COMC will coordinate its activities with other policy committees in areas of mutual concern. COMC will foster coordination with other professional organizations and government agencies on cooperative and parallel activities.

Though COMC is charged with attention to policy issues and with taking a long-range view towards matters affecting meetings and conferences, it may be appropriate for COMC to communicate informal suggestions to the Secretariat or the Meetings and Conferences Department for their consideration. Likewise, it may be appropriate for the Secretariat or the Meetings and Conferences Department to seek the informal advice of COMC about ongoing activities.

The report recommended that a subcommittee be established by the Council to revisit and perfect the broad charge of the Committee on the Profession. Furthermore, it was recommended and the Council approved that the first sentence of the charge of the Committee on the Profession be changed from

"The Committee is to take a long-range view of and provide major direction for Society activities on issues of a broad professional nature" to "The Committee is to take a long-range view of and provide major direction for Society activities on issues of a broad professional nature concerning the status of the profession and the situation of mathematics and mathematicians in the U.S. and abroad."

The committee made several recommendations for Council procedures, which the Council considered and approved, sometimes with amendments to the original proposals.

Resolution 1. While proposers (including committees) of motions concerning policy do not need approval of policy committees in order to bring motions before the Council, ordinarily they should consult relevant policy committees before doing so. The aim of such consultation is to assist the Council in handling its business expeditiously. If appropriate, the policy committee should try to work with the proposer to find optimal wording for a motion before it is brought to the Council for action. Furthermore, an analysis (by the proposer or the policy committee), indicating in particular the likely cost to the AMS in both time and money if a motion is approved, should usually be included;
and a motion should also include a recommendation as to who should be charged with implementing the motion if it is approved. Normally requests for consultation should be handled by e-mail as rapidly as reasonable. (Extensive reconsideration by policy committees of motions proposed by others is not envisioned here.)

Resolution 2. Ordinarily, any motion which is proposed for consideration at a Council meeting should be circulated by e-mail to all Council members well in advance of the meeting, so that the Council can conduct an e-mail discussion of the proposed motion. The aim should be to try to reach a consensus ahead of the Council meeting (with the motion in question then possibly being placed on the consent agenda), so that most of the limited Council meeting time can be spent on careful discussion of those motions on which it has not been possible to reach consensus ahead of time. It would be best if this e-mail discussion by the Council could be preceded by an analysis of the proposed motion by the appropriate committee.

Resolution 3. The Council requests that the Nominating Committee stress, in its discussions with possible candidates for election to the Council as Member-at-Large and as Vice-President, that much of a Council member's work will take place as a member of one of the policy committees and by e-mail. Possible candidates should be led to understand that much more work is involved than just attendance at Council meetings, though because of e-mail this work may not require more than one or two additional actual committee meetings per year.

Resolution 4. The Council requests that the annual reports of policy committees should include not only their accomplishments but also their future plans, including suggestions for prioritizing items in order to balance both items of pressing concern and long-range planning. The Council could then have more input into the items selected for study and their priority.

The Council discussed recent changes in immigration and visa policies. It passed the following resolution. (In the months following the Council meeting a similar resolution was passed by the Council so as to speak in the name of the Society. The final version of that resolution appears in the report of the April 1997 meeting.)

WHEREAS the American Mathematical Society recognizes the great value of international contacts to the mathematics of this country and the world; and

WHEREAS hospitality to foreign nationals has played a large and increasing role in making such contacts, and is fostered by all major universities;

BE IT RESOLVED that the Council deplores the announced intent of the "Illegal Immigration Reform and Immigrant Responsibility Act of 1996" to restrict visits by foreign nationals;

that the Council directs the AMS president and AMS staff to work with other professional societies and with U.S. universities and colleges in an effort to change or challenge the provisions of Section 641 of this act.

that the Council directs the officers and the Washington representative of the Society to monitor the progress of this issue, study other sections of the act, and report to the members on any further areas in which defense of the profession against this act may be possible.

that this resolution is to be publicized without delay to the membership, to JPB, to AAAS, to the National Academy of Sciences, and to the press.

The Council also discussed the role of the mathematical community in the International Mathematical Union and passed the following resolution.

Because the Council of the American Mathematical Society is interested in the effective participation of United States mathematicians in the International Mathematical Union (IMU), the Council charges the Washington office of the Society and the Council's Committee on Science Policy (CSP) to work with the National Research Council's Board on Mathematical Sciences (BMS) to support the development and effective operation of the new United States National Committee on Mathematics that is being formed by the BMS.

In particular, the CSP should provide input regarding appropriate resolutions that should be presented to the IMU's General Assembly and to the IMU committees.

The Council adjourned at approximately 5:00 p.m.

The April 1997 Council

The Council of the Society met on Saturday, April 12, 1997, in College Park, MD.

There were seventeen members in attendance.

The meeting was called to order at 7:07 p.m. by President Jaffe. Several corrections were noted in the minutes that had been distributed. It was noted that David Eisenbud attended the meeting as representative of the Bulletin Editorial Committee.

Item 3.3.1 should read that Susan Friedlander and William Harris were approved as Associate Secretaries.

There was a typographical error noted in the last paragraph of the resolution: The sentence should begin: that this....

The minutes were approved as corrected.

The Council conducted business by mail on February 15, 1997. The minutes were approved as presented and contained the items below.
The Council conducted an election for a member to serve on the Executive Committee (EC). John B. Conway, member-at-large, was elected to a four-year term on the EC. He will serve until a new member is elected, in February 2001, to replace him.

The Council also considered and approved, so as to speak in the name of the Society, a resolution on immigration that appears in the attached minutes.

This resolution states:

WHEREAS the American Mathematical Society recognizes the great value of international contacts to the mathematics of this country and the world; and

WHEREAS hospitality to foreign nationals has played a large and increasing role in making such contacts, and is fostered by all major universities;

BE IT RESOLVED that the American Mathematical Society deplores the announced intent of the "Illegal Immigration Reform and Immigrant Responsibility Act of 1996" to restrict visits by foreign nationals;

The Council directs the AMS president and AMS staff to work with other professional societies and with U.S. universities and colleges in an effort to change or challenge the provisions of Section 641 of this act.

One of the principal purposes for the April meeting of the Council is to consider nominations for the elections held in the fall. The Nominating Committee made its report to the Council, part of which was considered in Executive Session. The Council approved all the suggestions made by the committee, to wit:

The report recommended that the selection of the president-elect continue to be accomplished by means of a contested election, a recommendation which was approved by the Council.

The report requested more specific instructions concerning the election of trustees from the Council for elections after 1997.

The Council nominated Felix Browder (Rutgers) and Srinivasa Varadhan (Courant) for election to a one-year term as president-elect. Both agreed to run.

To write an article supporting the nomination of Browder, the Committee recommended the appointment of Jerry Bona as nominator. To write in support of the nomination of Varadhan, the Committee recommended Dan Stroock as nominator. These were approved by the Council.

The Council nominated Jennifer Chayes (Microsoft) and Efim Zelmanov (Yale) for election to a three-year term as vice-president.

The Council nominated Edward Aboufadel of Grand Valley State, Alejandro Adem of Wisconsin, Ara Basmajian of Oklahoma, Robert Bryant of Duke, Jane Hawkins of North Carolina, Lisa Jeffrey of IAS and McGill, Karen Parshall of Virginia, Michael Starbird of Texas, Abigail Thompson of UC Davis, and Dean Yang of Polytechnic for election as members-at-large of the Council. In addition, it agreed to nominate Mary Beth Ruskai of the University of Massachusetts as a candidate for election to the position of member-at-large of the Council. Ruskai was suggested by a petition by members of the Society.

The Council also nominated Roy Adler (IBM) and Frederick Wan (UC Irvine) for election to a five-year term as trustee of the Society.

The executive director, John H. Ewing, gave his annual report to the Council.

Since the Society no longer meets regularly in the summer, the usual August Council meetings do not take place. The questions arise as to whether the spring meeting should be called later in the spring and how the Council would conduct important business between the spring meeting and the annual winter meeting. Discussion took place, and the Council agreed to return to this matter at a later date.

The meeting adjourned at about 10 p.m.

Bylaws of the American Mathematical Society

Article I

Officers

Section 1. There shall be a president, a president-elect (during the even-numbered years only), an ex-president (during the odd-numbered years only), three vice-presidents, a secretary, four associate secretaries, a treasurer, and an associate treasurer.

Section 2. It shall be a duty of the president to deliver an address before the Society at the close of the term of office or within one year thereafter.

Article II

Board of Trustees

Section 1. There shall be a Board of Trustees consisting of eight trustees, five trustees elected by the Society in accordance with Article VII, together with the president, the treasurer, and the associate treasurer of the Society ex officio. The Board of Trustees shall designate its own presiding officer and secretary.

Section 2. The function of the Board of Trustees shall be to receive and administer the funds of the Society, to have full legal control of its investments and properties, to make contracts, and, in general, to conduct all business affairs of the Society.

Section 3. The Board of Trustees shall have the power to appoint such assistants and agents as may be necessary or convenient to facilitate the conduct of the affairs of the Society.

The executive director, John H. Ewing, gave his annual report to the Council.
Society and to fix the terms and conditions of their employment. The Board may delegate to the officers of the Society duties and powers normally inhering in their respective corporative offices, subject to supervision by the Board. The Board of Trustees may appoint committees to facilitate the conduct of the financial business of the Society and delegate to such committees such powers as may be necessary or convenient for the proper exercise of those powers. Agents appointed, or members of committees designated, by the Board of Trustees need not be members of the Board.

Nothing herein contained shall be construed to empower the Board of Trustees to divest itself of responsibility for, or legal control of, the investments, properties, and contracts of the Society.

Article III
Committees
Section 1. There shall be eight editorial committees as follows: committees for the Bulletin, for the Proceedings, for the Colloquium Publications, for the Journal, for Mathematical Surveys and Monographs, for Mathematical Reviews; a joint committee for the Transactions and the Memoirs; and a committee for Mathematics of Computation.

Section 2. The size of each committee shall be determined by the Council.

Article IV
Council
Section 1. The Council shall consist of fifteen members-at-large and the following ex officio members: the officers of the Society specified in Article I, except that it shall include only one associate secretary, the chairman of each of the editorial committees specified in Article III, any former secretary for a period of two years following the terms of office, and members of the Executive Committee (Article V) who remain on the Council by the operation of Article VII, Section 4.

The chairman of any committee designated as a Council member may name a deputy from the committee as substitute. The associate secretary shall be the one charged with the scientific program of the meeting at which the Council meets except that at a meeting associated with no scientific meeting of the Society the secretary may designate the associate secretary.

Section 2. The Council shall formulate and administer the scientific policy of the Society and shall act in an advisory capacity to the Board of Trustees.

Section 3. In the absence of the secretary from any meeting of the Council, a member may be designated as acting secretary for the meeting, either by written authorization of the secretary, or, failing that, by the presiding officer.

Section 4. All members of the Council shall be voting members. Each member, including deputies and the designated associate secretary, shall have one vote. The method for settling matters before the Council at any meeting shall be by majority vote of the members present. If the result of a vote is challenged, it shall be the duty of the presiding officer to determine the true vote by a roll call. In a roll call vote, each Council member shall vote only once (although possibly a member of the Council in several capacities).

Section 5. Any five members of the Council shall constitute a quorum for the transaction of business at any meeting of the Council.

Section 6. Between meetings of the Council, business may be transacted by mail vote. Votes shall be counted as specified in Section 4 of this Article, “members present” being replaced by “members voting”. An affirmative vote by mail on any proposal shall be declared if, and only if, (a) more than half of the total number of possible votes is received by the time announced for the closing of the polls, and (b) at least three-quarters of the votes received by then are affirmative. If five or more members request postponement at the time of voting, action on the matter at issue shall be postponed until the next meeting of the Council, unless either (1) at the discretion of the secretary, the question is made the subject of a second vote by mail, in connection with which brief statements of reason, for and against, are circulated; or (2) the Council places the matter at issue before the Executive Committee for action.

Section 7. The Council may delegate to the Executive Committee certain of its duties and powers. Between meetings of the Council, the Executive Committee shall act for the Council on such matters and in such ways as the Council may specify. Nothing herein contained shall be construed as empowering the Council to divest itself of responsibility for formulating and administering the scientific policies of the Society.

Section 8. The Council shall also have power to speak in the name of the Society with respect to matters affecting the status of mathematics or mathematicians, such as proposed or enacted federal or state legislation; conditions of employment in universities, colleges, or business, research or industrial organizations; regulations, policies, or acts of governmental agencies or instrumentalities; and other items which tend to affect the dignity and effective position of mathematics.

With the exception noted in the next paragraph, a favorable vote of two-thirds of the entire membership of the Council shall be necessary to authorize any statement in the name of the Society with respect to such matters. With the exception noted in the next paragraph, such a vote may be taken only if written notice shall have been given to the secretary by the proposer of any such resolution not later than one month prior to the Council meeting at which the matter is to be presented, and the vote shall be taken not earlier than one month after the resolution has been discussed by the Council.

If, at a meeting of the Council, there are present twelve members, then the prior notification to the secretary may be waived by unanimous consent. In such a case, a unanimous favorable vote by those present shall empower the Council to speak in the name of the Society.

The Council may also refer the matter to a referendum by mail of the entire membership of the Society and shall make such reference if a referendum is requested, prior to final action by the Council, by two hundred or more mem-
The taking of a referendum shall act as a stay upon Council action until the votes have been canvassed, and thereafter no action may be taken by the Council except in accordance with a plurality of the votes cast in the referendum.

Article V
Executive Committee
Section 1. There shall be an Executive Committee of the Council, consisting of four elected members and the following ex officio members: the president, the secretary, the president-elect (during even-numbered years), and the ex-president (during odd-numbered years).

Section 2. The Executive Committee of the Council shall be empowered to act for the Council on matters which have been delegated to the Executive Committee by the Council. If three members of the Executive Committee request that any matter be referred to the Council, the matter shall be so referred. The Executive Committee shall be responsible to the Council and shall report its actions to the Council. It may consider the agenda for meetings of the Council and make recommendations to the Council.

Section 3. Each member of the Executive Committee shall have one vote. An affirmative vote on any proposal before the Executive Committee shall be declared if, and only if, at least four affirmative votes are cast for the proposal. A vote on any proposal may be determined at a meeting of the Executive Committee, but it shall not be necessary to hold a meeting to determine a vote.

Article VI
Executive Director
Section 1. There shall be an Executive Director who shall be a paid employee of the Society. The Executive Director shall have charge of the offices of the Society, except for the office of the secretary, and shall be responsible for the general administration of the affairs of the Society in accordance with the policies that are set by the Board of Trustees and by the Council.

Section 2. The Executive Director shall be appointed by the Board of Trustees with the consent of the Council. The terms and conditions of employment shall be fixed by the Board of Trustees, and the performance of the Executive Director will be reviewed regularly by the Board of Trustees.

Section 3. The Executive Director shall be responsible to and shall consult regularly with a liaison committee consisting of the president as chair, the secretary, the treasurer, and the chair of the Board of Trustees.

Section 4. The Executive Director shall attend meetings of the Board of Trustees, the Council, and the Executive Committee, but shall not be a member of any of these bodies.

Article VII
Election of Officers and Terms of Office
Section 1. The term of office shall be one year in the case of the president-elect and the ex-president; two years in the case of the president, the secretary, the associate secretaries, the treasurer, and the associate treasurer; three years in the case of vice-presidents and members-at-large of the Council, one vice-president and five members-at-large retiring annually; and five years in the case of the trustees. In the case of members of the editorial committees and appointed members of the communications committees, the term of office shall be determined by the Council. The term of office for elected members of the Executive Committee shall be four years, one of the elected members retiring annually. All terms of office shall begin on February 1 and terminate on January 31, with the exception that the officials specified in Articles I, II, III, IV, and V (excepting the president-elect and ex-president) shall continue to serve until their successors have been duly elected or appointed and qualified.

Section 2. The president-elect, the vice-presidents, the trustees, and the members-at-large of the Council shall be elected by written ballot. An official ballot shall be sent to each member of the Society by the secretary on or before October 10, and such ballots, if returned to the secretary in envelopes bearing the name of the voter and received within thirty days, shall be counted. Each ballot shall contain one or more names proposed by the Council for each office to be filled, with blank spaces in which the voter may substitute other names. A plurality of all votes cast shall be necessary for election. In case of failure to secure a plurality for any office, the Council shall choose by written ballot among the members having the highest number of votes. The secretary, the associate secretaries, the treasurer, and the associate treasurer shall be appointed by the Council in a manner designated by the Council. Each committee named in Article III shall be appointed by the Council in a manner designated by the Council. Each such committee shall elect one of its members as chairman in a manner designated by the Council.

Section 3. The president becomes ex-president at the end of the term of office and the president-elect becomes president.

Section 4. On or before February 15, the secretary shall send to all members of the Council for a mail vote a ballot containing two names for each place to be filled on the Executive Committee. The nominees shall be chosen by a committee appointed by the president. Members of the Council may vote for persons not nominated. Any member of the Council who is not an ex officio member of the Executive Committee (see Article V, Section 1) shall be eligible for election to the Executive Committee. In case a member is elected to the Executive Committee for a term extending beyond the regular term on the Council, that person shall automatically continue as a member of the Council during the remainder of that term on the Executive Committee.

Section 5. The president and vice-presidents shall not be eligible for immediate re-election to their respective offices. A member-at-large or an ex officio member of the Council shall not be eligible for immediate election (or re-election) as a member-at-large of the Council.

Section 6. If the president of the Society should die or resign while a president-elect is in office, the president-elect shall serve as president for the remainder of the year and thereafter shall serve the regular two-year term. If the
From the AMS

president of the Society should die or resign when no president-elect is in office, the Council, with the approval of the Board of Trustees, shall designate one of the vice-presidents to serve as president for the balance of the regular presidential term. If the president-elect of the Society should die or resign before becoming president, the office shall remain vacant until the next regular election of a president-elect, and the Society shall, at the next annual meeting, elect a president for a two-year term. If the ex-president should die or resign before expiration of the term of office, the Council, with the approval of the Board of Trustees, shall designate a former president of the Society to serve as ex-president during the remainder of the regular term of the ex-presidency. Such vacancies as may occur at any time in the group consisting of the vice-presidents, the secretary, the associate secretaries, the treasurer, and the associate treasurer shall be filled by the Council with the approval of the Board of Trustees. If a member of an editorial or communications committee should take temporary leave from duties, the Council shall then appoint a substitute. The Council shall fill from its own membership any vacancy in the elected membership of the Executive Committee.

Section 7. If any elected trustee should die while in office or resign, the vacancy thus created shall be filled for the unexpired term of the Board of Trustees.

Section 8. If any member-at-large of the Council should die or resign more than one year before the expiration of the term, the vacancy for the unexpired term shall be filled by the Society at the next annual meeting.

Section 9. In case any officer should die or decline to serve between the time of election and the time to assume office, the vacancy shall be filled in the same manner as if that officer had served one day of the term.

Article VIII

Members and Their Election

Section 1. Election of members shall be by vote of the Council or of its Executive Committee.

Section 2. There shall be four classes of members, namely, ordinary, contributing, corporate, and institutional.

Section 3. Application for admission to ordinary membership shall be made by the applicant on a blank provided by the secretary. Such applications shall not be acted upon until at least thirty days after their presentation to the Council (at a meeting or by mail), except in the case of members of other societies entering under special action of the Council approved by the Board of Trustees.

Section 4. An ordinary member may become a contributing member by paying the dues for such membership. (See Article IX, Section 3.)

Section 5. A university or college, or a firm, corporation, or association interested in the support of mathematics may be elected a corporate or an institutional member.

Article IX

Dues and Privileges of Members

Section 1. Any applicant shall be admitted to ordinary membership immediately upon election by the Council (Article VIII) and the discharge within sixty days of election of the first annual dues. Dues may be discharged by payment or by remission when the provision of Section 7 of this Article is applicable. The first annual dues shall apply to the year of election, except that any applicant elected after August 15 of any year may elect to have the first annual dues apply to the following year.

Section 2. The annual dues of an ordinary member of the Society shall be established by the Council with the approval of the Trustees. The Council, with the approval of the Trustees, may establish special rates in exceptional cases and for members of an organization with which the Society has a reciprocity agreement.

Section 3. The minimum dues for a contributing member shall be three-halves of the dues of an ordinary member per year. Members may, upon their own initiative, pay larger dues.

Section 4. The minimum dues of an institutional member shall depend on the scholarly activity of that member. The formula for computing these dues shall be established from time to time by the Council, subject to approval by the Board of Trustees. Institutions may pay larger dues than the computed minimum.

Section 5. The privileges of an institutional member shall depend on its dues in a manner to be determined by the Council, subject to approval by the Board of Trustees. These privileges shall be in terms of Society publications to be received by the institution and of the number of persons it may nominate for ordinary membership in the Society.

Section 6. Dues and privileges of corporate members of the Society shall be established by the Council subject to approval by the Board of Trustees.

Section 7. The dues of an ordinary member of the Society shall be remitted for any years during which that member is the nominee of an institutional member.

Section 8. After retirement from active service on account of age or on account of long-term disability, any ordinary or contributing member who is not in arrears of dues and with membership extending over at least twenty years may, by giving proper notification to the secretary, have dues remitted. Such a member shall receive the Notices and may request to receive Bulletin as privileges of membership during each year until membership ends.

Section 9. An ordinary or contributing member shall receive the Notices and Bulletin as privileges of membership during each year for which dues have been discharged.

Section 10. The annual dues of ordinary, contributing, and corporate members shall be due by January 1 of the year to which they apply. The Society shall submit bills for dues. If the annual dues of any member remain undischarged beyond what the Board of Trustees deems to be a reasonable time, the name of that member shall be removed from the list of members after due notice. A member wishing to discontinue membership at any time shall submit a resignation in writing to the Society.

Section 11. Any person who has attained the age of 62 and has been a member for at least twenty years may become a life member by making a single payment equal to five times the dues of an ordinary member for the coming
year. Insofar as there is more than one level of dues for ordinary membership, it is the highest such dues that shall be used in the calculation, with the exception for members by reciprocity noted in the following paragraph. A life member is subsequently relieved of the obligation of paying dues. The status and privileges are those of ordinary members.

A member of the Society by reciprocity who has reached the age of 62, has been a member for at least 20 years, has been a member by reciprocity for at least 15 of those 20 years and asserts the intention of continuing to be a member by reciprocity may purchase a life membership by a one-time payment of a special rate established by the Council, with the approval of the Trustees.

Article XI

Publications

Section 1. The Society shall publish an official organ called the Bulletin of the American Mathematical Society. It shall publish four journals, known as the Journal of the American Mathematical Society, the Transactions of the American Mathematical Society, the Proceedings of the American Mathematical Society, and Mathematics of Computation. It shall publish a series of mathematical papers known as the Memoirs of the American Mathematical Society. The object of the Journal, Transactions, Proceedings, Memoirs, and Mathematics of Computation is to make known important mathematical researches. It shall publish a periodical called Mathematical Reviews, containing abstracts or reviews of current mathematical literature. It shall publish a series of volumes called Colloquium Publications which shall embody in book form new mathematical developments. It shall publish a series of monographs called Mathematical Surveys and Monographs which shall furnish expositions of the principal methods and results of particular fields of mathematical research. It shall also cooperate in the conduct of the American Journal of Mathematics. It shall publish a news periodical known as the Notices of the American Mathematical Society, containing programs of meetings, items of news of particular interest to mathematicians, and such other materials as the Council may direct.

Section 2. The editorial management of the publications of the Society listed in Section 1 of this article, with the exception of the Notices, and the participation of the Society in the editorial management of the American Journal of Mathematics shall be in the charge of the respective editorial committees as provided in Article III, Section 1. The editorial management of the Notices shall be in the hands of a committee chosen in a manner established by the Council.

Article XII

Indemnification

Any person who at any time serves or has served as a trustee or officer of the Society, or as a member of the Council, or, at the request of the Society, as a director or officer of another corporation, whether for profit or not for profit, shall be indemnified by the Society and be reimbursed against and for expenses actually and necessarily incurred in connection with the defense or reasonable settlement of any action, suit, legal or administrative proceeding, whether civil, criminal, administrative or investigatory, threatened, pending or completed, to which that
person is made a party by reason of being or having been such trustee, officer or director or Council member, except in relation to matters as to which the person shall be adjudged in such action, suit, or proceeding to be liable for negligence or misconduct in the performance of official duties. Such right of indemnification and reimbursement shall also extend to the personal representatives of any such person and shall be in addition to and not in substitution for any other rights to which such person or personal representatives may now or hereafter be entitled by virtue of the provisions of applicable law or of any other agreement or vote of the Board of Trustees, or otherwise.

Article XIII
Amendments
These bylaws may be amended or suspended on recommendation of the Council and with the approval of the membership of the Society, the approval consisting of an affirmative vote by two-thirds of the members present at a business meeting or of two-thirds of the members voting in a mail ballot in which at least ten percent of the members vote, whichever alternative shall have been designated by the Council, and provided notice of the proposed action and of its general nature shall have been given in the call for the meeting or accompanies the ballot in full.

As amended December 1995

AMS Lecturers, Officers, Funds, and Prizes

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<td>M. F. Atiyah, 1973</td>
<td>Robert P. Langlands, 1992</td>
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Endowment Fund

In 1923 an Endowment Fund was collected to meet the greater demands on the publication program of the Society, demands caused by the ever-increasing number of important mathematical memoirs. Of this fund, which amounted to approximately $94,000 in 1960, a considerable proportion was contributed by members of the Society. In 1961, upon the death of the last legatees under the will of the late Robert Henderson—for many years a Trustee of the Society—the entire principal of the estate was received by the Society, thereby bringing the Endowment Fund to approximately $648,000.
Prize Funds

The George David Birkhoff Prize in Applied Mathematics

This prize was established in 1967 in honor of Professor George David Birkhoff. The initial endowment of $2,066 was contributed by the Birkhoff family and there have been subsequent additions by others. It is normally awarded every five years, beginning in 1968, for an outstanding contribution to "applied mathematics in the highest and broadest sense." The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico.

First award, 1968: To Jürgen K. Moser for his contributions to the theory of Hamiltonian dynamical systems, especially his proof of the stability of periodic solutions of Hamiltonian systems having two degrees of freedom and his specific applications of the ideas in connection with this work.

Second award, 1973: To Fritz John for his outstanding work in partial differential equations, in numerical analysis, and, particularly, in nonlinear elasticity theory; the latter work has led to his study of quasi-isometric mappings as well as functions of bounded mean oscillation, which have had impact in other areas of analysis.

Third award, 1973: To James B. Serrin for his fundamental contributions to the theory of nonlinear partial differential equations, especially his work on existence and regularity theory for nonlinear elliptic equations, and applications of his work to the theory of minimal surfaces in higher dimensions.

Fourth award, 1978: To Garrett Birkhoff for bringing the methods of algebra and the highest standards of mathematics to scientific applications.

Fifth award, 1978: To Mark Kac for his important contributions to statistical mechanics and to probability theory and its applications.

Sixth award, 1978: To Clifford A. Truesdell for his outstanding contributions to our understanding of the subjects of rational mechanics and nonlinear materials, for his efforts to give precise mathematical formulation to these classical subjects, for his many contributions to applied mathematics in the fields of acoustic theory, kinetic theory, and nonlinear elastic theory, and the thermodynamics of mixtures, and for his major work in the history of mechanics.

Seventh award, 1983: To Paul R. Garabedian for his important contributions to partial differential equations, to the mathematical analysis of problems of transonic flow and airfoil design by the method of complexification, and to the development and application of scientific computing to problems of fluid dynamics and plasma physics.

Eighth award, 1988: To Elliott H. Lieb for his profound analysis of problems arising in mathematical physics.

Ninth award, 1994: To Ivo Babuška for important contributions to the reliability of finite element methods, the development of a general framework for finite element error estimation, and the development of $p$ and $h-p$ finite element methods; and to S. R. S. Varadhan for important contributions to the martingale characterization of diffusion processes, to the theory of large deviations for functionals of occupation times of Markov processes, and to the study of random media.

The Bôcher Memorial Prize

This prize was founded in memory of Professor Maxime Bôcher with an original endowment of $1,450. It is awarded every five years for a notable research memoir in analysis that has appeared during the past five years in a recognized North American Journal. This provision, introduced in 1971 and modified in 1993, is a liberalization of the terms of the award.


Eighth award, 1953: To Norman Levinson for his contributions to the theory of linear, nonlinear, ordinary, and partial differential equations contained in his papers of recent years.

Ninth award, 1959: To Louis Nirenberg for his work in partial differential equations.


Twelfth award, 1974: To Donald S. Ornstein in recognition of his paper, Bernoulli shifts with the same entropy are isomorphic, Advances in Mathematics, volume 4 (1970), pp. 337–352.


Fourteenth award, 1984: To Luis A. Caffarelli for his deep and fundamental work in nonlinear partial differential equations, in particular his work on free boundary problems, vortex theory and regularity theory.

Fifteenth award, 1984: To Richard B. Melrose for his solution of several outstanding problems in diffraction theory and scattering theory and for developing the analytical tools needed for their resolution.


Seventeenth award, 1994: To Leon Simon for his profound contributions toward understanding the structure of singular sets for solutions of variational problems.

The Frank Nelson Cole Prize in Algebra
The Frank Nelson Cole Prize in Number Theory

The Frank Nelson Cole Prize in Algebra

These prizes were founded in honor of Professor Frank Nelson Cole on the occasion of his retirement as secretary of the American Mathematical Society after twenty-five years of service and as editor-in-chief of the Bulletin for twenty-one years. The original fund was donated by Professor Cole from moneys presented to him on his retirement, was augmented by contributions from members of the Society, and was later doubled by his son, Charles A. Cole. The present endowment is $2,250. The prizes are awarded at five-year intervals for contributions to algebra and the theory of numbers, respectively, under restrictions similar to those for the Bôcher Prize.


Fifth award, 1944: To Oscar Zariski for four papers on algebraic varieties published in the American Journal of Mathematics, volumes 61 (1939) and 62 (1940), and in the Annals of Mathematics, Series 2, volumes 40 (1939) and 41 (1940).


Eighth award, 1951: To Paul Erdős for his many papers in the theory of numbers, and in particular for his paper, On a new method in elementary number theory which leads to an elementary proof of the prime number theorem, Proceedings of the National Academy of Sciences, volume 35 (1949), pp. 374–385.

Ninth award, 1954: To Harish-Chandra for his papers on representations of semisimple Lie algebras and groups, and particularly for his paper, On some applications of the universal enveloping algebra of a semisimple Lie algebra, Transactions of the American Mathematical Society, volume 70 (1951), pp. 28–96.


Fifteenth award, 1970: To John R. Stallings for his paper, On torsion-free groups with infinitely many ends, Annals of Mathematics, Series 2, volume 88 (1968), pp. 312–334; and to Richard G. Swan for his paper, Groups


Twenty-First award, 1985: To George Lusztig for his fundamental work on the representation theory of finite groups of Lie type. In particular for his contributions to the classification of the irreducible representations in characteristic zero of the groups of rational points of reductive groups over finite fields, appearing in Characters of reductive groups over finite fields, Annals of Mathematics Studies, volume 107, Princeton University Press, 1984.


Twenty-Fourth award, 1992: To Karl Rubin for his work in the area of elliptic curves and Iwasawa Theory with particular reference to his papers Tate-Shafarevich groups and L-functions of elliptic curves with complex multiplication and The “main conjectures” of Iwasawa theory for imaginary quadratic fields and to Paul Volta for his work on Diophantine problems with particular reference to his paper Siegel’s theorem in the compact case.

Twenty-Fifth award, 1995: To Michel Raynaud and David Harbater for their solution of Abhyankar’s conjecture. This work appeared in the papers Revêtements de la droite affine en caractéristique p > 0, Invent. Math. 116 (1994) 425–462 (Raynaud), and Abhyankar’s conjecture on Galois groups over curves, Invent Math. 117 (1994) 1–25 (Harbater).


The Delbert Ray Fulkerson Prize
Gifts of friends of the late Professor Fulkerson have provided a fund in excess of $7,000. Part or all of the proceeds is to be used jointly by the Mathematical Programming Society and the American Mathematical Society for the award of one or more prizes in discrete mathematics at regular intervals.


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

This prize, which was established in 1995, is to be awarded to an undergraduate student (or students having submitted joint work) for outstanding research in mathematics: it is entirely endowed by a gift of approximately $25,000 from Mrs. Frank (Brennie) Morgan. Any student who is an undergraduate in a college or university in Canada, Mexico, or the United States or its possessions is eligible to be considered for this prize. No more than one prize shall be awarded each year and a few honorable mentions may be made. The award is made jointly by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics.


The Award for Distinguished Public Service

To provide encouragement and recognition to those individuals who contribute their time to public service activities in support of mathematics, the Council of the Society established the Award for Distinguished Public Service. The award was established in response to a recommendation by the Society's Committee on Science Policy. The award is presented every two years to a research mathematician who has made a distinguished contribution to the mathematics profession during the preceding five years.

First award, 1991: Kenneth M. Hoffman for his outstanding leadership in establishing channels of communication between the mathematical community and makers of public policy as well as the general public.

Second award, 1992: Harvey B. Keynes for his multifaceted efforts to revitalize mathematics education, especially for young people.

Third award, 1993: Isadore M. Singer in recognition of his outstanding contributions to his profession, to science more broadly, and to the public good by bringing the best of mathematics and his own insights to bear on the activities of the National Academy of Sciences; on committees of the National Research Council, including the two so-called David Committees on the health of the mathematical sciences, and the Committee on Science, Engineering, and Public Policy; on the President's Science Advisory Council; on decisions of Congress, through testimony concerning the support of mathematics and mathematical research; and on a host of critical situations over many years in which his wisdom and intervention helped gain a hearing for the problems of his community and the contributions it makes to the nation.

Fourth award, 1995: Donald J. Lewis for his many contributions to mathematical education, mathematics policy, and mathematical research and administration during a career that has spanned several decades.

The Citation for Public Service

To provide encouragement and recognition for contributions to public service activities in support of mathematics, the Council of the Society established the Citation for Public Service. The award was established in response to a recommendation by the Society's Committee on Science Policy. One to three citations are presented each year for notable contributions to the mathematics profession through public service.

First award, 1991: Andre Z. Manitius for the contributions he made to the mathematical community while employed in the Division of Mathematical Sciences at the National Science Foundation.

Second award, 1992: Marcia P. Sward for her contributions toward establishing and directing the Mathematical Sciences Education Board from its inception in the fall of 1985 until August 1989.

The Ruth Lyttle Satter Prize in Mathematics

The prize was established in 1990 using funds donated by Joan S. Birman in memory of her sister, Ruth Lyttle Satter. Professor Birman requested that the prize be established to honor her sister's commitment to research and to encouraging women in science. The prizes are awarded every two years to recognize an outstanding contribution to mathematics research by a woman in the previous five years.

First award, 1991: To Dusa McDuff for her outstanding work during the past five years on symplectic geometry.

Second award, 1993: To Lai-Sang Young for her leading role in the investigation of the statistical (or ergodic) properties of dynamical systems.

Third award, 1995: To Sun-Yung Alice Chang for her deep contributions to the study of partial differential equations on Riemannian manifolds and in particular for her work on extremal problems in spectral geometry and the...
compactness of isospectral metrics within a fixed conformal class on a compact 3-manifold.

**Fourth award, 1997:** To Ingrid Daubechies for her deep and beautiful analysis of wavelets and their applications.

**The Leroy P. Steele Prizes**

These prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein, and are endowed under the terms of a bequest amounting to $145,000 from Leroy P. Steele. From 1970 to 1976 one or more prizes were awarded each year for outstanding published mathematical research; most favorable consideration was given to papers distinguished for their exposition and covering broad areas of mathematics. In 1977 the Council of the AMS modified the terms under which the prizes are awarded. Since then, up to three prizes have been awarded each year in the following categories: (1) 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) for a book or substantial survey or expository research paper; (3) 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. In 1993, the Council formalized the three categories of the prize by naming each of them: (1) The Leroy P. Steele Prize for Lifetime Achievement; (2) The Leroy P. Steele Prize for Mathematical Exposition; and (3) The Leroy P. Steele Prize for Seminal Contribution to Research.


**1976, 1977, 1978:** No awards were made.

**January 1979:** To Salomon Bochner for his cumulative influence on the fields of probability theory, Fourier analysis, several complex variables, and differential geometry.


**August 1979:** To Antoni Zygmund for his cumulative influence on the theory of Fourier series, real variables, and related areas of analysis.


**August 1980:** To André Weil for the total effect of his work on the general course of twentieth century mathematics, especially in the many areas in which he has made fundamental contributions.


**August 1980:** To Gerhard P. Hochschild for his significant work in homological algebra and its applications.

**August 1981:** To Oscar Zariski for his work in algebraic geometry, especially his fundamental contributions to the algebraic foundations of this subject.

**August 1981:** To Eberhard Hopf for three papers of fundamental and lasting importance: *Abzweigung einer periodischen Lösung von einer stationären Lösung eines Differential systems*, Berichte über die Verhandlungen der
Sächsischen Akademie der Wissenschaften zu Leipzig. Mathematisch-Naturwissenschaftliche Klasse, volume 95 (1943), pp. 3-22; A mathematical example displaying features of turbulence, Communications on Applied Mathematics, volume 1 (1948), pp. 303-322; and The partial differential equation $u_t + uu_x = \mu u_{xx}$, Communications on Pure and Applied Mathematics, volume 3 (1950), pp. 201-230.


August 1982: To Tsit-Yuen Lam for his expository work in his book Algebraic theory of quadratic forms (1973), and four of his papers: $K_0$ and $K_1$-an introduction to algebraic $K$-theory (1975), Ten lectures on quadratic forms over fields (1977), Serre's conjecture (1978), and The theory of ordered fields (1980).

August 1982: To John W. Milnor for a paper of fundamental and lasting importance, On manifolds homeomorphic to the 7-sphere, Annals of Mathematics (2) 64 (1956), pp. 399-405.

August 1982: To Fritz John for the cumulative influence of his total mathematical work, 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.

August 1983: To Paul R. Halmos for his many graduate texts in mathematics and for his articles on how to write, talk, and publish mathematics.


August 1983: To Shihing-Shen Chern for the cumulative influence of his total mathematical work, high level of research over a period of time, particular influence on the development of the field of differential geometry, and influence on mathematics through Ph.D. students.


August 1984: To Joseph L. Doob for his fundamental work in establishing probability as a branch of mathematics and for his continuing profound influence on its development.


August 1985: To Hassler Whitney for his fundamental work on geometric problems, particularly in the general theory of manifolds, in the study of differentiable functions on closed sets, in geometric integration theory, and in the geometry of the tangents to a singular analytic space.


January 1986: To Saunders MacLane for his many contributions to algebra and algebraic topology, and in particular for his pioneering work in homological and categorical algebra.

August 1987: To Martin Gardner for his many books and articles on mathematics and particularly for his column "Mathematical Games" in Scientific American.


August 1987: To Samuel Eilenberg for his fundamental contributions to topology and algebra, in particular for his classic papers on singular homology and his work on axiomatic homology theory which had a profound influence on the development of algebraic topology.


August 1988: To Deane Montgomery for his lasting impact on mathematics, particularly mathematics in America. He is one of the founders of the modern theory of transformation groups and is particularly known for his contributions to the solution of Hilbert’s fifth problem.


August 1989: To Irving Kaplansky for his lasting impact on mathematics, particularly mathematics in America. By his energetic example, his enthusiastic exposition, and his overall generosity, he has made striking changes in mathematics and has inspired generations of younger mathematicians.


August 1990: To Raoul Bott for having been instrumental in changing the face of geometry and topology, with his incisive contributions to characteristic classes, K-theory, index theory, and many other tools of modern mathematics.


August 1991: To Eugenio Calabi for his fundamental work on global differential geometry, especially complex differential geometry.

August 1991: To Armand Borel for his extensive contributions in geometry and topology, the theory of Lie groups, their lattices and representations and the theory of automorphic forms, the theory of algebraic groups and their representations and extensive organizational and educational efforts to develop and disseminate modern mathematics.


January 1993: To Peter D. Lax for his numerous and fundamental contributions to the theory and applications of linear and nonlinear partial differential equations and functional analysis, for his leadership in the development of computational and applied mathematics, and for his extraordinary impact as a teacher.


August 1993 – Lifetime Achievement: To Eugene B. Dynkin for his foundational contributions to Lie algebras and probability theory over a long period and his production of outstanding research students in both Russia and the United States, countries to whose mathematical life he has contributed so richly.


August 1994 – Seminal Contribution to Research: To Louis de Branges for his proof of the Bieberbach Conjecture.

August 1994 – Lifetime Achievement: To Louis Nirenberg for his numerous basic contributions to linear and nonlinear partial differential equations and their application to complex analysis and differential geometry.


August 1995 – Seminal Contribution to Research: To Edward Nelson for the following two papers in mathematical physics characterized by leaders of the field as extremely innovative: “A quartic interaction in two dimensions” in *Mathematical Theory of Elementary Particles*, MIT Press, 1966, pages 69–73; and “Construction of quantum fields from Markoff fields” in *Journal of Functional Analysis*, 12 (1973), 97–112. In these papers he showed for the first time how to use the powerful tools of probability theory to attack the hard analytic questions of constructive quantum field theory, controlling renormalizations with $L^p$ estimates in the first paper, and in the second turning Euclidean quantum field theory into a subset of the theory of stochastic processes.

August 1995 – Lifetime Achievement: To John T. Tate for scientific accomplishments spanning four and a half decades. He has been deeply influential in many of the important developments in algebra, algebraic geometry, and number theory during this time.


August 1996 – Lifetime Achievement: To Goro Shimura for his important and extensive work on arithmetical geometry and automorphic forms; concepts introduced by him were often seminal, and fertile ground for new developments, as witnessed by the many notations in number theory that carry his name and that have long been familiar to workers in the field.

January 1997 – Mathematical Exposition: To Anthony W. Knapp for his book, Representation Theory of Semisimple Groups (An overview based on examples), Princeton University Press, 1986, a beautifully written book which starts from scratch but takes the reader far into a highly developed subject.

January 1997 – Seminal Contribution to Research: To Mikhail Gromov for his paper, Pseudo-holomorphic curves in symplectic manifolds, Inventiones Math. 82 (1985), 307–347, which revolutionized the subject of symplectic geometry and topology and is central to much current research activity, including quantum cohomology and mirror symmetry.

January 1997 – Lifetime Achievement: To Ralph S. Phillips for being one of the outstanding analysts of our time. His early work was in functional analysis: his beautiful theorem on the relation between the spectrum of a semigroup and its infinitesimal generator is striking as well as very useful in the study of PDEs. His extension theory for dissipative linear operators predated the interpolation approach to operator theory and robust control. He made major contributions to acoustical scattering theory in his joint work with Peter Lax, proving remarkable results on local energy decay and the connections between poles of the scattering matrix and the analytic properties of the resolvent. He later extended this work to a spectral theory for the automorphic Laplace operator, relying on the Radon transform on horospheres to avoid Eisenstein series. In the last fifteen years, Ralph Phillips has done brilliant work, in collaboration with others, on spectral theory for the Laplacian on symmetric spaces, on the existence and stability of cusp forms for general noncompact quotients of the hyperbolic plane, on the explicit construction of sparse optimal expander graphs, and on the structure of families of isospectral sets in two dimensions (the collection of drums that sound the same).

The Oswald Veblen Prize in Geometry
This prize was established in 1961 in memory of Professor Oswald Veblen through a fund contributed by former students and colleagues. The fund was later doubled by the widow of Professor Veblen, bringing the fund to $2,000. The first two awards of the prize were made in 1964 and the next in 1966; thereafter, an award will ordinarily be made every five years for research in geometry or topology under conditions similar to those for the Bôcher Prize.


Third award, 1966: To Steven Smale for his contributions to various aspects of differential topology.

Fourth award, 1966: To Morton Brown and Barry Mazur for their work on the generalized Schoenflies theorem.


Seventh award, 1976: To William P. Thurston for his work on foliations.

Eighth award, 1976: To James Simons for his work on minimal varieties and characteristic forms.

Ninth award, 1981: To Mikhail Gromov for his work relating topological and geometric properties of Riemannian manifolds.

Tenth award, 1981: To Shing-Tung Yau for his work in nonlinear partial differential equations, his contributions to the topology of differentiable manifolds, and for his work on the complex Monge-Ampère equation on compact complex manifolds.

Eleventh award, 1986: To Michael H. Freedman for his work in differential geometry and, in particular, the solution of the four-dimensional Poincaré conjecture.

Twelfth award, 1991: To Andrew J. Casson for his work on the topology of low-dimensional manifolds, and to Clifford H. Taubes for his foundational work in Yang-Mills theory.

Thirteenth award, 1996: To Richard Hamilton for his continuing study of the Ricci flow and related parabolic equations for a Riemannian metric, and to Gang Tian for his contributions to geometric analysis.

The Norbert Wiener Prize in Applied Mathematics
This prize was established in 1967 in honor of Professor Norbert Wiener and was endowed by a fund amounting to $2,000 from the Department of Mathematics of the Massachusetts Institute of Technology. The prize is normally awarded every five years, beginning in 1970, for an outstanding contribution to "applied mathematics in the highest and broadest sense." The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico.

First award, 1970: To Richard E. Bellman for his pioneering work in the area of dynamic programming, and for his related work on control, stability, and differential–delay equations.
Second award, 1975: To Peter D. Lax for his broad contributions to applied mathematics, in particular, for his work on numerical and theoretical aspects of partial differential equations and on scattering theory.

Third award, 1980: To Tosio Kato for his distinguished work in the perturbation theory of quantum mechanics.

Fourth award, 1980: To Gerald B. Whitham for his broad contributions to the understanding of fluid dynamical phenomena and his innovative contributions to the methodology through which that understanding can be constructed.

Fifth award, 1985: To Clifford S. Gardner for his contributions to applied mathematics in the areas of supersonic aerodynamics, plasma physics and hydromagnetics, and especially for his contributions to the truly remarkable development of inverse scattering theory for the solution of nonlinear partial differential equations.

Sixth award, 1990: To Michael Aizenman for his outstanding contribution of original and nonperturbative mathematical methods in statistical mechanics by means of which he was able to solve several long open important problems concerning critical phenomena, phase transitions, and quantum field theory; and to Jerrold E. Marsden for his outstanding contributions to the study of differential equations in mechanics: he proved the existence of chaos in specific classical differential equations; his work on the momentum map, from abstract foundations to detailed applications, has had great impact.

Seventh award, 1995: To Hermann Flaschka for deep and original contributions to our understanding of completely integrable systems; and to Ciprian Foias, for basic contributions to operator theory, analysis, and dynamics and their applications.

Special Funds

**AMS Centennial Fellowship Fund**
This fund was established by the Society in 1973 and provides one-year Research Fellowships awarded each year in March. In 1988 the Fellowship was named to honor the AMS Centennial. The number of fellowships granted each year depends on the contributions the Society receives, matched by a contribution from the Society of not more than $50,000. Over the years the fund has been targeted at different groups. In 1995 the Council of the AMS voted to direct the fellowships toward applicants who are citizens or permanent residents of a country in North America, who will have held the award for at least two years at the time of the award, who do not have permanent tenure, and who will have held less than two years of research support at the time of the award.

First award, 1974-1975: Fred G. Abramson, James Li-Ming Wang.


**The Levi L. Conant Fund**
Levi L. Conant bequeathed a sum of $9,500 which the Trustees incorporated with the permanent endowments for prize funds.

**The Karl Menger Fund**
The family of the late Karl Menger were the major contributors to a fund established at Duke University totalling $40,000. The majority of the income from this fund is to be used by the Society for annual awards at the International Science and Engineering Fair.


Fifth award, 1994: Davesh Maulik, Eric Matthew Dennis, Sarah Ann Lord, Timothy Stephen Eller, Rahul Manu Kohli,
Sixth award, 1995: Davesh Maulik, Benjamin Michael Goetz, Jacob Lurie, Daniel Kalman Biss, Samit Dasgupta, Yueh-Hsing Lin, Claus Mazanti Soerensen, Theodore Haw-Yun Hwa, Samuel Jacob Klein Jr., Katherine Anne Paur, Bridget Helen Penny, Scott Nicholas Sanders.


The Eliakim Hastings Moore Fund
This fund was donated in 1922 in honor of Professor Eliakim Hastings Moore on the occasion of the twenty-fifth anniversary of the Chicago (Western) section of the Society. The fund is $2,575 and the income from the fund is to be used at the discretion of the Council for the publication of important mathematical books and memoirs and for the award of prizes.

The C. V. Newsom Fund
In 1990 the Society received a bequest of $100,000 from the estate of Carroll V. Newsom. The bequest was made to memorialize John von Neumann and his accomplishments. The income from this fund is to be used to support a quadrennial symposium, called the von Neumann Symposium, that will focus on fundamental concepts in the forefront of mathematics.

The Program Development Fund
In 1993 the Executive Committee and Board of Trustees (ECBT) established the Program Development Fund (formerly referred to as the General Fund). Gifts to the Program Development Fund are directed toward initiatives which address immediate needs of the mathematics community, enabling the AMS to act decisively and quickly. Contributions are matched dollar-for-dollar to a maximum of $50,000. Programs supported are approved by the ECBT.

The Joseph Fels Ritt Memorial Fund
From the estate of Estelle F. Ritt, the income from a fund of $22,500 is available for the publication of works in the field of mathematics as shall be determined by the governing bodies of the Society.

The Waldemar J. Trjitzinsky Memorial Fund
The Society received a bequest from the estate of Waldemar J., Barbara G., and Juliet Trjitzinsky, the income from which is used to assist students who have declared a major in mathematics at a college or university that is an institutional member of the AMS. These funds help support students who lack adequate financial resources and who may be in danger of not completing the degree program in mathematics for financial reasons. Each year the Society selects four geographically distributed schools who in turn make one-time awards of roughly $2,500 each to beginning mathematical students to assist them in pursuit of careers in mathematics.

First award, 1992: Duke University, University of Scranton, Montana State University, Howard Payne University.

Second award, 1993: Allegheny College, Memphis State University, University of California at Irvine, University of Puerto Rico.

Third award, 1994: University of California at Los Angeles, State University of New York at Geneseo, Eastern New Mexico University, University of Virginia.

Fourth award, 1995: Boise State University, Illinois Institute of Technology, Temple University, University of Maryland at College Park.

Fifth award, 1996: Murray State University, Stanford University, Union College, Western Illinois University.

Friends of Mathematics Fund
A Friends of Mathematics Fund has been created to incorporate monetary gifts to the Society of a general nature. The principle of this fund is now $123,572. The proceeds of the fund are a part of the invested assets of the Society. The following gifts are components of this fund: $1,000 from the estate of Professor Ernest William Brown; $1,000 from the estate of Genevra B. Hutchinson; $3,000 from Solomon A. Joffe; $650 from the estate of Professor Helen A. Merrill; $23,600 from the estate of Dean Marion Reilly; $1,000 from the estate of James K. Whittemore; and $2,700 from an anonymous donor.
Add this Cover Sheet to all of your Academic Job Applications

How to use this form

1. Using the facing page or a photocopy, (or a TeX version which can be downloaded from the e-math "Employment Information" menu, http://www.ams.org/profession/employ.html), fill in the answers which apply to all of your academic applications. Make photocopies.

2. As you mail each application, fill in the remaining questions neatly on one cover sheet and include it on top of your application materials.

The Joint Committee on Employment Opportunities has adopted the cover sheet on the facing page as an aid to job applicants and prospective employers. The form is now available on e-math in a TeX format which can be downloaded and edited. The purpose of the cover form is to aid department staff in tracking and responding to each application.

Mathematics Departments in Bachelor's, Master's and Doctorate granting institutions have been contacted and are expecting to receive the form from each applicant, along with any other application materials they require. Obviously, not all departments will utilize the cover form information in the same manner. Please direct all general questions and comments about the form to:
emp-info@ams.org
or call the Professional Programs and Services Department, AMS, at 800-321-4267 extension 4105.

JCEO Recommendations for Professional Standards in Hiring Practices

The JCEO believes that every applicant is entitled to the courtesy of a prompt and accurate response that provides timely information about his/her status. Specifically, the JCEO urges all institutions to do the following after receiving an application:

(1) Acknowledge receipt of the application—immediately; and
(2) Provide information as to the current status of the application, as soon as possible.

The JCEO recommends a triage-based response, informing the applicant that he/she
(a) is not being considered further;
(b) is not among the top candidates; or
(c) is a strong match for the position.
### Academic Employment in Mathematics

**AMS Standard Cover Sheet**

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**Indicate the mathematical subject area(s) in which you have done research using, if applicable, the 1991 Mathematics Subject Classification printed on the back of this form. If listing more than one number, list first the one number which best describes your current primary interest.**

Primary Interest: ____________________________

Secondary Interests *optional*: ____________________________

Give a brief synopsis of your current research interests (e.g., finite group actions on four-manifolds). Avoid special mathematical symbols and please do not write outside of the boxed area.

Most recent, if any, position held *post Ph.D.*

University or Company: ____________________________

Position Title: ____________________________ Dates: ____________________________

Indicate the position for which you are applying and position posting code, if applicable

If unsuccessful for this position, would you like to be considered for a temporary position?

☐ Yes  ☐ No  If yes, please check the appropriate boxes.

- ☐ Postdoctoral Position  ☐ 2+ Year Position  ☐ 1 Year Position

List the names, affiliations, and e-mail addresses of up to four individuals who will provide letters of recommendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.

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The Reference section of the Notices is intended to provide the reader with frequently sought information in an easily accessible manner. New information is printed as it becomes available and is referenced after the first printing. As soon as information is updated or otherwise changed, it will be noted in this section.

Upcoming Deadlines

December 1, 1997: Deadline for receipt of applications for AMS Centennial Fellowships. For application forms, write Executive Director, American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248; 401-455-4103; e-mail ams@ams.org. Forms are also available at http://www.ams.org/committee/profession/.

December 5, 1997: Deadline for submission of manuscripts to be considered for Ferran Sunyer i Balaguer Prize. For further information, consult the Web site http://crm.es/info/ffsb.htm.

December 9, 1997: Deadline for proposals for NSF Professional Opportunities for Women in Research and Education (POWRE) for fiscal year 1998. Denise Caldwell, telephone 703-306-1807, dca1dwe@nsf.gov.


Where to Find It
A brief index to information which appears in this and previous issues of the Notices.
- AMS e-mail addresses October 1997, p. 1118
- AMS Ethical Guidelines June 1995, p. 694
- AMS Officers and Committee Members September 1997, p. 972
- Board on Mathematical Sciences and Staff May 1997, p. 597
- Bylaws of the American Mathematical Society November 1997, p. 1339
- Classification of degree-granting departments of mathematics January 1997, p. 48

Program Officers for Federal Funding Agencies (DoD, DoE, NSF)
- October 1997, pp. 1150-1151
- NSF Mathematical and Physical Sciences Advisory Board May 1997, p. 597
- Mathematics Research Institutes Contact Information May 1997 p. 598
- National Science Board of NSF, November 1996, p. 1380
- Officers of the Society 1996 and 1997 (Council, Executive Committee, Publications Committees, Board of Trustees) May 1997, p. 593
This journal provides a forum for mathematical work in related fields broadly described as conformal geometry and dynamics. This includes complex dynamics (and real dynamics using complex techniques), Kleinian groups, hyperbolic geometry, Teichmuller theory, and quasiconformal mappings.

**Current volume includes...**

Thirty-three yes or no questions about mappings, measures, and metrics
Juha Heinonen and Stephen Semmes

Properties of convergence groups and spaces
Eric M. Freden

Branch sets of uniformly quasiregular maps
G. J. Martin

Dynamics of the family $\lambda \tan z$
Linda Keen and Janina Kotus

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http://www.ams.org/ecgd/
Mathematics Calendar

November 1997

*17-19 National Conference on Mathematical Analysis and Differential Equations (NCMADE), JaiNarain Vyas University, Jodhpur-342005, India.

Organizing Committee: P.K. Banerji, P.K. Bhattacharya, R.C. Bhattacharya.
Description: There will be invited talks/lectures and a paper reading session.
Information: Contact P.K. Banerji, tel: 00-91-0291-613446/41914.

December 1997

*14-16 CMS Winter 1997 Meeting, Victoria Conference Centre, Victoria, British Columbia.
Program: This meeting will feature plenary speakers from a broad spectrum of mathematics. It will also feature sessions in various areas of mathematics.
Prize Lectures: The Coxeter-James Lecture will be given by J. Ward, Univ. of British Columbia. The first CMS Doctoral Prize will be awarded to J. Geelen, Univ. of Waterloo.
Public Lecture: M. Klave, Computer Science, Univ. of British Columbia, will deliver a public lecture on Monday, December 15.
Symposia: There will be symposia in five areas. The session titles are: Joint CMS-Fields Institute Session on Homotopy Theory; Lie Theory; Joint CMS-PIMS Session on Partial Differential Equations; Joint CMS-CRM Session on the Structure and Classification of Amenable C*-Algebras; Education; Dynamical Systems and Applications.
Contributed Papers: Contributed papers of 15 minutes' duration are invited and graduate students are particularly urged to participate. For an abstract to be eligible, the abstract must be received before October 15, 1997. The abstract must be accompanied by its contributor's registration form and appropriate fees.
Graduate Student Seminar: A special session is being organized for graduate students. Anyone interested in participating in the organization of this program should contact the Meeting Director at the following address: mt-w97@cms.math.ca.
Information: For more information, contact mt-w97@cms.math.ca. Telnet: e.math.ams.org; login and password e-math.

January 1998

*6 Ethnomathematics and the History of Mathematics: Conference in Honor of the 65th Birthday of Ubiratan D'Ambrosio, Omni Hotel, Baltimore, Maryland.
Speakers: M. Ascher, J. Fauvel, P. Gerdes, and others to be determined.
Contributed Papers: All who wish to contribute a paper related to Professor D'Ambrosio's work in ethnomathematics, the history of mathematics, and mathematics education should submit a one-page proposal by September 15, 1997, to vkatz@maa.org or by mail to V. J. Katz, c/o Mathematical Association of America, 1529 18th St., N.W., Washington, DC 20036.
Information: For more information, contact vkatz@maa.org.

*23-24 A Numerical Analysis Conference in Honor of Oluf B. Wiidlund on the Occasion of his 60th Birthday, Courant Institute of Mathematical Sciences, New York University, New York City, NY.
Organizing Committee: P. Bjorstad (Univ. of Bergen, Norway); M. Overton (Courant Institute); B. Smith (Argonne National Laboratory); D. B. Szyl (Temple Univ.).
February 1998


Topics: Multivariate statistics; data analysis; cluster analysis; operations research; optimization; modelling; teaching of statistics. The International Symposium on Mathematical Methods Applied to the Sciences (SIMMAC) is the most important Conference on Applied Mathematics in Central America; it is organized every two years by the University of Costa Rica (UCR) and the Costa Rican Institute of Technology (ITCR). The SIMMAC is an opportunity for researchers of Central America and the rest of the world to discuss the applications of mathematics. In 1998, the SIMMAC will celebrate its 20th anniversary.

Communications: Proposals for short communications and short courses must be sent to the Organizing Committee of the SIMMAC for their scientific evaluation; authors should respect the deadlines given in this notice. Proposals may be considered for presentation and publication in the Proceedings, or presentation only. Types of participation: attendance; short-course; short communication presented; short communication published; software exposition.

Committees: Professors of both universities (UCR and ITCR) are in the Organizing Committee, whose president is J. Trejos. The president of the Local Organizing Committee in San Carlos is G. Damazio. The president of the Scientific Committee is W. Castillo.

Speakers: Some invited speakers for the SIMMAC are: Y. Schektman (Toulouse, France); E. Diday (Paris IX-INRIA, France); I.-C. Lerman (Rennes-IRISA, France); J.-P. Rasson (Namur, Belgium); M. Carbon (Rennes, France); R. Baier (Karlsruhe, Germany); T. Hill (Georgia Tech, USA); M. Jones (Charleston, USA).

Instructions to Authors: 10 pages maximum for communications and 15 pages for short courses; we recommend the use of LaTeX or Word 6.0 for Windows; the paper must have a title, names and addresses of the authors, an abstract (max. 12 lines), 3 to 7 keywords, complete references; text bodies: font: 12-point; margin: 2.54 cm; compiled on machines of the article to: XI SIMMAC, Escuela de Matematica, Universidad de Costa Rica, 2060 Jose, Costa Rica; tel: +506-207-5574; fax: +506-207-4397; e-mail: jtrejos@cariar.u-cr.ac.cr.

Registration: Fees: before November 15th, 1997: US$40; after November 15th, 1997: US$50. Students receive a 50% discount. Registration fees may be paid in U.S. dollars or in local currency. Registration covers participation in the symposium; documentation; coffee-breaks, breakfast, lunch, transfer San Jose/Santa Clara and one excursion, but neither dinner nor hotel. Organizers can provide student rooms at a low rate—they will be reserved upon payment of registration. A list of hotels near the conference location will be announced in a second notice. Payment: Cash (colones or dollars); cheque payable to FUNDEVI or FUNDAYEC.


March 1998

* 16-18 Conference on Complex Hyperbolic Geometry and Discrete Groups, Okayama University of Science, Okayama, Japan.

Focus: This conference is a succession of the AMS meeting at Stillwater in 1994 (special session on Complex Hyperbolic Geometry and Discrete Groups).

Scientific Organizers: Y. Kamishima (Kumamoto), S. Kamiya (Okayama).

Information: For information, contact S. Kamiya, Okayama Univ. of Science, 1-1 Ridai-cho, Okayama 700 Japan; tel: +81-86-252-3161; fax:+81-86-255-3611; e-mail: kamiya@math.ouc.ac.jp.

* 23-29 Japan-U.S. Mathematics Institute Conference and Workshop on Geometric Foliations and Intrinsic Metrics in Complex Geometry, Johns Hopkins University, Baltimore, Maryland.


Program: The activities include a conference March 26-29 with invited one-hour lectures and a workshop March 23-25 where there will be informal sessions and short talks.

Information: Department of Mathematics, Johns Hopkins University, Baltimore, MD 21218; tel: 410-516-4178; fax: 410-516-5549; e-mail: jiami@math.jhu.edu; Internet: http://www.math.jhu.edu/JAMST97-98/overview.html.

April 1998

* 19-22 Supporting Educational, Faculty & TA Development Within Departments and Disciplines, Austin, Texas.

Focus: On April 19-22, 1998, the International Consortium for Educational Development (ICED) in conjunction with the Center for Teaching Effectiveness at the University of Texas at Austin and the Professional and Organizational Development Network in Higher Education (POD Network) will host an international conference.

Description: The conference theme is: Supporting Educational, Faculty & TA Development Within Departments and Disciplines. Some of the subthemes are: supporting research into teaching and learning within departments; running discipline-specific short courses and workshops; funding and supporting educational, faculty & TA development projects within departments; incorporating technology to facilitate educational, faculty & TA development that is discipline-specific.

Keynote Speakers: P. Candy, Deputy Vice-Chancellor (scholarship) at Univ. of Ballarat in Victoria, Australia; U. Treisman, Dana Center for Mathematics, Univ. of Texas at Austin.

Information: Information about ICED and the Call for Proposals may be found at: http://iced. cte.utexas.edu:8001/; for a hard copy of the Call for Proposals or additional information about the conference please contact: K. G. Lewis, Conference Coordinator: e-mail: kglewis@mail.utexas.edu.

June 1998


Information: J. Nedaoma, Institute of Computer Science, Academy of Sciences, 182 07 Prague 8, Pod vodarenskou vezi 1, Czech Republic; tel: +422-6603-3280; fax: +422-8585-789; e-mail: jnedoma@uvit.cas.cz.


Purpose: To bring together researchers and educators in all aspects of pure and applied linear algebra and matrix theory in order to allow for a broad exchange of ideas and...
Mathematics Calendar

dissemination of recent developments and results. The conference will be dedicated to Hans Schneider in recognition of his enormous contributions to linear algebra and the linear algebra community.

**Invited Speakers:** Hour Speakers: R. Brualdi, R. Bhatia, G. Harel, D. Hershkowitz, N. Higham, T. Laffey, V. Mehrmann, U. Rothblum; half-hour speakers: C. de Boor, P. Lancaster, R. Loewy, J. McDonald, F. Silva.

**Minisymposia:** Topological methods in linear algebra (M. Goldberg), linear algebra methods in statistics (H.J. Werner), graph theory and linear algebra (R. Merris), numerical linear algebra (M. Overton), matrix inertia and stability (B.N. Datta), educational issues in linear algebra (D. Carlson & E. Uhlig).

**Contributed Papers:** On all aspects of linear algebra and matrix theory.

**Proceedings:** A special issue of the journal Linear Algebra and Its Applications, with special editors B. Cain, B.N. Datta, M. Golberg, U. Rothblum, D. Szyld, will be dedicated to Hans Schneider.

**Housing:** An entire dormitory, Chadbourne Hall, a two minute walk to the mathematics building Van Vleck Hall, has been reserved for conference participants. Rooms have also been set aside at a nearby Howard Johnson's Hotel.

**Information:** Visit the URL http://www.math.temple.edu/iic or send an electronic message to brualdi@math.wisc.edu.

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American Mathematical Society

**Probability**

**Control of Systems with Aftereffect**

V. B. Kolmanovskii, Moscow University of Electronics and Mathematics, Russia, and L. E. Shalkhet, Donetsk State Academy of Management, Russia

The study of natural and social phenomena indicates that the future development of many processes depends not only on their present state, but also on their history. Such processes can be described mathematically by using the machinery of equations with aftereffect.

This book is a comprehensive, up-to-date presentation of control theory for hereditary systems of various types. Topics covered include background of the theory of hereditary equations, their applications in modeling real phenomena, optimal control of deterministic and stochastic systems, optimal estimation of systems with delay, and optimal control with uncertainties. The exposition is illustrated by examples, figures, and tables.


**Nonlinear Dynamics and Time Series**

Colleen D. Cutler, University of Waterloo, ON, Canada,
Daniel T. Kaplan, McGill University, Montreal, PQ, Canada,
Editors

This book is a collection of research and expository papers reflecting the interfacing of two fields: nonlinear dynamics (in the physiological and biological sciences) and statistics. It presents the proceedings of a four-day workshop entitled "Nonlinear Dynamics and Time Series: Building a Bridge Between the Natural and Statistical Sciences" held at the Centre de Recherches Mathematiques (CRM) in Montréal in July 1995. The goal of the workshop was to provide an exchange forum and to create a link between two diverse groups with a common interest in the analysis of nonlinear time series data.

**Features:**
- A survey of state-of-the-art developments in nonlinear dynamics time series analysis with open statistical problems and areas for further research.
- Contributions by statisticians to understanding and improving modern techniques commonly associated with nonlinear time series analysis, such as surrogate data methods and estimation of local Lyapunov exponents.
- Starting point for both scientists and statisticians who want to explore the field.
- Expositions that are readable to scientists outside the featured fields of specialization.

**Fields Institute Communications**, Volume 11; 1997; 252 pages; Hardcover; ISBN 0-8218-0521-5; List $79; Individual member $47; Order code FIC/11NA

**Stochastic Analysis: Random Fields and Measure-Valued Processes**

Jean-Pierre Fouque, Ecole Polytechnique, CMAP, Palaiseau, France,
Kenneth J. Hochberg and Ely Merzbach, Bar-Ilan University, Ramat-Gan, Israel

This volume contains papers on probability theory and stochastic analysis resulting from two international conferences held at the Department of Mathematics of Bar-Ilan University in 1993 and 1995. The work includes expository and advanced research presentations, presenting an accurate reflection of the nature, scope, and vibrancy of these conferences on stochastic analysis.

**Israel Mathematical Conference Proceedings** series is published by Bar-Ilan University of Israel and distributed worldwide by the AMS.

Israel Mathematical Conference Proceedings, Volume 10; 1996; 214 pages; Softcover; List $45; Individual member $27; Order code IMCP/10NA

All prices subject to change. Charges for delivery are $3.00 per order. For air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P.O. Box 6248, Providence, RI 02940-4804. For credit card orders, call toll free 800-321-4AMS (4267) in the U.S. and Canada, 415-455-4000 worldwide. Or place your order through the AMS bookstore at http://www.ams.org/bookstore/. Residents of Canada, please include 7% GST.
New Publications Offered by the AMS

General and Interdisciplinary

Discrete Mathematics in the Schools
Joseph G. Rosenstein, Rutgers University, New Brunswick, NJ; Deborah S. Franzblau, City University of New York (CUNY), Staten Island, and Fred S. Roberts, Rutgers University, New Brunswick, NJ, Editors

This volume is a collection of articles written by experienced primary, secondary, and collegiate educators. The book explains why discrete mathematics should be taught in K-12 classrooms and offers practical guidance on how to do so.

In this book teachers at all levels will find a great deal of valuable material to help them introduce discrete mathematics in their classrooms. One main article provides a comprehensive and detailed view of discrete mathematics for K-12. Another surveys the resources that are available for teachers. School and district curriculum leaders will find material that addresses how discrete mathematics can be introduced into their curricula. College faculty members will find ideas and topics that can be incorporated into a variety of courses.

Features:
- Classroom activities and an annotated list of resources.
- Authors who are directors of innovative programs and who are well known for their work.
- A description of discrete mathematics providing the opportunity for a fresh start for students who have been previously unsuccessful in mathematics.
- Discussion on discrete mathematics as it is used to achieve the goals of the current effort to improve mathematics education.
- Guidance on topics, resources and teaching; a valuable guide for both pre-service and in-service professional development.

This volume is co-published with the National Council of Teachers of Mathematics (NCTM), Reston, VA.

Séminaire Bourbaki, Volumes 1–10

The volumes of this printing of the seminar fully cover the progress of pure mathematics during the very fertile years from 1948 until 1968 (the birth of modern algebraic geometry, the development of the theory of Lie groups and of their homogeneous spaces, fibred spaces, cohomological methods, harmonic analysis, the birth of the modern theory of automorphic forms, etc.). They continue to be a reference for this period of the history of mathematics.

Many of the texts in the Séminaire Bourbaki have not been the subject of other publications. These texts are still quoted abundantly. For example, the best source for the conjecture of Birch and Swinnerton-Dyer is still the lecture of John Tate in 1966, and the series of ten talks of Grothendieck (during the period from 1956 to 1966) in the Séminaire is truly a founding text in modern algebraic geometry.

Individual volumes may be purchased separately. Contact the AMS for more information.

Published by the Société Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive an additional discount; contact the AMS for details.

Contents: See the AMS Bookstore at www.ams.org/bookstore.

January 1997, 4400 pages, Hardcover, 1991 Mathematics Subject Classification: 00B15, Individual member $495, List $795, Order code BOSESET/1/1ON

Algebra and Algebraic Geometry

The Classification of the Finite Simple Groups, Number 3
Daniel Gorenstein, Richard Lyons, Rutgers University, New Brunswick, NJ, and Ronald Solomon, Ohio State University, Columbus

This book offers a single source of basic facts about the structure of the finite simple groups with emphasis on a detailed description of their local subgroup structures, coverings and automorphisms. The method is by examination of the specific groups, rather than by the development of an abstract theory of simple groups. While the purpose of the book is to provide the background for the proof of the classification of the finite simple groups—dictating the choice of topics—the subject matter is covered in such depth and detail that the book should be of interest to anyone seeking information about the structure of the finite simple groups.

This volume offers a wealth of basic facts and computations. Much of the material is not readily available from any other source. In particular, the book contains the statements and proofs of the fundamental Borel-Tits Theorem and Curtis-Tits Theorem. It also contains complete information about the centralizers of semisimple involutions in groups of Lie type, as well as many other local subgroups.

Contents: Some theory of linear algebraic groups; The finite groups of Lie type; Local subgroups of groups of Lie type. I; Local subgroups of groups of Lie type. II; The alternating groups and the twenty-six sporadic groups; Coverings and embeddings of quasisimple X-groups; General properties of X-groups; Background references; Expository references; Errata for numbers 1 and 2; Glossary; Index.

Mathematical Surveys and Monographs, Volume 40

Diagram Groups
Victor Guba, Vologda State Pedagogical Institute, Russia, and Mark Sapir, University of Nebraska, Lincoln

Diagram groups are groups consisting of spherical diagrams (pictures) over monoid presentations. They can be also defined as fundamental groups of the Squier complexes associated with monoid presentations. The authors show that the class of diagram groups contains some well-known groups, such as the R. Thompson group $F$. This class is closed under free products, finite direct products, and some other group-theoretical operations. The authors develop combinatorics on diagrams similar to the combinatorics on words. This helps in finding some structure and algorithmic properties of diagram groups. Some of these properties are new even for R. Thompson’s group $F$. In particular, the authors describe the centralizers of elements in $F$, prove that it has solvable conjugacy problem, etc.

Contents: Introduction; Rewrite systems; Semigroup diagrams; Monoid pictures; Diagram groups; Squier’s complexes; Monoid presentations and the diagram groups; Diagram groups and group theoretic constructions; Diagram groups over complete presentations; Finitely presented diagram groups; Commutator subgroups of diagram groups; Asphericity; Recursive presentations of diagram groups; Computational complexity of the word problem in diagram groups; Combinatorics on diagrams; Different types of diagrams and finitely presented simple groups; Open problems.

Memoirs of the American Mathematical Society, Volume 130, Number 620

Families of Curves in $\mathbb{P}^3$ and Zeuthen’s Problem
Robin Hartshorne, University of California, Berkeley

This book provides a negative solution to Zeuthen’s problem, which was proposed as a prize problem in 1901 by the Royal Danish Academy of Arts and Sciences. The problem was to decide whether every irreducible family of smooth space curves admits limit curves which are *stick figures*, composed of lines meeting only two at a time.

To solve the problem, the author makes a detailed study of curves on cubic surfaces in $\mathbb{P}^3$ and their possible degenerations as the cubic surface specializes to a quadric plus a plane or the union of three planes.

Contents: Introduction; Preliminaries; Families of quadric surfaces; Degenerations of cubic surfaces; Standard form for certain deformations; Local Picard group of some normal hypersurface singularities; Solution of Zeuthen’s problem.

Memoirs of the American Mathematical Society, Volume 130, Number 617

Group Representations: Cohomology, Group Actions and Topology
Alejandro Adem, University of Wisconsin, Madison, Jon Carlson, University of Georgia, Athens, Stewart Priddy, Northwestern University, Evanston, IL, and Peter Webb, University of Minnesota, Minneapolis, Editors

This volume combines contributions in topology and representation theory that reflect the increasingly vigorous interactions between these areas. Topics such as group theory, homotopy theory, cohomology of groups, and modular representations are covered. All papers have been carefully refereed and offer lasting value.

Features:
- State of the art contributions from this active, interdisciplinary branch of mathematical research
- Excellent, high-level survey papers by experts in the field
- A unique combination of topics in algebra and topology
- A compilation of open problems

This text will also be of interest to those working in geometry and topology.

Contents: T. Akita, On the cohomology of Coxeter groups and their finite parabolic subgroups; I; R. Boltje, Linear source modules and trivial source modules; S. Bouc, Réolutions de foncteurs de Mackey; C. Broto and A. Viruel, Homotopy uniqueness of $BPV(3)$; J. Brundan, Lowering operators for $GL(n)$ and quantum $GL(n)$; J. F. Carlson and W. W. Wheeler, Homomorphisms in higher complexity quotient categories; F. R. Cohen and R. Levi, On the homotopy theory of $p$-completed classifying spaces; M. D. Crossley, $H^*V$ is of bounded type over $A(p)$; J. Dietz and T. Ratliff, Classifying spaces of central group extensions; W. G. Dwyer, Sharp homology decompositions for classifying spaces of finite groups; P. Fong and R. J. Milgram, On the geometry and cohomology of the simple groups $G_2(q)$ and $3D_4(q)$; D. J. Green and P. A. Minh, Transfer and Chern classes for extraspecial $p$-groups; R. Griess, The infinite order of the symplectic classes in the cohomology of the stable mapping class group; H-W. Henn, A variant of the proof of the Landweber Stong conjecture; H-W. Henn, Unstable modules over the Steenrod algebra and cohomology of groups; L. G. Lewis, Jr., The category of Mackey functors for a compact Lie group; Z. Lin, Comparison of extensions of modules for algebraic groups and quantum groups; F. Luca, The defect of the completion of a Green functor;
Mathas, Simple modules of Ariki-Koike algebras; R. J. Milgram, On the geometry and cohomology of the simple groups $G_2(q)$ and $3D_4(q)$; II; R. J. Milgram, On the relation between simple groups and homotopy theory; D. K. Nakano, Varieties for $G$-T-modules; F. Oda, On defect groups of the Mackey algebras for finite groups; S. Priddy, Applications of stable classifying space theory to group cohomology; Yu. B. Rudyak, The spectra $k$ and $ko$ are not Thom spectra; N. S. Narasimha Sastry and P. Sin, The code of a regular generalized quadrangle of even order; M. Schaps, D. Shapiro, and O. Shlomo, Quivers of blocks with normal defect group; T. Watanabe, Cohomology of a homogeneous space $E_t$; I. SV(0); D. Benson, Problem session, Seattle 1996.


Analysis

Homeomorphisms in Analysis
Casper Goffman, Purdue University, West Lafayette, IN, Togo Nishiuara, Wayne State University, Detroit, MI, and Daniel Waterman, Syracuse University, NY

The book is well written, packed with information and makes a novel contribution to the literature. Much of what is in the book is important material that is now for the first time readily accessible ... readers will appreciate the many comments that provide historical or motivational perspectives ...

—Professor Andrew Bruckner, University of California, Santa Barbara

This book features the interplay of two main branches of mathematics: topology and real analysis. The material of the book is largely contained in the research publications of the authors and their students from the past 50 years. Parts of analysis are touched upon in a unique way, for example, Lebesgue measurability, Baire classes of functions, differentiability, $C^m$ and $C^m$ functions, the Blumberg theorem, bounded variation in the sense of Cesari, and various theorems on Fourier series and generalized bounded variation of a function.

Features:
- Contains new results and complete proofs of some known results for the first time.
- Demonstrates the wide applicability of certain basic notions and techniques in measure theory and set-theoretic topology.
- Gives unified treatments of large bodies of research found in the literature.

Contents: Part 1. The One Dimensional Case: Subsets of $\mathbb{R}$; Baire class 1; Differentiability classes; The derivative function; Part 2. Mappings and Measures on $\mathbb{R^n}$; Bi-Lipschitzian homeomorphisms; Approximation by homeomorphisms; Measures on $\mathbb{R^n}$; Blumberg's theorem; Part 3. Fourier Series: Improving the behavior of Fourier series; Preservation of convergence of Fourier series; Fourier series of integrable functions; Supplementary material; Bibliography; Index.


Proceedings of the Ashkelon Workshop on Complex Function Theory (May 1996)
Lawrence Zalcman, Bar-Ilan University, Ramat-Gan, Israel, Editor

This volume comprises the scientific proceedings of the Spring Workshop in Complex Function Theory held in Ashkelon, Israel. The papers vary in form from brief and highly focused research announcements to detailed and relatively leisurely expositions of areas of current research. In content, the papers represent a wide variety of interests within complex analysis, ranging from approximation theory and the analytic theory of polynomials to quasiconformal mappings, complex dynamics, and spectral geometry. There are papers on spaces of analytic functions on the disc, on entire, subharmonic, and meromorphic functions, and on function theory on Riemann surfaces. More specialized topics discussed include the application of theta functions to partition identities, Fuchsian differential equations for matrix-valued analytic functions, and duality in one and several complex variables. Three papers deal with various aspects of mean-value conditions, a topic of particular interest to a number of Israeli analysts.

This volume of proceedings presents a snapshot view of current Israeli activity in complex function and provides impressive evidence of the vigor, enthusiasm, and success with which classical complex analysis is cultivated in Israel today.

Contents: M. L. Agranovsky, Radon transforms on polynomial level sets and related problems; D. Aharonov, An invariant generalization of the Mauldon inclination theorem; L. Aizenberg, Duality in complex analysis; A. Atzmon, Entire functions, invariant subspaces, and Fourier transforms; V. Azarin, On the Valiron-Titchmarsh theorem and limit sets of entire functions; R. Brooks, Some relations between graph theory and Riemann surfaces; H. M. Farkas, A variation on a theorem of Euler; R. Greiner, On a theorem of Andrievskii and Ruscheweyh; W. Haussmann and K. Zeller, Canonical point sets in multivariate constructive function theory; C. Horowitz and B. Pinchuk, A survey of recent results in $A^\alpha$ and $A^\alpha$; V. Katsnelson, Fuchsian differential systems related to rational matrix functions in general position and the joint system realization; A. Kheifets, Nehari's interpolation problem and exposed points of the unit ball in the Hardy space $H^p$; J. J. Klinckhammer, On the Pompeiu problem in $\mathbb{R}^n$; I. Kra, On a Ramanujan partition identity; S. L. Kruskal, On quasireflections and holomorphic functions; G. Levin, The adjoint equation for the eigenvalues of transfer operators on holomorphic repellers; N. Nadirashvili, Conformal maps and isoperimetric inequalities for eigenvalues of the
New Publications Offered by the AMS


Israel Mathematical Conference Proceedings, Volume 11
November 1997, 245 pages, Softcover, 1991 Mathematics Subject Classification: 30; 31, 32, 34, 35, 44, 47, 58, Individual member $35, List $59, Institutional member $47, Order code IMCP/11N

Differential Equations

Second Order Equations of Elliptic and Parabolic Type
E. M. Landis, Moscow State University, Russia

Most books on elliptic and parabolic equations emphasize existence and uniqueness of solutions. By contrast, this book focuses on the qualitative properties of solutions. In addition to the discussion of classical results for equations with smooth coefficients (Schauder estimates and the solvability of the Dirichlet problem for elliptic equations; the Dirichlet problem for the heat equation), the book describes properties of solutions to second order elliptic and parabolic equations with measurable coefficients near the boundary and at infinity.

The book presents a fine elementary introduction to the theory of elliptic and parabolic equations of second order. The precise and clear exposition is suitable for graduate students as well as for research mathematicians who want to get acquainted with this area of the theory of partial differential equations.

Contents: Elliptic equations in nondivergence form; Elliptic equations in divergence form; Parabolic equations; Appendix; Bibliography; Index.

Translations of Mathematical Monographs

Geometry and Topology

CR-Geometry and Overdetermined Systems
Takao Akahori, Himeji Institute of Technology, Hyogo, Japan, Gen Komatsu, Osaka University, Japan, Kimio Miyajima, Kagoshima University, Japan, Makoto Namba, Osaka University, Japan, and Keizo Yamaguchi, Hokkaido University, Sapporo, Japan, Editors

This volume consists of survey articles and research papers on the most recent developments of CR-geometry and overdetermined systems. Some of the papers are based on the lectures delivered at a conference of the same title. The volume contains notes from three lectures on the invariant theory of the Bergman kernel, and on the deformation of CR structures with applications. Other papers, original or expository, are recent contributions on important problems in complex geometry of differential geometric aspects of analysis, and many of them are related to CR geometry. This volume offers timely and useful information on the subject area.

Advanced Studies in Pure Mathematics is published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and distributed worldwide, except in Japan, by the AMS.


Advanced Studies in Pure Mathematics, Volume 25
Knotted Surfaces and Their Diagrams

J. Scott Carter, University of South Alabama, Mobile, and Masahico Saito, University of South Florida, Tampa.

In this book the authors develop the theory of knotted surfaces in analogy with the classical case of knotted curves in 3-dimensional space. In the first chapter knotted surface diagrams are defined and exemplified; these are generic surfaces in 3-space with crossing information given. The diagrams are further enhanced to give alternative descriptions. A knotted surface can be described as a movie, as a kind of labeled planar graph, or as a sequence of words in which successive words are related by grammatical changes.

In the second chapter the theory of Reidemeister moves is developed in this memoir. There are fewer than one would think and the proofs are harder than one would expect, requiring some innovative twists. The main protagonists on the scene are $SL(2,\mathbb{R})$ and its universal covering group, almost abelian solvable Lie groups (i.e., vector groups extended by homotheties), and compact Lie groups.

This text will also be of interest to those working in algebra and algebraic geometry.

Contents: Diagrams of knotted surfaces; Moving knotted surfaces; Braid theory in dimension four; Combinatorics of knotted surface diagrams; The fundamental group and the Seifert algorithm; Algebraic structures related to knotted surface diagrams; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 55


Two Classes of Riemannian Manifolds Whose Geodesic Flows Are Integrable


Two classes of manifolds whose geodesic flows are integrable are defined, and their global structures are investigated. They are called Liouville manifolds and Kähler-Liouville manifolds respectively. In each case, the author finds several invariants with which they are partly clas-
The papers in this volume provide a contemporary sample of mathematical hierarchies and biology. Boris Mirkin, DIMACS, Rutgers University, Piscataway, NJ, F. R. McMorris, University of Louisville, KY, Fred S. Roberts, Rutgers University, New Brunswick, NJ, and Andrey Rzhetsky, Columbia University, New York City, Editors

The mathematical approach to the study of hierarchies presents the theoretical basis for many important areas of current scientific investigation. Biology has benefited from this research and has also stimulated the mathematical study of hierarchies.

This collection presents papers devoted to theoretical, algorithmic, and application issues related to i) reconstructing hierarchies (trees or ranking) from (diss)similarity or entity-to-character data, ii) using hierarchies for modeling evolution and other processes, and iii) combining (gene) trees.

The papers in this volume provide a contemporary sample of many new results in hierarchy theory with applications in biology, psychology, data analysis, and systems engineering.

Features:
- Mathematical treatment of hierarchies in several interconnected frameworks: set systems, linear subspaces, graph objects, and tree metrics.
- The relationship of hierarchies to many issues of current application—from learning robots to wavelets to intron evolution to the evolution of language.
- Solutions to several important problems.

This text will also be of interest to those working in discrete mathematics and combinatorics.

Contents: Part 1. Liouville Manifolds: Introduction; Preliminary remarks and notations; Local structure of proper Liouville manifolds; Proper Liouville manifolds of rank one; Appendix. Simply connected manifolds of constant curvature; Part 2. Kahler-Liouville manifolds: Introduction; Preliminary remarks and notations; Local calculus on $M^1$; Summing up the local data; Structure of $M - M^1$; Torus action and the invariant hypersurfaces; Properties as a toric variety; Bundle structure associated with a subset of $\mathbb{A}$; The case where $\mathbb{A} = 1$; Existence theorem.

Memorandum of the American Mathematical Society, Volume 130, Number 619


New Publications Offered by the AMS

Applications

Mathematical Hierarchies and Biology


DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 37


1370 NOTICES OF THE AMS VOLUME 44, NUMBER 10
**Titles in Probability from the AMS**

**Asymptotic Methods in the Theory of Gaussian Processes and Fields**

Vladimir I. Piterbarg, NII SAI RAN, Moscow, Russia... valuable addition to the set of English-language monographs dealing with related topics.

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**The Ergodic Theory of Discrete Sample Paths**

Paul C. Shields, University of Toledo, OH

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**Gaussian Processes**

Takeyuki Hida, Meijo University, Nagoya, Japan, and Masuyuki Hitsuda, Kumamoto University, Japan

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**An Introduction to Branching Measure-Valued Processes**

Eugene B. Dynkin, Cornell University, Ithaca, NY

A reader whose primary interest is in applications to analysis... will find the essentials here in concise form... though perhaps rather daunting at first sight, Dynkin's book becomes more and more user-friendly with acquaintance.

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**Introduction to Probability Revised Second Edition**

Charles M. Grinstead, Swarthmore College, PA, and J. Laurie Snell, Dartmouth College, Hanover, NH


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**Introduction to the Theory of Diffusion Processes**

N. V. Krylov, University of Minnesota, Minneapolis

What makes this book different is the presentation of the material. The author starts from scratch, introducing all the necessary concepts and techniques as he needs them. This makes it an excellent tool of thought and to get to the main topics, stochastic integrals and stochastic differential equations, without detour and without many prerequisites... invaluable help when studying from this book is a "dual" presentation of the material: All the main concepts and results are accompanied by a discussion of the intuitive idea behind them, and almost all proofs are given in a straightforward and precise manner...

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**Probability Theory: Collection of Problems**

A. Ya. Dorogovtsev, Kiev, Ukraine, D. S. Silvestrov, Kiev State University, Ukraine, A. V. Skorokhod, Ukrainian Academy of Sciences, Kiev, and M. I. Yadrenko, Kiev State University, Ukraine


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In particular, readers should note that the
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The Age Discrimination Act of 1967 (29 U.S.C.,
§§ 621 et seq., as amended), makes it unlawful
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"recent graduate", since the latter tend (on
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Classified Advertisements

Positions available, items for sale, services available, and more

ARIZONA

ARIZONA STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics at Arizona State University invites applications for several tenure-track and visiting positions at the assistant and associate professor levels, pending budgetary approval, commencing fall 1998. All candidates must have a Ph.D. in mathematics, statistics, or a closely related area and demonstrated potential for excellence in research and teaching at the undergraduate level. For candidates at the associate professor level, additional requirements include an outstanding research record and proven commitment to excellence and innovation in teaching at all levels.

Tenure-track candidates must have research strengths in one or more of the following areas: i) applied and theoretical statistics, ii) computationally oriented applied mathematics, iii) differential equations (ordinary and/or stochastic), or iv) operator algebras. Candidates in the first three areas should also have experience in modeling and computation, encompassing applications from industry, the life sciences or engineering, and expect to participate fully in a cross-disciplinary environment.

Applications for visiting positions are invited from candidates who must have research strengths in applied mathematics or discrete mathematics and interests in modeling, computation, and participation in multidisciplinary activities.

The main campus of Arizona State University has approximately 43,000 students and is located in the rapidly growing metropolitan Phoenix area, which provides a wide variety of recreational and cultural opportunities. The Department of Mathematics currently has 58 full-time faculty members, 27 lecturers, and over 70 supported graduate students. Departmental computing facilities include networked clusters of high-end workstations as well as several graphics computers and access to the university's central computing facilities.

Applicants must send i) their résumé, ii) an AMS Cover Sheet, iii) a letter stating for which position they wish to be considered and addressing their research agenda, iv) a statement of teaching philosophy, and v) at least three letters of recommendation by the deadline to: R. A. Renaut, Chair, Department of Mathematics, P. O. Box 871804, Arizona State University, Tempe, AZ 85287-1804.

Review of the applications will begin on November 30, 1997, and will continue weekly until the positions are filled.

CALIFORNIA

UNIVERSITY OF CALIFORNIA, DAVIS
Regular and Visiting Faculty Positions in Mathematics

Applications are invited for anticipated positions at either the assistant (tenure-track) or associate professor (tenured) level and Visiting Research Assistant Professorship (VRAP) positions in the Department of Mathematics, University of California, Davis, effective July 1, 1998. These positions are contingent on budgetary and administrative approval.

Appointments of the assistant or associate professor positions will be made commensurate with qualifications. Minimum qualifications include a Ph.D. degree in mathematical sciences and great promise in research and teaching. Candidates for the associate professor position must have demonstrated outstanding attainment in research and teaching. Duties include mathematical research, undergraduate and graduate teaching, and service. The Department of Mathematics is recruiting at the assistant and/or the associate professor level in the following areas: (1) analysis/partial differential equations, (2) discrete mathematics/experimental mathematics, (3) geometry/topology, and (4) scientific computation/numerical analysis/applied mathematics.

The VRAP positions are renewable for a total of three years with satisfactory performance in research and teaching. The VRAP applicants are required to have completed their Ph.D. no earlier than 1994. The Department of Mathematics is interested in applicants in the following areas for the VRAP positions: 1) algebra, 2) analysis/PDEs, 3) applied mathematics, 4) geometry/topology, 5) mathematical physics, 6) numerical analysis/scientific computation.

The positions are open until filled, but to assure full consideration, applications should be received by December 15, 1997. To initiate the application process, request an application package by writing an e-mail to:

Chair,
Department of Mathematics,
University of California, Davis,
Davis, CA 95616

Suggested uses for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

The 1997 rate is $100 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional part of 1/2 inch or more will be charged at the next inch rate. No discounts for multiple ads or the same ad in consecutive issues. For an additional $10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Headlines will be centered in boldface at no extra charge. Ads will appear in the language in which they are submitted. There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified advertising.


U.S. laws prohibit discrimination in employment on the basis of color, age, sex, race, religion, or national origin. "Positions Available" advertisements from institutions outside the U.S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U.S. laws. Details and specific wording may be found on page 1373.

Situations wanted advertisements from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-521-AMS (521-4267) in the U.S. and Canada, or 401-455-4984 worldwide, for further information.

Submission: Promotions Department, AMS, P. O. Box 6248, Providence, Rhode Island 02940, or via fax, 401-331-3842, or send e-mail to classifieds@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.
Applications are invited for several one- or two-year Visiting Assistant Professor positions in the following areas of research: (1) applied and computational mathematics, (2) analysis and PDE (includes mathematical physics), (3) geometry and topology (includes geometric analysis), (4) logic and set theory, (5) probability, (6) algebra and number theory (includes algebraic and arithmetic geometry). Candidates must possess a Ph.D. Strong promise in research and teaching is required. Current annual salary is set at $39,600. Teaching load: five to six quarter courses per year. Applicants should send a resume, preprints, dissertation abstract, and a letter of recommendation to: Visiting Assistant Professor Search Committee at the above address. The deadline for applications is December 31, 1997, or until the positions are filled. The University of California is an Equal Opportunity Employer committed to excellence through diversity.

Applications are invited for three tenure-track or tenured positions. Priorities will be placed on the following areas: (1) applied and computational mathematics, (2) analysis and PDE (includes mathematical physics), (3) geometry and topology (includes geometric analysis), (4) logic and set theory, (5) probability, (6) algebra and number theory (includes algebraic and arithmetic geometry). Candidates must possess a Ph.D. Very strong record and potential in research and teaching are required for the positions. Applicants should send a curriculum vitae, a list of publications, preprints, and a research plan to the Search Committee at the above address. They should also arrange for four letters of recommendation to be sent to the Search Committee. Applicants are encouraged to use the AMS Cover Sheet. The deadline for applications is December 31, 1997, or until the positions are filled. The University of California is an Equal Opportunity Employer committed to excellence through diversity.

UNIVERSITY OF CALIFORNIA, LOS ANGELES Department of Mathematics Temporary Positions

Subject to availability of resources and administrative approval: (1) Three E. R. Hedrick Assistant Professorships. Applicants must show very strong promise in research and teaching. Salary $45,000. Three-year appointment. Teaching load: four quarter courses per year, which may include one advanced course in the candidate’s field. Preference will be given to applications completed by January 6, 1998. (2) One or two Research Assistant Professorships in Computational and Applied Mathematics. Applicants must show very strong promise in research and teaching. Salary $45,000. One-year appointment, probably renewable up to two times. Teaching load: at most four quarter courses per year, which may include one advanced course in the candidate’s field. Preference will be given to applications completed by January 6, 1998. (3) One Adjunct Assistant Professorship or Lectureship in the Program in Computing (PIC). Applicants for the adjunct position must show very strong promise in teaching and research in an area related to computing. Teaching load: four quarter programming courses and one more advanced quarter course per year. One-year appointment, probably renewable once. Salary $48,400. Applicants for the lectureship must show very strong promise in the teaching of programming. An M.S. in computer science or equivalent degree is preferred. Teaching load: six quarter programming courses per year. One-year appointment, probably renewable one or more times depending on the needs of the program. Salary is $40,656 or more. Preference will be given to applications completed by February 1, 1998. (4) An Adjunct Assistant Professorship. One-year appointment, probably renewable once. Strong research and teaching background required. Salary $41,900-43,900. Teaching load: five quarter courses per year. (5) Possibly one or more positions for visitors.

To apply, please submit the following materials in a single package: letter of application (including your e-mail address, fax number, and position applied for), the AMS Cover Sheet, and a curriculum vitae. Candidates for assistant professor, visiting, and/or postdoctoral positions should also arrange for three letters of recommendation to be sent. Mail all materials to: Chair of Appointments Committee, Department of Mathematics-DBR 155, University of Southern California, Los Angeles, CA 90089-1113. Review of applications will begin December 1, 1997. Additional information about USC can be found on the Web at http://www.usc.edu/. USC is an Equal Opportunity/Affirmative Action Employer.

STANFORD UNIVERSITY Department of Mathematics Assistant Professorships in Honor of Gabor Szego

The department expects to make one or more appointments in 1998-99 for these special three-year positions. Applicants are expected to show outstanding promise in research and clear evidence of achievement. They should have received the Ph.D. prior to the start of the appointment, but not before 1996. Stanford is committed to excellence in teaching, and applicants should count this as one of their goals. Candidates should send a letter of application with a curriculum vitae, a list of publications, and information concerning teaching experience, and three letters of recommendation to Prof. Gunnar Carlsson, Chairman, Department of Mathematics, Stanford University, Stanford, CA 94305-2125, by December 15, 1997. Stanford is an Affirmative Action/Equal Opportunity Employer and welcomes applications from women and minorities.

STANFORD UNIVERSITY Department of Mathematics

The department expects to make at least one tenure-track or tenured appointment beginning September 1998 among the following fields: (1) analysis; (2) geometry or topology; (3) algebra, number theory, or logic; (4) applied mathematics or probability. In the last case there are also possibilities for joint appointments with other departments. At the tenured level, preference would go to individuals in the earlier years of their ranks, though a more senior appointment may be possible for an extremely well-qualified individual.
Candidates should send a letter of application and a curriculum vitae, a list of publications, and a cover sheet clearly stating the following information: name, area of specialization, institution, (expected) date of Ph.D., and Ph.D. advisor. Also the candidate should arrange to have three letters of recommendation and some evidence of commitment to excellence in teaching sent to Prof. Gunnar Carlsson, Department of Mathematics, Stanford University, Stanford, CA 94305-2125, by January 15, 1998.

Stanford is an Equal Opportunity/Affirmative Action Employer and welcomes applications from women and minorities.

COLORADO

UNIVERSITY OF COLORADO AT BOULDER
Department of Mathematics

Applications are invited for two tenure-track faculty positions at the assistant professor level beginning in the fall of 1998, one in probability and one in classical analysis. Candidates should have earned a Ph.D. in mathematics by August 1998, have demonstrated interest and ability in teaching, and have experience in and commitment to mathematical research. These positions require teaching at various levels, mathematical research, and service.

Applications, including a résumé and four letters of reference, should be sent to: Search Committee, Department of Mathematics, Campus Box 395, University of Colorado, Boulder, CO 80309-0395. Review of applications will begin December 15, 1997, and will continue until the position is filled.

The University of Colorado at Boulder strongly supports the principle of diversity in all its forms. We are interested in receiving applications from women, ethnic minorities, persons with disabilities, veterans, and veterans of the Vietnam era.

GEORGIA

GEORGIA INSTITUTE OF TECHNOLOGY

The School of Mathematics expects to have visiting and tenure-track positions at various levels in pure and applied mathematics and statistics, beginning in fall 1998. The School intends to expand its areas of expertise and foresee a potential for 10-15 new appointments in the next five years. Candidates with strong research and teaching records or potential should arrange for a résumé, at least three letters of reference, and a summary of their research plans to be sent to The Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332-0160. Georgen Tech, an institution of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

ILLINOIS

NORTHEASTERN UNIVERSITY
Department of Mathematics
2033 Sheridan Road
Evanston, Illinois 60208-2730

The Department of Mathematics is soliciting applications for two Ralph Boas assistant professorships of three years each starting in September 1998. These positions are part of the Emphasis Year in Algebraic Geometry, which the department will be sponsoring in 1998-99. We seek applicants in the areas of algebraic geometry, algebraic K-theory, complex geometry, and allied areas.

Applications should be sent to the Emphasis Year Personnel Committee at the department address and include: (1) the American Mathematical Society's Application Cover Sheet for Academic Employment in Mathematics, (2) a curriculum vitae, and (3) three letters of recommendation. Inquiries may be sent via e-mail to hiring@math.nwu.edu. In order to ensure full consideration, applications should be received by December 15, 1997. Northwestern University is an Affirmative Action/Equal Opportunity Employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

SOUTHERN ILLINOIS UNIVERSITY AT CARBONDALE
Department of Mathematics
Carbondale, Illinois 62901-4408
Continuing Position

Applications are invited from qualified candidates for a tenure-track position in algebra at the assistant professor level beginning on August 16, 1998. Applicants must have a research program in algebra or a closely related field and hold a Ph.D. in mathematics at the time of appointment. If all requirements for the doctorate are not completed by the effective date of employment, appointment will be as an instructor on a term contract. Candidates must show evidence of or strong potential for excellence in research. All applicants must also provide evidence of excellence in teaching and of the ability to teach effectively in English. Postdoctoral experience is preferred. Send letter of application, resume, and three letters of recommendation to:

Continuing Position
C/O Andrew G. Earnest, Chair
Department of Mathematics
Southern Illinois University
at Carbondale
Carbondale, Illinois 62901-4408

Closing date is December 1, 1997, or until position is filled. SIUC is an Equal Opportunity/Affirmative Action Employer. Women and minorities are particularly encouraged to apply.

UNIVERSITY OF ILLINOIS AT CHICAGO
Department of Mathematics, Statistics, and Computer Science

The department has active research programs in all areas of pure mathematics, computational and applied mathematics, combinatorics and computer science, statistics, and mathematics education. See http://www.math.uic.edu/ for more information. Applications are invited for the following positions, effective August 21, 1998. First, a tenure-track or tenured position. Candidates in all areas of interest to the department will be considered. The position is initially budgeted at the assistant professor level, but candidates with a sufficiently outstanding research record may be considered for higher levels. Applicants must have a Ph.D. or equivalent degree in mathematics, computer science, statistics, mathematics education or related field, an outstanding research record, and evidence of strong teaching ability. Salary negotiable. Second, a research assistant professorship. This is a

NOTICES OF THE AMS
non-tenure-track position normally renewable annually to a maximum of three years. The position carries a teaching load of one course per semester, with the requirement that the incumbent play a significant role in the research life of the department. The salary for FY 1998-99 for this position is expected to be $40,000. Applicants must have a Ph.D. or equivalent degree in mathematics, computer science, statistics, mathematics education, or related field; and evidence of outstanding research potential. We encourage applicants to submit an electronic cover sheet. The electronic cover sheets may be filled out on the Web at http://www.pdis.org/ or may be obtained by sending e-mail to the address coversheet@pdis.org. However, for this search we still require that an original paper application also be submitted. Send vita and three letters of recommendation indicating the position being applied for to Henri Gillet, Head; Dept. of Mathematics, Statistics, and Computer Science; University of Illinois at Chicago; 851 S. Morgan (M/C 249); Chicago, IL 60607. To ensure full consideration, materials must be received by December 22, 1997. Minorities, persons with disabilities, and women are particularly encouraged to apply. UIC is an AA/EEO employer.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Postdoctoral Positions
J. L. Doob Research Assistant Professor

The Department of Mathematics of the University of Illinois at Urbana-Champaign is soliciting applications for postdoctoral positions. Two appointments will be made starting August 21, 1998; each appointment is for three years and is not renewable. The positions are for recent Ph.D. recipients (with a strong preference for those not more than one year past the Ph.D. degree). The Department of Mathematics offers an excellent scientific environment to pursue research in pure and applied mathematics. The position carries a salary of $39,000 per year.

Applications should include a curriculum vitae and a brief statement of research interests and activities. The use of the AMS Cover Sheet will be appreciated.

Applications should be sent by regular mail to the Postdoctoral Search Committee, Department of Mathematics, University of Illinois at Urbana-Champaign, 1409 W. Green St., Urbana, Illinois 61801-2975.

Applicants should arrange for at least three letters of recommendation to be sent to the same address.

For more information visit our Web page at http://www.math.uiuc.edu/.

Inquiries may be sent to: postdocs@math.uiuc.edu.

For full consideration the application must be received by December 7, 1997.

The University of Illinois is an Affirmative Action/Equal Opportunity Employer. Women and minorities are strongly encouraged to apply.

NORTHEASTERN UNIVERSITY
Department of Mathematics

Applications are invited for anticipated tenure-track or tenured positions starting September 1998. Priority will be given to exceptionally promising research mathematicians. Fields of interest within the department include algebra, algebraic geometry, analysis, dynamical systems, probability, partial differential equations, and topology.

Candidates should arrange to have their application materials sent to Chairperson, Personnel Committee, Department of Mathematics, Applications should include: (1) the American Mathematical Society’s Application Cover Sheet for Academic Employment in Mathematics, (2) a curriculum vitae, and (3) at least four letters of recommendation, including one which discusses in some detail the candidate’s teaching qualifications. Inquiries may be sent via e-mail to hiring@math.nwu.edu. In order to receive full consideration, applications should be received by November 15, 1997.

Northeastern is an Affirmative Action/Equal Opportunity Employer committed to fostering a diverse faculty; women and minority candidates are especially encouraged to apply.

INDIANA

UNIVERSITY OF NOTRE DAME
Department of Mathematics
Notre Dame, IN 46556
Regular Positions in Pure Mathematics

The Department of Mathematics of the University of Notre Dame invites applications for two positions starting August 26, 1998. The fields of interest are gauge theory and symplectic topology, Lie representation theory, and several complex variables, but outstanding candidates in all fields are encouraged to apply. The positions are at the tenure-track level, though a tenured appointment may be possible for an exceptional candidate. The teaching load is one course one semester and two courses the other semester. Salaries are competitive. Applications, including a curriculum vitae, a letter of application, and a completed AMS Standard Cover Sheet, should be sent to: Alexander J. Hahn, Chair, at the above address. Applicants should also arrange for at least three letters of recommendation to be sent to the chair. These letters should address the applicant’s research accomplishments and should supply evidence that the applicant has the ability to teach articulately and effectively. Notre Dame is an Equal Opportunity Employer. Women and minorities are urged to apply. The evaluation of candidates will begin December 1. Information about the department is available at http://www.math.nd.edu/.

UNIVERSITY OF NOTRE DAME
Department of Mathematics
Notre Dame, IN 46556
Regular Position in Stochastic Analysis

The Department of Mathematics of the University of Notre Dame invites applications for a position in the field of stochastic analysis starting August 26, 1998. Of special interest are candidates with expertise in stochastic control, stochastic optimization, or stochastic differential equations. The position is at the tenure-track level, but a tenured appointment may be possible for an exceptional candidate. The teaching load is one course one semester and two courses the other semester. The salary is competitive. Applications, including a curriculum vitae, a letter of application, and a completed AMS Standard Cover Sheet, should be sent to: Alexander J. Hahn, Chair, at the above address. Applicants should also arrange for at least three letters of recommendation to be sent to the chair. These letters should address the applicant’s research accomplishments and should supply evidence that the applicant has the ability to teach articulately and effectively. Notre Dame is an Equal Opportunity Employer. Women and minorities are urged to apply. The evaluation of candidates will begin December 1. Information about the department is available at http://www.math.nd.edu/.

KANSAS

UNIVERSITY OF KANSAS
Henry J. Bischoff Professor of Mathematics

The Department of Mathematics of the University of Kansas seeks an internationally renowned scholar for the Henry J. Bischoff professorship. This position is one of 23 distinguished chairs in the College of Liberal Arts and Sciences. In addition to an outstanding research record, applicants for the position must have a demonstrated interest in teaching mathematics.

Interested individuals should submit a letter of inquiry and a vita. All inquiries will be kept confidential. Review of applications will begin January 15, 1998, and will continue until the position is filled. The University of Kansas is an EO/AA Employer.

Send correspondence to: Charles J. Himmelberg, Chairman, Department of Mathematics, 405 Snow Hall, University of Kansas, Lawrence, KS 66045.
Applications are invited for a tenure-track position at the assistant professor level beginning August 18, 1998, or as negotiated. (This position is contingent on final budgetary approval.) Preference will be given to candidates in algebra/algebraic geometry and to those who have interests in pure or applied mathematics whose specialties mesh well with those already represented in the department. Candidates must have a Ph.D. or its requirements completed by August 15, 1998. Postdoctoral experience is preferred.

Letter of application, detailed résumé with description of research, completed AMS standardized application form, and three recommendation letters should be sent to C. J. Himmelberg, Chairman, Department of Mathematics, 405 Snow Hall, University of Kansas, Lawrence, KS 66045-2142. Deadlines: Review of applications will begin on January 1, 1998, and will continue until the positions are filled.

EO/AA Employer.

KANSAS STATE UNIVERSITY
Department of Mathematics
Subject to budgetary approval, applications are invited for tenure-track and visiting positions commencing August 9, 1998; rank and salary commensurate with qualifications. The department seeks candidates whose research interests mesh well with current faculty. The department has research groups in the areas of analysis, algebra, geometry/topology, and differential equations. Applicants must have strong research credentials and a commitment to excellence in teaching. A Ph.D. in mathematics or a Ph.D. dissertation accepted with only formalities to be completed is required. Letter of application, current vita, description of research, and three letters of recommendation should be sent to:

Louis Pigno
Department of Mathematics
Cardwell Hall 138
Kansas State University
Manhattan, KS 66506

Offers may begin by December 8, 1997, but applications for positions will be reviewed until February 1, 1998, or until positions are closed. AA/EEO

MARYLAND

UNIVERSITY OF MARYLAND
AT COLLEGE PARK
Department of Mathematics
Applications are invited for tenured and tenure-track positions in the Department of Mathematics from researchers with strong interests in at least one of the following three fields: applied analysis, numerical analysis, and scientific computation. Exceptional research and teaching required. Successful candidates will integrate their research with our educational program.

C. K. Cheung
Search Committee
Department of Mathematics
Boston College
Chestnut Hill, MA 02167-3806

E-mail inquiries may be directed to search.math@bc.edu. Electronic applications will NOT be accepted. Review of applications will begin on January 1, 1998, and will continue until the position is filled. Boston College is an Affirmative Action/Equal Opportunity Employer.

EO/AA Employer.

WILLIAMS COLLEGE
Department of Mathematics
Williamstown, Massachusetts 01267
Anticipated tenure-eligible position in statistics beginning fall 1998, probably at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and statistics, including scholarship and consulting, and Ph.D. required.

Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Evaluation of applications will begin November 15 and will continue until the position is filled. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

EO/AA Employer.

WILLIAMS COLLEGE
Department of Mathematics
Williamstown, Massachusetts 01267
Anticipated visiting position(s) in mathematics or statistics for the 1998-99 year, probably full-time, probably at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and research and Ph.D. required.

Please have a vita and three letters of recommendation on teaching and research sent to Visitor Hiring Committee. Evaluation of applications will begin November 15 and will continue until the position is filled. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

EO/AA Employer.

KALAMAZOO COLLEGE
Assistant Professor of Mathematics
Kalamazoo College invites applications for a tenure-track position at the assistant professor level beginning September 1, 1998. A Ph.D. in mathematics, statistics, or operations research is required, with preference given to candidates of broader experience in mathematics, science, or the liberal arts. Teaching load is two courses per quarter, three quarters per year. Salary is competitive and consistent with level of experience.

Experience with and interest in the application of statistics to problems in the life or social sciences is essential. The ideal candidate will also have an interest in developing an active research program that involves undergraduate student participation. Candidates are expected to have high aptitude and interest in undergraduate teaching, a commitment to the liberal arts, and a desire to involve undergraduates in scholarship both inside and outside the classroom.

Kalamazoo College is a selective, private, four-year liberal arts institution of 1,200

EO/AA Employer.

MICHIGAN

WILLIAMS COLLEGE
Department of Mathematics
Williamstown, Massachusetts 01267
Anticipated tenure-eligible position in statistics beginning fall 1998, probably at the rank of assistant professor; in exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and statistics, including scholarship and consulting, and Ph.D. required.

Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Evaluation of applications will begin November 15 and will continue until the position is filled. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

EO/AA Employer.
students known for its innovative program and strong tradition in the sciences. Founded in 1833, it is the oldest institution of higher education in Michigan. The campus is located midway between Chicago and Detroit in Kalamazoo, Michigan, a community of 80,000 in a metropolitan area of 225,000 which supports four college and university campuses along with numerous civic, arts, and cultural associations. Thirty-five miles from Lake Michigan, the area offers many opportunities for outdoor activities. For more information about the college, visit our Web home page at http://www.kzoo.edu/.

Completed applications received by December 31, 1997, will receive full consideration, with later applications reviewed as needed until the position is filled. Send curriculum vitae, undergraduate and graduate transcripts (unofficial acceptable), a two-to-three-page statement of teaching philosophy and research plans, and three letters of recommendation to Prof. John Fink Chair, Department of Mathematics Kalamazoo College 1200 Academy Street Kalamazoo, MI 49006-3295 fink@cc.kzoo.edu Kalamazoo College encourages candidates who will contribute to the cultural diversity of the College to apply and to identify themselves if they wish. Equal Opportunity Employer.

**MISSOURI**

**UNIVERSITY OF MISSOURI-KANSAS CITY**

Department of Mathematics & Statistics

Assistant Professorship in Statistics

The Department of Mathematics and Statistics invites applications for a tenure-track position of assistant professor of statistics beginning in August 1998. The applicant should have a Ph.D. in statistics or a Ph.D. in mathematics with a specialization in statistics. Duties include teaching courses in probability and statistics at both the undergraduate and graduate levels and research of a quality sufficient to enable the successful candidate to participate in the department's doctoral and master's programs. The salary is competitive.

Please apply to:

Search Committee
Department of Mathematics & Statistics
4825 Troost, Room 101
University of Missouri-Kansas City
Kansas City, MO 64110-2499

Applications should include a vita and three letters of recommendation. Prior experience is not necessary, but the application materials should demonstrate strong potential for successful research and effective teaching. Women and minorities are especially encouraged to apply.

The University of Missouri-Kansas City is an Affirmative Action/Equal Opportunity Employer.

**NEW HAMPSHIRE**

**DARTMOUTH COLLEGE**

John Wesley Young Research Instructorship in Mathematics

The John Wesley Young Research Instructorship is a two-year postdoctoral appointment for promising new or recent Ph.D.s whose research interests overlap a department member's. Current departmental interests include areas in algebra, analysis, combinatorics, differential geometry, logic and set theory, number theory, probability and topology. Teaching duties of four ten-week courses spread over two or three quarters typically include at least one course in the instructor's specialty and include elementary, advanced, and (at instructor's option) graduate courses. Nine-month salary of $39,000 supplemented by summer research stipend of $8,667 for instructors in residence for two months in summer. Send letter of application, resume, graduate transcript, thesis abstract, description of other research activities and interests if appropriate, and 3, or preferably 4, letters of recommendation (at least one should discuss teaching) to Betty Harrington, Department of Mathematics, 6188 Bradley Hall, Dartmouth College, Hanover, NH 03755-3551. Applications received by January 15 receive first consideration; applications will be accepted until position is filled. Dartmouth College is committed to Affirmative Action and encourages applications from minorities and women.

**DARTMOUTH COLLEGE**

The Department of Mathematics anticipates an opening for a professor of mathematics, with appointment effective in the 1998-99 academic year. Field open. A candidate for the position must demonstrate evidence of an exceptional research program that has achieved peer recognition and research leadership in the mathematical community. Moreover, a candidate must demonstrate a record of exceptional teaching and continued interaction with students at all levels of undergraduate and graduate study. Leadership in guiding Ph.D. theses is also essential. Applications are welcome in all fields of mathematics.

To create an atmosphere supportive of research, Dartmouth offers new faculty members grants for research-related expenses, a quarter of sabbatical leave for each three academic years in residence, and flexible scheduling of teaching responsibilities. The teaching responsibility in mathematics is four courses spread over two or three quarters. The department encourages good teaching with a combination of committed colleagues and bright, responsive students.

To apply, send a letter of application, curriculum vitae, and a brief statement of research results and interests, and the names of four references, at least one of whom can specifically address teaching. These materials should be sent to Betty Harrington, Recruiting Secretary, Department of Mathematics, Dartmouth College, 6188 Bradley Hall, Hanover, NH 03755-3551. Applications complete by January 1, 1998, including reference letters (allow enough lead-time for us to make the solicitation from the names you provide), will receive consideration. Dartmouth is committed to Affirmative Action and encourages applications from African Amer-
NEW JERSEY

MONTCLAIR STATE UNIVERSITY
Department of Mathematics and Computer Science

Applications are invited for a tenure-track position in discrete applied mathematics starting fall 1998 at the rank of assistant professor. Candidates are required to have a Ph.D. in mathematics with expertise in operations research required together with one or more of the following areas preferred: graph theory, game theory, or combinatorial mathematics.

Candidates are expected to be active scholars and to participate in professional and grant activities. Applicants must have strong commitment to quality teaching at both the undergraduate and graduate levels.

Teaching load is 12 credits per semester but may be reduced to 9 credits per semester if actively engaged in research.

The Department of Mathematics and Computer Science at Montclair State University includes undergraduate programs in mathematics, mathematics education, computer science and physics; Master's programs in mathematics, mathematics education, computer science, and statistics. Currently, there are thirty-nine full-time faculty in the department.

Applicants should send a vita, a statement of professional goals, research interests and teaching philosophy, and three letters of recommendation to:

Applied Mathematics
Search Committee (V#-1)
c/o Dr. George Santiago
Assistant Dean, CSAM
Montclair State University
Upper Montclair, NJ 07043

Screening begins immediately and continues until the position is filled.

Montclair State University is an Equal Opportunity/Affirmative Action Employer. Women and minorities are encouraged to apply. Subject to available funding.

NEW MEXICO

THE UNIVERSITY OF NEW MEXICO
Albuquerque, New Mexico
Department of Mathematics and Statistics

One appointment is to be in applied mathematics. We are interested in outstanding candidates at the assistant professor level in applied analysis. Preference will be given to applicants with research interests in the areas of fluid dynamics, solid mechanics, material sciences, or mathematical biology, but other areas of applied analysis will also be considered. Exceptionally well-qualified senior candidates may also be considered. Minimal qualifications include a Ph.D. in applied mathematics or mathematics and postdoctoral experience. Selection criteria include research accomplishments as well as potential interactions and contributions to the research interests of the department and its educational program.

Another appointment is to be made in pure mathematics. Preference will be given to outstanding candidates at the assistant professor level in algebraic geometry, C*-algebras, dynamical systems, K-theory, number theory, or several complex variables. Exceptionally well-qualified senior candidates may also be considered. Minimal qualifications include a Ph.D. and postdoctoral experience. Selection criteria include research accomplishments in mathematics as well as potential interactions and contributions to the research interests of the department and its educational program.

The department currently has 33 faculty members and an active and expanding graduate program. Many faculty members have research ties with Los Alamos and Sandia National Laboratories. The department is closely associated with the Maui HPCC, a national center committed to the development of scalable processing technologies. Additional information is available at http://www.math.unm.edu/.

Applicants should send a curriculum vitae and three letters of recommendation to:

Search Committee (specify applied or pure)
Department of Mathematics and Statistics
The University of New Mexico
Albuquerque, NM 87131

We shall begin reviewing applications on December 1, 1997. Candidates providing an electronic mail address will be informed when their application is complete. The University of New Mexico is an Equal Opportunity and Affirmative Action Employer.

NEW YORK

RENSSELAER POLYTECHNIC INSTITUTE
Department of Mathematical Sciences

Applications are invited for a tenure-track assistant professor position in applied mathematics to begin in August 1998. Applicants are expected to have demonstrated outstanding research potential and to have a strong interest and ability in teaching. Of particular interest are candidates with a commitment to interdisciplinary research who are knowledgeable in scientific computation.

Applicants should submit a letter of application, a curriculum vitae, a description of research interests, and three letters of recommendation to: Search Committee Chair, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, NY 12180. Evaluation of applications will begin October 15, 1997, and will continue until a candidate is selected.

Rensselaer is an Equal Opportunity/Affirmative Action Employer and strongly encourages applications from women and underrepresented minorities.

NORTH CAROLINA

NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics invites applications for a tenure-track position at the assistant or associate professor level in representation theory and combinatorics beginning in the fall of 1998. Candidates must have a doctoral degree in mathematics, a strong ongoing research program in representation theory and/or algebraic combinatorics, and a commitment to effective teaching at the undergraduate and graduate levels. Preference will be given to candidates with postdoctoral experience. Applicants should send a vita and at least three letters of recommendation to Algebra Search Committee, Department of Mathematics, North Carolina State University, Raleigh, NC 27695-8205. Review of completed applications will begin immediately. Applications will continue to be accepted until the position is filled. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, veteran status, or disability.

WAKE FOREST UNIVERSITY
Department of Mathematics and Computer Science

Applications are invited for a tenure-track position in mathematics at the assistant professor level beginning August 1998. Duties include teaching mathematics at the undergraduate and graduate levels and continuing research. A Ph.D. in mathematics is required. Leadership and participation in the departmental major in mathematical economics is also required; this is a joint major with the Department of Economics. Research areas of interest include optimization, control theory, and dynamical systems but other areas of research will be considered. Women and minorities are encouraged to apply. The department has 24 members and offers a B.S. and M.A. in mathematics, a
in mathematics with a strong commitment to mathematics education at the K–12 level and the potential to become an effective teacher are required. We seek an individual who will actively develop relations between the university and the community, will work with the appropriate faculty in the School of Education, and will actively pursue grants to develop workshops for teachers. Responsibilities include teaching, advising, and curriculum development in an undergraduate mathematics education program. The teaching responsibilities are three classes each semester, primarily in the undergraduate mathematics education curriculum and in the undergraduate mathematics curriculum.

The University of Dayton is a private, comprehensive Catholic university founded by the Society of Mary in 1850. It has more than 6,000 undergraduate and 3,000 graduate students. The Department of Mathematics offers B.A. degrees in mathematics and an M.S. degree in applied mathematics. The School of Education offers a B.S. degree in education with certification in elementary and secondary teaching. Moreover, we offer B.A. and B.S. degrees in mathematics with certification in secondary teaching.

The selection process will begin on December 1, 1997, and will continue until the positions are filled. Please send a résumé and three letters of recommendation to the Hiring Committee, Department of Mathematics, University of Dayton, Dayton, Ohio 45469-2316, or to math@udayton.edu. Please include an e-mail address in your correspondence. Further information can be obtained at http://www.udayton.edu/mathdept/. The University of Dayton is an Equal Opportunity Employer. Women, minorities, individuals with disabilities, and Vietnam era veterans are strongly encouraged to apply.

THE OHIO STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics of The Ohio State University expects to have available at least one tenure-track/tenured position and several visiting positions, effective autumn quarter 1998. Candidates in all areas of applied and pure mathematics are invited to apply. Preference will be given to those in applied mathematics for one tenure-track position. The department will also have available a few Hans J. Zassenhaus Assistant Professorships. These term positions are renewable annually up to a total of three years. Significant mathematical research accomplishments or exceptional promise and evidence of excellent teaching ability are required.

Please send a C.V. and at least three letters of recommendation to Professor Ruth Charnley, Interim Chair, Department of Mathematics, The Ohio State University, 231 W. 18th Avenue, Columbus, Ohio 43210.

The Ohio State University is an Equal Opportunity/Affirmative Action Employer. Women and minority candidates are encouraged to apply.

Pennsylvania

Carnegie Mellon University
Department of Mathematical Sciences
Assistant Professorships

The Carnegie Mellon Department of Mathematical Sciences seeks to make two tenure-track appointments at the assistant professor level. These positions will commence in the fall of 1998. One appointment will be made in numerical analysis/computational mathematics, and the second in discrete mathematics and combinatorics. Applicants should send a vita, a list of publications, and a statement describing current and planned research. Candidates should also arrange to have at least three letters of recommendation sent to: Appointments Committee, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

Carnegie Mellon University
Department of Mathematical Sciences
Zeev Nehari Visiting Assistant Professorship

The Zeev Nehari Visiting Assistant Professorship was established to honor the memory of Professor Nehari, who had a long and distinguished career in the Department of Mathematics. This position is available for a period of three years beginning in September 1998 and carries a reduced academic-year teaching load of six hours a week during one semester and three hours a week during the other. Applicants are expected to show exceptional research promise as well as clear evidence of achievement and should have research interests which intersect those of current faculty of the department. Applicants should send a vita, a list of publications, and a statement describing current and planned research. Candidates should also arrange to have at least three letters of recommendation sent to: Zeev Nehari Appointments Committee, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

Carnegie Mellon University
Center for Nonlinear Analysis
Department of Mathematical Sciences

The Center for Nonlinear Analysis expects to make several postdoctoral appointments for 1998–99 in the area of
applied analysis. This is a one-year (twelve-month) joint appointment by the Center and Department of Mathematical Sciences. Recipients will teach at most two courses per year. Applicants should send a vita, a list of publications, a statement describing current and planned research, and at least three letters of recommendation to the committee. The deadline for applications is January 19, 1998. All communications should be addressed to: Postdoctoral Appointments Committee, Department of Mathematical Sciences, Carnegie Mellon University, Pittsburgh, PA 15213. Carnegie Mellon University is an Affirmative Action/Equal Opportunity Employer.

TENNESSEE TECHNOLOGICAL UNIVERSITY
Chairperson, Department of Mathematics

The Department of Mathematics invites applications and nominations for the position of Chairperson. A Ph.D. in a mathematical science (mathematics, applied mathematics, or statistics) is required. Candidates must have at least five years of full-time faculty experience with sufficient academic credentials, including a distinguished record of teaching, scholarly activity, and service, to qualify for appointment as associate or full professor with tenure. A strong commitment to excellence in undergraduate and graduate instruction as well as faculty research and development is essential. Candidates must possess excellent collegial, communication, and interpersonal skills and must be able to interact effectively with the various components of an academic community. Evidence of managerial skills and ability to lead a multidisciplinary mathematics department effectively are required. Administrative experience is desirable.

Duties include administration of a diverse department currently numbering 23 faculty, research, scheduling, long-term strategic planning, refinement of departmental goals, teaching one three-hour course each semester, and service to the academic community.

Cookeville is within an easy drive of Nashville, Knoxville, and Chattanooga and lies along Interstate 40 on the scenic Cumberland Plateau near several state parks and recreational areas. See the University and Cookeville home pages: http://www.tntech.edu/ and http://cookeville. midtenn.net/.

To apply, send a letter of application, curriculum vitae, and graduate transcripts to Dr. Phillip J. Campana, Mathematics Search Committee Chairman, Box 5061, Tennessee Technological University, Cookeville, TN 38505. Also have three letters of recommendation, at least one of which must include an assessment of teaching, sent to the same address. Inquiries may also be sent to Dr. Campana at pj2549@tntech.edu.

Screening will begin January 8, 1998, and will continue until the position is filled. TTU is an Affirmative Action/Equal Opportunity Employer.

TEXAS
BAYLOR UNIVERSITY
Department of Mathematics

The Department of Mathematics invites applications for a tenure-track position at the assistant professor level starting in August 1998. A Ph.D. is required, excellence in teaching is essential, and research/scholarship is expected. While exceptional candidates in all areas of mathematics will be considered, the department especially encourages people in numerical linear algebra, stochastic analysis, analysis, and applied mathematics to apply.

Applicants should provide a curriculum vitae, three letters of reference, transcripts, and a professional statement describing their philosophy about both teaching and research. Completed applications received by January 2, 1998, will be given full consideration.

Baylor is a Baptist university affiliated with the Baptist General Convention of Texas. As an Affirmative Action/Equal Opportunity Employer, Baylor encourages minorities, women, veterans, and persons with disabilities to apply. Send all materials to: Mathematics Search Committee, P. O. Box 97328, Waco, TX 76798-7328; e-mail address: Ed_Oxford@baylor.edu.

RICE UNIVERSITY
Griffith Conrad Evans Instructorships

Postdoctoral appointments for two to three years for promising research mathematicians with research interests in common with the active research areas at Rice, particularly geometric topology, geometric analysis, differential geometry, mathematical physics, and ergodic theory. Duties will include research and classroom teaching. Applications received by December 31, 1997, will receive full consideration. Rice University is an Equal Opportunity/Affirmative Action Employer and strongly encourages applications from women and minority group members. Inquiries and applications should be addressed to Chair, Evans Committee, Department of Mathematics, Rice University, P. O. Box 1892, Houston, TX 77251-1892. Submitting the AMS Application Cover Sheet (available in Notices, EIMS, or on e-MATH) would be greatly appreciated.

UTAH
UNIVERSITY OF UTAH
Department of Mathematics

University of Utah, Department of Mathematics, invites applications for the following positions. Availability of positions is contingent upon funding.

1. At least one full-time tenure-track appointment at the assistant or associate
professorial levels. The department is primarily interested in applicants who work in the research areas represented in the department and who receive their Ph.D. degrees prior to 1997. Selection will be based on research and teaching ability.

2. Several nonrenewable three-year instructorships. Persons of any age receiving their Ph.D. degrees in 1997 or 1998 are eligible. Applicants will be selected on the basis of ability and potential in teaching and research. Starting salary will be $39,000; increases are given annually, but amounts vary from year to year. Teaching duties over the three-year term consist of ten courses (semesters).

3. Two C. R. Wylie Instructorships. The term of this instructorship is one year, but it may be renewed for up to three years. It will be awarded either to an incoming instructor or to one of the instructors already in residence on the basis of ability and potential in teaching and research. The stipend is $43,000. Teaching duties are three courses (semesters) per year.

4. One or more visiting faculty positions of one year or less in any of the professorial ranks, depending upon availability. Selection will be based on potential contribution to the department's research program and on teaching ability.

It is expected that offers of instructorships will begin on January 1, 1998. Applications for all positions will be accepted until January 31, 1998, or until all positions are filled.

Applications for any of these positions should include curriculum vitae, bibliography, and three letters of reference. Instructorship applications should also include an abstract of the thesis and either a list of graduate courses completed or a transcript of graduate work. Visiting faculty applications should indicate the portion of the academic year during which the applicant wishes to visit. Please send your application to the Committee on Staffing, Department of Mathematics, 233 JWB, University of Utah, Salt Lake City, Utah 84112. The University of Utah is an Equal Opportunity/Affirmative Action Employer and encourages applications from women and minorities and provides reasonable accommodation to the known disabilities of applicants and employees.

For further information and a submission form, see http://www.math.utah.edu/jobs/.

WASHINGTON

WESTERN WASHINGTON UNIVERSITY

Tenure-Track Assistant Professor
Mathematics

Begin fall 1998. Candidates with experience in statistics or stochastic processes preferred. Ph.D., refereed publications, and evidence of effective teaching required. Independent and collaborative grant-funded research expected. Commitment to innovative undergraduate instruction essential. Teaching assignments include large lower-division classes. WWU, beside Bellingham Bay between Seattle and Vancouver, has 500 faculty and 12,000 students. Access to excellent recreational opportunities and metropolitan facilities. Get Position Announcement and WWU Summary from http://www.wwu.edu/mathweb/ or address below, and submit summary, vita, transcripts, description of research and teaching accomplishments and interests, and four letters of recommendation addressing both teaching and research by January 16, 1998, to: Search Committee, Math, WWU, Bellingham, WA 98225-9063; fax: 360-650-7788; tel: 360-650-3785; e-mail: mathdept@henson.cc.wwu.edu. No electronic applications. AA/EOE.

CANADA

QUEEN'S UNIVERSITY AT KINGSTON
Mathematics and Engineering

The Department of Mathematics and Statistics will be making a renewable (tenure-track) appointment in mathematics and engineering at the assistant professor level to begin July 1998. Primary needs at present are for candidates specializing in the areas of digital communication and information theory, but other areas will be considered. Membership or eligibility for membership in a Canadian professional engineering association is required. Candidates must have an earned Ph.D. in applied mathematics, electrical engineering, or a closely related field. They are expected to have a strong research record, develop an independent research program, be willing and competent to teach a broad range of applied mathematics and/or statistics courses, and supervise graduate students. Interested candidates should arrange to have a curriculum vitae, a description of teaching and research interests, at least three letters of recommendation, and copies of their three most significant publications arrive at the address below before December 19, 1997. At least one letter should comment on the candidate's teaching.

Professor James A. Mingo
Associate Head
Department of Mathematics and Statistics
Queen's University
Kingston, Ontario, K7L 3N6
fax: 613-542-2964
e-mail: position@maat.queenu.ca
http://www.maat.queenu.ca/

Queen's University is committed to employment equity and welcomes applications from all qualified women and men, including visible minorities, aboriginal people, persons with disabilities, gay men, and lesbians.

UNIVERSITY OF ALBERTA
Department of Mathematical Sciences
Tenure-Track Positions

The Department of Mathematical Sciences at the University of Alberta is recruiting several new faculty members over the next three years with the following positions starting January 1, 1999 (one may commence September 1, 1998, depending on budget approval). All positions are initially considered at the tenure-track assistant professor level with the salary range $39,490-$55,882. We are looking for individuals with very strong proven ability or exceptional demonstrated potential in research, excellent communication skills for teaching, and leadership potential. Successful individuals will be expected to establish vigorous and well-funded research programs. Exceptional individuals wishing to complete prestigious Postdoctoral Awards would be considered for deferred appointment.

Algebra (A-98): Applicants in all areas of algebra are invited to apply for any of the positions, but special consideration will be given to applications in arithmetic/algebraic geometry, representations of groups and algebras, and algebraic number theory.

Analysis of Functional Analysis (A/FA-98): One position will be in the area of analysis, classical or functional (excluding differential equations). For classical analysis we are looking for an outstanding candidate in harmonic analysis (including wavelet analysis), complex analysis, and approximation theory. In functional analysis we are particularly interested in a mathematician working in operator spaces, with an emphasis on Banach space and C*-algebra aspects of the theory; other areas such as abstract harmonic analysis, geometric functional analysis, probabilistic methods in Banach spaces and harmonic analysis will also be considered.

Scientific Computation (SC-98): One position will be for a pure or applied mathematician with a strong commitment to scientific computing whose research combines traditional research tools and computation in sophisticated and novel ways. Willingness and ability to collaborate with business and industrial partners will be an asset. The department has established computational excellence in various applied disciplines, such as fluid and plasma dynamics, mathematics of finance, representations of Lie groups and algebras, and semiconductor simulations, although applications are not limited to those areas. Candidates in computational algebra, geometry, number theory and analysis, and willing to bridge pure, applied, and industrial mathematics are encouraged to apply.

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. If suitable Canadian
citizens and permanent residents cannot be found, other individuals will be considered. Candidates should send a curriculum vitae, including a list of publications, and at least three letters of reference to:

S. D. Riemenschneider, Chair
Department of Mathematical Sciences
University of Alberta
Edmonton, Alberta T6G 2G1
Canada

Early applications are encouraged.

See http://www.math.ualberta.ca/ for information about the department.

Closing date for applications is January 9, 1998.

The University of Alberta is committed to the principle of equity in employment. As an employer we welcome diversity in the workplace and encourage applications from all qualified women and men, including Aboriginal peoples, persons with disabilities, and members of visible minorities.

UNIVERSITY OF TORONTO
Tenure-Stream Appointment in Applied Mathematics

The Department of Mathematics, University of Toronto, solicits applications for a tenure-stream appointment in an mathematician working in the area of applied mathematics (physical science).

The appointment is at the downtown (St. George) campus at the level of assistant professor, to begin July 1, 1998. Candidates are expected to have demonstrated excellence in both teaching and research after the Ph.D.; in particular, a candidate’s research record should show clearly the ability to make significant original and independent contributions to mathematics. Salary commensurate with experience.

Applicants should send their complete C.V., including a list of publications, a short statement describing their research program, and all appropriate material about their teaching. They should also arrange to have at least four letters of reference sent directly to Professor I. M. Sigal, Associate Chair, Department of Mathematics, University of Toronto, Toronto, Canada MS5 3G3. At least one letter should be primarily concerned with the candidate’s teaching. In addition, it is recommended that applicants submit the electronic application form which is available from our World Wide Web Employment Opportunities page: http://www.math.toronto.edu/job/.

To insure full consideration, this information should be received by December 1, 1997.

In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and to permanent residents of Canada. In accordance with its Employment Equity Policy, the University of Toronto encourages applications from qualified women or men, members of visible minorities, aboriginal peoples, and persons with disabilities.

NEW GUINEA
UNIVERSITY OF PAPUA NEW GUINEA

Positions in mathematics, statistics, and computer science. Challenging opportunities in developing nation for creative, adventurous people with Ph.D. Outstanding teaching, excellent English, and practical computer proficiency essential. Three-year contracts. Start January 1998 preferred, later possible. Details from D. Arganbright, Head, Maths, UPNG, P. O. Box 320, University P.O., NCD, Papua New Guinea; e-mail: 100353.163@compuserve.com.

PUBLICATIONS WANTED
MATHEMATICS BOOKS PURCHASED

Pure & appl. adv. & research level, any age, usable cond. Reprints OK. One box to whole libraries sought. Contact: Collier Brown or Kirsten Berg @ Techn. Bks., Portland, OR. Call 800-225-6911, fax 503-228-0505, or e-mail: kirsten@technical.powells.com.
The authors concentrate on the techniques and boundary integral equations. Among the broad spectrum of topics studied in this book are mechanics, genetics, thermal physics, economics and population studies.

**Cambridge Monographs on Applied and Computational Mathematics 4**

1997  c.500 pp.  58351-8 Hardback  $69.95

**Finite Fields and Applications**

Stephen D. Cohen and Harald Niederreiter, Editors

This book gives a state-of-the-art account of finite fields and their applications in communications (coding theory, cryptography), combinatorics, design theory, quasirandom points, algorithms and their complexity. Typically, theory and application are tightly interwoven in the survey articles and original research papers included here.

London Mathematical Society Lecture Note Series 233

1996  421 pp.  56736-X Paperback  $42.95

**Computational Differential Equations**

Volume 1

Kenneth Eriksson, Donald Estep, Peter Hansbo, and Claes Johnson

The book begins by developing the basic issues at an elementary level in the context of a set of model problems in ordinary differential equations. The authors then widen the scope to cover the basic classes of linear partial differential equations modeling elasticity, heat flow, wave propagation and convection-diffusion-absorption problems.

1996  554 pp.  56312-7 Hardback  $100.00  56738-6 Paperback  $44.95

**Modelling with Differential and Difference Equations**

Glenn Fulford, Peter Forrester, and Arthur Jones

The authors concentrate on the techniques used to set up mathematical models and describe many systems in full detail, covering both differential and difference equations in depth. Among the broad spectrum of topics studied in this book are mechanics, genetics, thermal physics, economics and population studies.

Australian Mathematical Society Lecture Series 10

1997  415 pp.  44618-X Paperback  $29.95

**Nonlinear Dynamics, Chaotic and Complex Systems**

E. Infeld, R. Zelazny, and A. Galkowski, Editors

In this book, two dozen scientists and mathematicians who were deeply involved in the "nonlinear revolution" cover most of the basic aspects of the field. The book is divided into five parts: dynamical systems, bifurcation theory and chaos; spatially extended systems; dynamical chaos, quantum physics and the foundations of statistical mechanics; evolutionary and cognitive systems; and complex systems as an interface between the sciences.

1997  349 pp.  58201-6 Hardback  $79.95

**Acta Numerica 1997**

Arieh Iserles, Editor

Acta Numerica surveys annually the most important developments in numerical analysis. This volume includes articles on multivariate integration; numerical analysis of semiconductor devices; fast transforms in applied mathematics; complexity issues in numerical analysis.

1997  c.380 pp.  59106-6 Hardback  $60.00

**Spectral Theory of the Riemann Zeta-Function**

Y. Motohashi

This ground-breaking work combines the classic (the zeta-function) with the modern (the spectral theory) to create a comprehensive but elementary treatment of spectral resolution. The author achieves this by the use of standard tools from analysis rather than any heavy machinery, forging a substantial aid for beginners in spectral theory.

Cambridge Tracts in Mathematics 127

1997  c.250 pp.  44520-5 Hardback  $49.95

**Theories of Computability**

Nicholas Pippenger

Broad in coverage, mathematically sophisticated, and up to date, this book provides an introduction to theories of computability. It treats not only "the" theory of computability (the theory created by Alan Turing and others in the 1930s), but also a variety of other theories (of Boolean functions, automata and formal languages) as theories of computability.

1997  251 pp.  55380-6 Hardback  $44.95

**Fourier Series and Integral Transforms**

Allan Pinkus and Samy Zafrany

The aim of this book is to provide a basic understanding of Fourier series, Fourier transforms, and Laplace transforms. It is an expanded and polished version of the authors’ notes for a one-semester course intended for students of mathematics, electrical engineering, physics and computer science.

1997  197 pp.  59209-7 Hardback  $59.95  59771-4 Paperback  $19.95

**Stable Groups**

F. Wagner

In this book, the general theory of stable groups is developed from the beginning (including a chapter on preliminaries in group theory and model theory), concentrating on the model- and group-theoretic aspects. It brings together the various extensions of the original finite rank theory under a unified perspective and provides a coherent exposition of the current knowledge in the field.

London Mathematical Society Lecture Note Series 240

1997  319 pp.  59839-7 Paperback  $44.95

**Stochastic Flows and Stochastic Differential Equations**

H. Kunita

This book provides a systematic treatment of stochastic differential equations and stochastic flow of diffeomorphisms and describes the properties of stochastic flows. Professor Kunita's approach regards the stochastic differential equation as a dynamical system driven by a random vector field, including K. Itô's classical theory.

Cambridge Studies in Advanced Mathematics 24

1997  350 pp.  59925-3 Paperback  $29.95
The Encyclopaedia of Mathematics

The most up-to-date, authoritative and comprehensive work of reference in Mathematics - now available on CD ROM!

The Encyclopaedia of Mathematics is the most up-to-date, authoritative and comprehensive English-language work of reference in mathematics and is now available on CD-ROM. The CD-ROM edition contains all articles published in the 10-volume set and the first Supplementary volume. All articles are hyperlinked and some animation and 3D objects have been added. Presentation and navigation is managed by Dynatext and an advanced search engine allows for full text search, searching with wildcards, Boolean search, proximity search and structure aware searches. All text can be printed and exported. The CD-ROM is available in two versions: a Network version for PC and Unix platforms, and a Standalone version for PC and Mac platforms only.

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The Korean Journal of Pure and Applied Mathematics is a biannual international journal devoted to publication of high quality research papers in all areas in pure and applied mathematics and welcomes the submission of manuscripts from all parts of the world. The journal is currently soliciting articles in areas related to the research interests of the editorial members.

A printed copy of manuscript and diskette prepared by AMS-TeX or AMS-LaTeX should be submitted to:

S. Hahn
Department of Mathematics
KAIST
Yusong-gu, Taejon
South Korea 305-701

For further information, please contact Dr. S. Hahn:
sghahn@mathx.kaist.ac.kr
Tel 82-42-869-2727
Fax 82-42-869-2710

http://mathnet.kaist.ac.kr/journal
Applications are being accepted for Senior Research Scientist (Mathematical Sciences), U.S. Army Research Office. The annual salary range is $89,165 - $121,265 depending upon individual qualifications and salary history.

The incumbent conducts basic and applied research in the mathematical and computer sciences including nonlinear analysis, computational mathematics, stochastic analysis, discrete mathematics, computational algebra and geometry, intelligent systems, database science, and formal methods of software. Applies extensive knowledge of mathematical, computer trends and computational sciences to a wide range of scientific and technical problems; forecasts technologies; conducts original research and research teams. Provides a critical focus on key DoD issues impacted by research programs that drive the technical community and industry. Serves as an Army spokesperson in the mathematical and computer science community.

Applicants must show evidence of contributions and professional reputation in areas related to the work of the position through citations, patents, and publications which advance knowledge in the field; possess stature in the profession as indicated by memberships and activity in professional and scientific societies, honors, awards, and other recognition and leadership in national and international scientific communities; and possess the ability to establish and maintain effective working relationships with key management and scientific personnel and advise and consult on scientific and technological programs. Applicants must have a Ph.D. in mathematics, physics, computer engineering, electrical engineering, or equivalent doctoral degree related to the work of the position or an equivalent combination of education and experience (i.e., extensive publication in open literature and peer recognition as a researcher), and three years of professional experience.

Applicants must be U.S. citizens, be able to obtain a top secret clearance, and comply with provisions of the Ethics in Government Act.

Interested individuals may obtain a complete application package by calling Ms. Tammy Higgins, (703) 617-9415 or by writing to Commander, U.S. Army Material Command, ATTN: AMCPE-CS, 5001 Eisenhower Ave., Alexandria, VA 22333-6001. Applications must be postmarked by December 1, 1997.

THE DEPARTMENT OF THE ARMY IS AN EQUAL OPPORTUNITY EMPLOYER

INSTITUTE FOR MATHEMATICS AND ITS APPLICATIONS ANNOUNCES A PROGRAM ON MATHEMATICS IN BIOLOGY 1998-99

ORGANIZING COMMITTEE: Lisa Fauci, Simon A. Levin, James D. Murray, Alan Perelson (Chair), Michael J. Reed

A one-year program with three parts:

Fall: September - December 1998, THEORETICAL PROBLEMS IN DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY
Winter: January - March 1999, MATHEMATICAL PROBLEMS IN PHYSIOLOGY
Spring: April - June 1999, DYNAMIC MODELS OF ECOSYSTEMS AND EPIDEMICS

TWO-YEAR POSTDOCTORAL MEMBERSHIPS
THE 1999-2000 ANNUAL PROGRAM WILL BE:
REACTIVE FLOW AND TRANSPORT PHENOMENA

During the 1999-2000 year, postdocs will have a 50% teaching assignment in the School of Mathematics at the University of Minnesota.

All requirements for a doctorate should be completed by September 1, 1998. Applicants must show evidence of mathematical excellence, but they do not need to be specialists in the field. The following materials must be submitted (all materials should arrive by January 15, 1998):

1. Personal statement of scientific interests, research plans, and reasons for wishing to participate in the Mathematics In Biology Program.
2. Curriculum vitae and a list of publications.
3. Three letters of recommendation, to be sent directly to the IMA.

SENIOR MEMBERSHIPS
Preference will be given to supplementary support for persons with sabbatical leaves, fellowships, or other stipends.

*****************************************************************************

POSTDOCTORATES IN INDUSTRIAL MATHEMATICS

IMA announces two-year positions in Industrial Mathematics, effective September 1, 1998. These appointments are in addition to the regular program and are funded jointly by the NSF and participating industries. They are designed to prepare mathematicians for research careers involving industrial interaction. Applicants should have fulfilled all requirements for a Ph.D. in Mathematics, Applied Mathematics or Statistics by September 1, 1998. Postdoctorates will spend 50% effort working with industrial scientists and 50% effort in the regular IMA program. Requirements and application procedures are the same as for the postdoctoral memberships listed above.

The University of Minnesota is an equal opportunity educator and employer.

The application forms are available via staff@ima.umn.edu, gopher.ima.edu, http://www.ima.umn.edu or call (612) 624-6066. All correspondence should be sent to either POSTDOC/VISITING MEMBERSHIP COMMITTEE or INDUSTRIAL MATHEMATICS POSTDOCTORATE MEMBERSHIP COMMITTEE

Institute for Mathematics and its Applications
University of Minnesota
514 Vincent Hall
206 Church St. S.E.
Minneapolis, MN 55455-0436
Please read the "Membership Categories" section of this form to determine the membership category for which you are eligible. Then fill out this application and return it as soon as possible.

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If formerly a member of AMS, please indicate dates.

Check here if you are now a member of either MAA □ or SIAM □

Degrees, with institutions and dates

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Primary Fields of Interest (choose five from the list at right)

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Secondary Fields of Interest (choose from the list at right)

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Address for all mail


Telephone number(s)


Electronic address


Signature

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To use credit cards, fill in information requested and mail to American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248 or call (401) 455-4000 or 1-800-321-4AMS.

For Foreign Bank Transfers: American Mathematical Society, State Street Bank and Trust Company, 225 Franklin St., ABA #011000028, Account #0128-262-3, Boston, MA 02110.

American Express □ Discover □ VISA □ MasterCard □

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Application for Membership 1998

(January–December)

Date 19

Fields of Interest

If you wish to be on the mailing lists to receive information about publications in fields of mathematics in which you have an interest, please consult the list of major headings below. These categories will be added to your computer record so that you will be informed of new publications or special sales in the fields you have indicated.

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American Mathematical Society

(1956–1998)
Membership Categories

Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

For ordinary members whose annual professional income is below $45,000, the dues are $96; for those whose annual professional income is $45,000 or more, the dues are $128.

The CMS cooperative rate applies to ordinary members of the AMS who are also members of the Canadian Mathematical Society and reside outside of the U.S. For members whose annual professional income is $45,000 or less, the dues are $82; for those whose annual professional income is above $45,000, the dues are $109.

For a joint family membership, one member pays ordinary dues, based on his or her income; the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the Notices and the Bulletin as a privilege of membership, but both members will be accorded all other privileges of membership.)

Minimum dues for contributing members are $192. The amount paid which exceeds the higher ordinary dues level and is purely voluntary may be treated as a charitable contribution.

For either students or unemployed individuals, dues are $32, and annual verification is required.

The annual dues for reciprocity members who reside outside the U.S. and Canada are $64. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement, and annual verification is required. Reciprocity members who reside in the U.S. or Canada must pay ordinary member dues ($96 or $128).

The annual dues for category-S members, those who reside in developing countries, are $16. Members can choose only one privilege journal. Please indicate your choice below.

Members can purchase a multi-year membership by prepaying their current dues rate for either two, three, four, or five years. This option is not available to category-S, unemployed, or student members.

1998 Dues Schedule (January through December)

Ordinary member .................................................. $96 $128

CMS cooperative rate ............................................. $82 $109

Joint family member (full rate) .................................. $96 $128

Joint family member (reduced rate) .............................. $76 $108

Contributing member (minimum $192) ......................... $192

Student member (please verify)\(^1\) ........................... $32

Unemployed member (please verify)\(^2\) ....................... $32

Reciprocity member (please verify)\(^3\) ........................ $64 $96 $128

Category-S member\(^4\) ........................................... $16

Multi-year membership ............................................ $ for ....... years

\(^1\) Student Verification (sign below)

I am a full-time student at ........................................ currently working toward a degree.

\(^2\) Unemployed Verification (sign below) I am currently unemployed and actively seeking employment.

\(^3\) Reciprocity Membership Verification (sign below) I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.

\(^4\) send NOTICES  send BULLETIN

Signature

Reciprocating Societies

- Allahabad Mathematical Society
- Australian Mathematical Society
- Azerbaijan Mathematical Society
- Berliner Mathematische Gesellschaft e.V.
- Calcutta Mathematical Society
- Croatian Mathematical Society
- Cyprus Mathematical Society
- Dansk Matematisk Forening
- Deutsche Mathematiker-Vereinigung e.V.
- Edinburgh Mathematical Society
- Egyptian Mathematical Society
- Gesellschaft für Angewandte Mathematik und Mechanik
- Glasgow Mathematical Association
- Hellenic Mathematical Society
- Icelandic Mathematical Society
- Indian Mathematical Society
- Iranian Mathematical Society
- Irish Mathematical Society
- Israel Mathematical Union
- János Bolyai Mathematical Society
- The Korean Mathematical Society
- London Mathematical Society
- Malaysian Mathematical Society
- Mathematical Society of Japan
- Mathematical Society of the Philippines
- Mathematical Society of the Republic of China
- Mongolian Mathematical Society
- Nepal Mathematical Society
- New Zealand Mathematical Society
- Nigerian Mathematical Society
- Norsk Matematisk Forening
- Österreichische Mathematische Gesellschaft
- Palestine Society for Mathematical Sciences
- Polskie Towarzystwo Matematyczne
- Punjabi Mathematical Society
- Ramanujan Mathematical Society
- Real Sociedad Matemática Española
- Saudi Association for Mathematical Sciences
- Sociedad Colombiana de Matemáticas
- Sociedad de Matemática de Chile
- Sociedad Matemática de la República Dominicana
- Sociedad Matemática Mexicana
- Sociedad Uruguaya de Matemática y Estadística
- Sociedade Brasileira de Matemática
- Sociedade Brasileira de Matemática Aplicada e Computacional
- Societatea Paranaense de Matematică
- Sociedade Portuguesa de Matemática
- Societat Catalana de Matemàtiques
- Societatea de Științe Matematice din România
- Societatea Matematicianilor din România
- Société de Mathématiques Appliquées et Industrielles
- Société Mathématique de Belgique
- Société Mathématique de France
- Société Mathématique Suisse
- Society of Associations of Mathematicians & Computer Science of Macedonia
- Society of Mathematicians, Physicists, and Astronomers of Slovenia
- South African Mathematical Society
- Southeast Asian Mathematical Society
- Suomen Matematiikan Yhdistys
- Svenska Matematikersamfundet
- Union Mathematica Argentina
- Union of Bulgarian Mathematicians
- Union of Czech Mathematicians and Physicists
- Union of Slovak Mathematicians and Physicists
- Unione Matematica Italiana
- Vijnana Parishad of India
- Wiskundig Genootschap
Volume 3, 1997

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First Announcement
The Organizing Committee is pleased to announce that the next International Congress of Mathematicians will take place in Berlin, Germany, from Tuesday, August 18, through Thursday, August 27, 1998. It will be held under the auspices of the International Mathematical Union (IMU) and sponsored by many other institutions.

Mathematical Program
Responsibility for the scientific program lies with the Program Committee appointed by IMU. There will be about twenty one-hour Plenary Lectures covering recent developments in the major areas of mathematics and about 170 forty-five-minute Invited Lectures in nineteen sections. The sections are as follows:
1. Logic
2. Algebra
3. Number Theory and Arithmetic Algebraic Geometry
4. Algebraic Geometry
5. Differential Geometry and Global Analysis
6. Topology
7. Lie Groups and Lie Algebras
8. Analysis
9. Ordinary Differential Equations and Dynamical Systems
10. Partial Differential Equations
11. Mathematical Physics
12. Probability and Statistics
13. Combinatorics
14. Mathematical Aspects of Computer Science
15. Numerical Analysis and Scientific Computing
16. Applications
17. Control Theory and Optimization
18. Teaching and Popularization of Mathematics
19. History of Mathematics

Every registered participant (traditionally called Ordinary Member) of the Congress will have the opportunity to give a short presentation, either during a poster session or in the form of a fifteen-minute lecture. A formal call for such presentations will be issued in the Second Announcement. Informal mathematical seminars may be organized at the initiative of groups of participants. English, French, German, and Russian are the official languages of the Congress.

All Plenary and Invited Lectures will be published in the Proceedings of ICM’98; after the Congress, a complimentary copy of these Proceedings will be sent to each Ordinary Member. Abstracts of all lectures and of all short presentations will be distributed free of charge to Ordinary Members at Congress check-in.

The Fields Medals and the Nevanlinna Prize will be awarded during the Opening Ceremony on the first day of the Congress. This will take place in the International Congress Center Berlin (ICC); all other scientific events will be held at Technische Universität Berlin. No scientific activities are scheduled for Sunday, August 23.

In an effort to reach out to a wider audience, the ICM’98 organizers have initiated several cultural activities related to mathematics that are attractive to the general public. In particular, there will be a VideoMath Festival, software demonstrations, talks about mathematics and its relations to other subjects, several exhibitions (Mathematics in the Arts, etc.), and other events (Mathematics and Music, etc.).
Special consideration will be given to the impact of the Nazi regime on mathematics in Berlin and Germany.

Social Events
On August 18, a buffet-banquet for all registered participants will be held at noon directly after the Opening Ceremony in the ICC. During the Congress, a number of guided tours of Berlin, visits to museums, and walking tours will be offered. On Sunday, August 23, it will be possible to choose from several excursions. For that evening, tickets have been reserved for the opera *The Magic Flute* at the Deutsche Oper. Registered participants may purchase tickets in advance for these events as well as for many day trips and pre- or post-congress tours to places of interest in the vicinity of Berlin.

Organization
Up-to-date information about all aspects of ICM'98 is available on the following Website: http://elib.zib.de/ICM98/. This includes information about registration, abstract submission, etc. Correspondence should be directed to icm98@zib.de. It will be forwarded to an appropriate member of the Organizing Committee. If electronic communication is not available, you may also write to ICM'98, c/o Prof. Dr. J. Winkler, TU Berlin, MA 8-2, Straße des 17. Juni 135, D-10623 Berlin, Germany; Fax: +49/30/314-21604.

Registration and Accommodation
DER-Congress, a professional congress and tour organizer, has been appointed by the Organizing Committee to handle all nonscientific matters for individual participants: registration to the Congress and the social events, hotel reservation, tourist program, collection of registration fees, etc. The formal registration procedure for the Congress will be described in the Second Announcement (see below).

Participants will be housed in a variety of hotels in Berlin; the necessary reservations have already been made by DER-Congress. In addition, DER-Congress will make student residences available and will provide a certain amount of private accommodation at a cheap rate for participants willing to accept less comfort. Detailed information on locations and rates will be provided in the Second Announcement.

Forms for registration and accommodation requests will be made available on the ICM'98 server in January 1998.

Second Announcement
The Second Announcement of ICM'98 will describe the activities of the Congress in more detail and give instructions on how to complete the registration process and obtain accommodation. It will provide more, although not complete, information on the scientific program, contain a call for contributed short presentations, and give instructions regarding the submission of abstracts.

The Second Announcement will also include advice on how to proceed upon arrival at airports and train stations, and it will be accompanied by a brochure describing the day trips and tours organized by DER-Congress.

Several conferences of a more specialized nature are scheduled immediately before or after ICM'98. The Second Announcement will also contain a list of such "satellite conferences".

To receive the Second Announcement, fill out the form on the ICM'98 server (http://elib.zib.de/ICM98/). Alternatively, send an empty e-mail to icm98@zib.de with Second Announcement in the SUBJECT line to receive an e-mail form. If this is not possible for you, please fill out the form below and send it to the ICM'98 Secretary Prof. Winkler (see address above).

The Second Announcement will be mailed from Berlin at the beginning of 1998.

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I would like to receive the Second Announcement of ICM'98. Please print.

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NOVEMBER 1997 NOTICES OF THE AMS 1393
The Canadian Mathematical Society and the University of Victoria cordially invite researchers, educators and students to the 1997 Winter Meeting of the Canadian Mathematical Society. The scientific programme will take place at the Victoria Conference Centre, 720 Douglas Street, Victoria, British Columbia, from Sunday, December 14, to Tuesday, December 16, 1997.

**Plenary Speakers:** A. Chang (UCLA), Paul Goerss (Washington), Neal Koblitz (Washington), P. Littelmann (Louis Pasteur, Strasbourg, France), Ian Putnam (Victoria).

**Symposia and Preliminary List of Speakers:**

- Joint CMS-Fields Institute Session on Homotopy Theory (Org: Eddy Campbell, Queen’s University; Paul Goerss (Washington)—plenary, Ethan Devinatz (Washington), Stephen Mitchell (Washington), Boris Botvinnik (Oregon), Hal Sadosky (Oregon), Ralph Cohen (Stanford), Gunnar Carlsson (Stanford), Rick Jardine (Western), Stan Kochman (York), Stephen Theriault (Toronto).
- Lie Theory (Org: Arturo Pianzola, University of Alberta); P. Littelmann (Louis Pasteur, France)—plenary, S. Donkin (Queen Mary College, London), R.V. Moody (Alberta), B. Allison (Alberta), M. Racine (Ottawa), Y. Billig (New Brunswick).
- Joint CMS-Fields Institute Session on Partial Differential Equations (Org: Nassif Ghoussooub, University of British Columbia); A. Chang (UCLA)—plenary, S. Alama (McMaster), N. Alkikos (Tennessee), W. Allegretto (Alberta), P. Bates (BYU), J. Chen (MIT), X. Chen (Pittsburgh), L. Evans (Berkeley), G. Fang (UBC), J. Feldman (UBC), R. Froese (UBC), N. Ghoussooub (UBC), C. Gui (UBC), R. Illner (Victoria), F.H. Lin (Chicago), K. Promislow (SFU), I. Sigal (Toronto), C. Sulem (Toronto), H. Tehani (Nevada-Las Vegas / UBC), P. Yang (USC), J. Xin (Arizona), M. Zhu (UBC).
- Joint CMS-Fields Institute Session on Operator Algebras and Applications (Org: George Elliott, University of Toronto); I. Putnam (Victoria)—plenary, B. Blackadar (Nevada-Reno)—plenary, E. Blanchard (Marseilles), M. Dadarlat (Purdue), S. Eilers (Copenhagen), T. Giordano (Ottawa), G. Gong (Puerto Rico), D. Handelman (Ottawa), E. Kirchberg (Humboldt, Berlin), A. Kumjian (Reno), L. Li (Puerto Rico), H. Lin (Oregon), Q. Lin (Victoria), T. Loring (New Mexico), C. Pasnicu (Puerto Rico), N. Phillips (Oregon), M. Roerdam (Odense, Denmark), K. Thomsen (Aarhus, Denmark), J. Villadsen (The Fields Institute), S. Walters (UNBC), S. Wassermann (Glascow).

**Education** (Org: Malgorzata Dubiel, Simon Fraser University and Mike Fellows, University of Victoria); N. Koblitz (Washington-Seattle)—plenary.

**Dynamical Systems and Applications** (Org: Jacques Belair, CRM Florin Diacu and Pauline Van den Driessche, University of Victoria); Edoh Amiran (Western Washington University), Jacques Belair (Montreal), Sun Ann Campbell (Waterloo), Florin Diacu (Victoria), Leah Keeshet (UBC), William Langford (Guelph/Fields Institute), Dana Schlimmik (Montreal), Gail Wolkowicz (McMaster), Hungfu Zou (Victoria).

**Prize and Public Lectures:** The Coxeter-James Lecture will be given by Michael Ward, University of British Columbia. The first CMS Doctoral Prize will be awarded to Jim Geelen, University of Waterloo. Maria Elowe, Computer Science, University of British Columbia, will deliver a public lecture on Monday, December 15.

**Contributed Papers:** Contributed papers of 15 minutes duration are invited and graduate students are particularly urged to participate. For an abstract to be eligible, the abstract must be received before October 15, 1997. The abstract must be accompanied by its contributor's registration form and appropriate fees.

**Graduate Student Seminar:** A special session is being organized for graduate students. Anyone interested in participating in the organization of this programme should contact the Meeting Director at the following address: md-w97 @cms.math.ca.

**Submission of Abstracts:** The CMS publishes abstracts for all scheduled talks. Abstracts for Plenary Speakers, Prize Lecturers and Invited Special Session Speakers for the scientific and education programme will appear in the November issue of the CMS Notes. Abstracts for Contributed Papers will appear in the December issue of the CMS Notes. All abstracts will also be available on the Canadian Mathematical Electronics Services (CanMS).

**Plenary Speakers, Prize Lecturers, and Invited Special Sessions for the scientific and education programme:** These speakers are asked to submit their abstracts to the CMS as instructed by their organizers. Abstracts may be sent electronically, following instructions given below. Abstracts may also be prepared on the standard CMS form available from the session organizer or the CMS office in Ottawa. Abstracts should be sent to the Abstracts Coordinator, CMS Executive Office.
Contributed Papers: Those submitting contributed papers may submit their abstracts electronically, following instructions given below, or by using the standard CMS form available from the CMS office in Ottawa or in the September issue of the CMS Notes. Abstracts should be sent to the Abstracts Coordinator, CMS Executive Office, 577 King Edward, P.O. Box 450, Station A, Ottawa, Ontario CANADA K1N 6N5, so as to arrive by the contributed papers deadline of October 15, 1997.

Electronic submission of abstracts: This service is available only to those who use the TeX typesetting system. Files should include the speaker's name, affiliation, complete address, title of talk, and the abstract itself. Files may be sent by e-mail to the Abstracts Coordinator at: abstracts@cms.math.ca. Please note the appropriate deadline given above for the submission of your abstract. Please note that we cannot accept abstracts sent by fax.

Social Events: Social events include a cash-bar reception scheduled for Saturday evening from 7:00–9:00 p.m., during evening registration in the Plaza area of the Victoria Conference Centre. The CMS banquet will be held in the Crystal Ballroom, Empress Hotel, on Sunday, December 14, 1997 at 6:30 p.m. A cash bar will precede the event at 6:30 p.m. in the Palm Court area of the Empress Hotel. Banquet tickets are available at $50 each.

Registration: Forms are available from the CMS Executive Office, 577 King Edward, Suite 109, PO Box 450, Station A, Ottawa, Ontario, CANADA K1N 6N5; tel: 613-562-5702; fax: 613-565-1339; e-mail: meetings@cms.math.ca. Payment may be made by cheque, or by VISA or MasterCard. Although registration fees are given in Canadian dollars, delegates may send cheques in U.S. dollars by contacting their financial institution for the current exchange rate. Speakers should contact their organizers for special speaker rates. Electronic pre-registration is available on our Camel site at http://camel.math.ca/Events/winter-97. This site also has the latest information on the meetings.

Before | After
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Oct 15 | Oct 15

CMS/AMS/MAA members with grants | $295 | $380
CMS/AMS/MAA members without grants | 150 | 190
Non-members with grants | 440 | 575
Non-members without grants | 220 | 285
One-day fee | 150 | 190
Teachers/students/postdocs/retired/unemployed | 110 | 145
Sunday night Banquet | 50 | 50

Accommodations: It is recommended that those attending the conference book early to avoid disappointment. Blocks of rooms have been reserved at three different facilities and will be held until the dates given below. Reservations not in by that date will be on a request only, space available basis. Attendees should make their own reservations. Please mention that you are participating in the CMS Winter Meeting. Reservations will be held until 6:00 p.m. on the arrival day only, unless guaranteed by a major credit card. The conference rate is extended up to two days pre- and post-convention.

The Empress Hotel
720 Douglas Street
Victoria, British Columbia CANADA V9W 1W5
Check-in: 4:00 pm, Check-out: 12:00 noon
Reservation Deadline: November 12, 1997
Rate: $380.00 single/double occupancy
Applicable taxes: 7% GST + 10% room tax
Phone: (250) 384-8111
Reservations Fax: (250) 381-4334
Toll-free reservations: 1-800-441-1414

Executive House Hotel
777 Douglas Street
Victoria, British Columbia CANADA V8W 2B5
Check-in: 3:00 pm, Check-out: 12:00 noon
Reservation Deadline: November 12, 1997
Rate: $70.00 single/double occupancy–Superior Rooms
$85.00 single/double occupancy–Deluxe one bedroom suites
Applicable taxes: 7% GST + 10% room tax
Phone: (250) 388-5111 Fax: (250) 385-1323
Toll-free reservations: 1-800-663-7001

Renouf House
2010 Stanley Avenue
Victoria, British Columbia CANADA V8R 3X6
Check-in: 2:00–4:00 pm, Check-out: 11:00 am
Reservation Deadline: November 13, 1997
Rate: $197.75/person–Bunk & Breakfast (four people per room)
$33.25 single; $50.00 double–private room (shared bath)
Applicable taxes: 7% GST (on private rooms only)
Phone: (250) 595-4774 Fax: (250) 598-1515
Net: http://www.islandnet.com/~renouf

Child care is available at the YM-YWCA, located at 880 Courtney Street, Victoria, B.C. Also, guests of the Empress Hotel and Executive House are invited to contact the front desk to arrange child care.

Travel: Victoria is located on the southern tip of Vancouver Island. Several airlines connect with national and international flights in Vancouver, Calgary, and Seattle. There is also regularly scheduled float-plane service between Victoria, Seattle, and Vancouver and helijet service between Victoria harbour and Vancouver harbour and airport. A cruise aboard the BC or Washington State ferries or Victoria Clipper is certainly something to remember. Grayline of Seattle offers seasonal connections between Victoria and Seattle/Anacortes. Pacific Coach Lines connects Victoria to downtown Vancouver and Vancouver International Airport via BC Ferries.

Acknowledgements: The Programme Committee wishes to extend its thanks to the CRM, The Fields Institute, Plms., and the members of the Mathematics and Statistics Department at the University of Victoria, for its support.

Programme Committee: Meeting Director and Local Arrangements Committee Chair: David Leeming (Victoria); Homotopy Theory: Eddy Campbell (Queen's University); Education: Malgorzata Dubiel (Simon Fraser University) and Mike Fellows (University of Victoria); The Structure and Classification of Amenable C*-Algebras: George Elliott (University of Toronto); Partial Differential Equations: Nassif Ghoussoub (University of British Columbia); Lie Theory: Arturo Pianzola (University of Alberta); Dynamical Systems and Applications: Jacques Bélair (CRM), Florin Diacu and Pauline van den Driessche (Victoria); Other members: Monique Bouchard (CMS)—Ex-officio, Bill Pfaffenberger (Victoria), John Phillips (Victoria), G.P. Wright (CMS)—Ex-officio.

577 King Edward, P.O. Box 450, Station A, Ottawa, Ontario CANADA K1N 6N5, so as to arrive by the invited speaker deadline of September 15, 1997.
Meetings & Conferences of the AMS

The most comprehensive and up-to-date information on AMS meetings and conferences is available on e-MATH at http://www.ams.org/meetings/.

Albuquerque, New Mexico

University of New Mexico
November 8–9, 1997

Meeting #928
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: September 1997
Program issue of Notices: November 1997
Issue of Abstracts: Volume 18, Issue 4

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Registration and Meeting Information
Registration will take place in the DoubleTree Hotel from 7:30 a.m. to noon and 1:30 p.m. to 4:00 p.m. on Saturday, November 8; and 9:00 a.m. to noon on Sunday, November 9. Registration fees are payable on-site only: $30/AMS member, $45/nonmember, and $10/emeritus member, students, or unemployed mathematical scientists. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express credit cards. Lectures will take place in meeting rooms in the Albuquerque Convention Center, adjacent to the DoubleTree Hotel.

Oaxaca, Mexico

Oaxaca, Mexico
December 3–6, 1997

Meeting #929
Third joint Meeting of the American Mathematical Society and the Sociedad Mathematica Mexicana.
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: September 1997
Program issue of Notices: December 1997
Issue of Abstracts: To be announced
Baltimore, Maryland

Baltimore Convention Center

January 7-10, 1998

Meeting #930

Joint Mathematics Meetings, including the 104th Annual Meeting of the AMS, 81st Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL). Associate secretary: Robert J. Daverman

Announcement issue of Notices: October 1997

Program issue of Notices: January 1998

Issue of Abstracts: Volume 19, Issue 1

Deadlines

All deadlines have expired.

Program Updates:

MAA Short Course

This Short Course on Introduction to Mathematical Imaging and Image Processing is organized by Akram Aldroubi, National Institutes of Health, and Dennis Healy, DARPA. This course will provide a general overview of the exciting challenges and opportunities encountered in modern imaging and image processing as well as some indication of the variety of sophisticated mathematical techniques currently being applied to these problems. Advance registration fees are $50 student, $125 MAA member/meeting participant, and $175 nonmember/meeting nonparticipant. (On-site fees are $60, $140, and $190 respectively.) Contact Jane Heckler (jheckler@maa.org) for registration and other information.

Activities of Other Organizations

Joint Policy Board for Mathematics (JPBM)

Mathematics Awareness Week (MAW) 1998 Panel Discussion, Wednesday, 2:15 p.m. to 3:45 p.m.

Writing Mathematics Books for the Popular Market, Thursday, 2:15 p.m. to 3:45 p.m., panel organized by Keith J. Devlin, St. Mary's College of California. Panelists: K. C. Cole, Los Angeles Times; Keith J. Devlin; William W. Dunham, Muhlenberg College; Ivars Peterson, Science News; and moderator Donald J. Albers, MAA.

Social Events

Robert S. Doran, organizer for the AMS Special Session Representation Theory and Noncommutative Harmonic Analysis: A Special Session Honoring the Memory of Harish-Chandra, and Becky Herb are co-organizing a dinner on Friday night in honor of Paul Sally's 65th birthday. Session speakers and participants, friends, and colleagues are invited to attend. Tickets are $35 and include wine served with the meal. Checks should be sent and made payable...
Meetings & Conferences

Abigail Thompson, University of California, Santa Barbara, and Beata Randrianantoanina, Miami University, Ohio.

Wachs, Applied Probability and Actuarial Science

Banach Space Theory

Bogdan Gapinski, Ewa M. Kubicka, Krzysztof Ostraszewski, and Grzegorz Rempala, University of Louisville.

Banach Space Theory (Code: AMS SS F1), Patrick N. Dowling and Beata Randrianantoanina, Miami University, Ohio.

Boundary Value Problems for Differential Equations (Code: AMS SS J1), Paul W. Eloe, University of Dayton.

Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.

Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kezdy, Grzegorz Kubicki, and Jenoe Lehel, University of Louisville.

Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.

Fractal Geometry and Related Topics (Code: AMS SS D1), Ka-Sing Lau, University of Pittsburgh, and Weibin Zeng, University of Louisville.

Functional Equations and Inequalities (Code: AMS SS E1), Thomas Riedel and Prasanna Sahoo, University of Louisville.

Geometry of Affine Space (Code: AMS SS M1), Gene Freudenburg, University of Southern Indiana, and David Wright, Washington University.

Low-Dimensional Topology (Code: AMS SS R1), Martin Scharlemann, University of California, Santa Barbara, and Abigail A. Thompson, University of California, Davis.

Modern Function Theory (Code: AMS SS Q1), David A. Herron and David Mindia, University of Cincinnati.

Real Analysis (Code: AMS SS G1), Udayan B. Darji and Lee Larson, University of Louisville.

Semigroups, Algorithms, and Universal Algebra (Code: AMS SS H1), Ralph N. McKenzie, Vanderbilt University, and Steven Seif, University of Louisville.

Spectral Geometry (Code: AMS SS K1), Ruth Gornet, Texas Tech University, and Peter Anton Perry, University of Kentucky.

Spectral Theory, Mathematical Physics and Disordered Media (Code: AMS SS L1), Peter David Hislop, University of Kentucky, and Gunter H. Stolz, University of Alabama at Birmingham.

The Use of the History of Mathematics and Science in the University and School Classroom (Code: AMS SS N1), Richard M. Davitt, University of Louisville.

Louisville, Kentucky

University of Louisville

March 20-21, 1998

Meeting #931

Southeastern Section

Associate secretary: Robert J. Daverman

Announcement issue of Notices: January 1998

Program issue of Notices: May 1998

Issue of Abstracts: Volume 19, Issue 2

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: December 3, 1997

For abstracts: January 28, 1998

Invited Addresses

Anders Bjorner, Royal Institute of Technology, Stockholm, Sweden, Title to be announced.

Andrew Bruckner, University of California at Santa Barbara, Title to be announced.

Philippe DiFrancesco, University of North Carolina at Chapel Hill, Title to be announced.

Abigail Thompson, University of California at Davis, Title to be announced.

Special Sessions

Algebraic Combinatorics (Code: AMS SS N1), Anders Bjorner, Royal Institute of Technology, and Michelle L. Wachs, University of Miami.

Applied Probability and Actuarial Science (Code: AMS SS P1), Bogdan Gapinski, Ewa M. Kubicka, Krzysztof Ostraszewski, and Grzegorz Rempala, University of Louisville.

Banach Space Theory (Code: AMS SS F1), Patrick N. Dowling and Beata Randrianantoanina, Miami University, Ohio.

Boundary Value Problems for Differential Equations (Code: AMS SS J1), Paul W. Eloe, University of Dayton.

Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.

Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kezdy, Grzegorz Kubicki, and Jenoe Lehel, University of Louisville.

Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.

Fractal Geometry and Related Topics (Code: AMS SS D1), Ka-Sing Lau, University of Pittsburgh, and Weibin Zeng, University of Louisville.

Functional Equations and Inequalities (Code: AMS SS E1), Thomas Riedel and Prasanna Sahoo, University of Louisville.

Geometry of Affine Space (Code: AMS SS M1), Gene Freudenburg, University of Southern Indiana, and David Wright, Washington University.

Low-Dimensional Topology (Code: AMS SS R1), Martin Scharlemann, University of California, Santa Barbara, and Abigail A. Thompson, University of California, Davis.

Modern Function Theory (Code: AMS SS Q1), David A. Herron and David Mindia, University of Cincinnati.

Real Analysis (Code: AMS SS G1), Udayan B. Darji and Lee Larson, University of Louisville.

Semigroups, Algorithms, and Universal Algebra (Code: AMS SS H1), Ralph N. McKenzie, Vanderbilt University, and Steven Seif, University of Louisville.

Spectral Geometry (Code: AMS SS K1), Ruth Gornet, Texas Tech University, and Peter Anton Perry, University of Kentucky.

Spectral Theory, Mathematical Physics and Disordered Media (Code: AMS SS L1), Peter David Hislop, University of Kentucky, and Gunter H. Stolz, University of Alabama at Birmingham.

The Use of the History of Mathematics and Science in the University and School Classroom (Code: AMS SS N1), Richard M. Davitt, University of Louisville.

Manhattan, Kansas

Kansas State University

March 27-28, 1998

Meeting #932

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: January 1998

Program issue of Notices: June 1998

Issue of Abstracts: Volume 19, Issue 2
Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: December 10, 1997
For abstracts: February 2, 1998

Invited Addresses
Gopal Prasad, University of Michigan - Ann Arbor, Title to be announced.
Mikhail Vishik, University of Texas at Austin, Title to be announced.
Clarence Eugene Wayne, Pennsylvania State University, University Park, Title to be announced.
Zihong Jeff Xia, Northwestern University, Title to be announced.

Special Sessions
Abstract Harmonic Analysis (Code: AMS SS H1), Sadahiro Saeki, Kansas State University.
Cohomology of Finite Groups (Code: AMS SS F1), John S. Maginnis, Kansas State University, and Stephen F. Siegel, University of Massachusetts.
Dynamical Systems (Code: AMS SS N1), Amie Wilkinson and Zihong Jeff Xia, Northwestern University.
Groups and Geometry (Code: AMS SS I1), Ernest E. Shult, Kansas State University.
Integrable Systems and Their Applications (Code: AMS SS M1), Kirill L. Vaninsky, Kansas State University.
Lie Groups, Algebraic Groups, Their Arithmetic and Representation Theory (Code: AMS SS O1), Gopal Prasad, University of Michigan - Ann Arbor.
Linear Operators and Holomorphic Function Spaces (Code: AMS SS G1), V. V. Peller, Kansas State University.
Mathematics Education and the Internet (Code: AMS SS C1), Andrew G. Bennett, Kansas State University.
Nonlinear Problems (Code: AMS SS D1), Lev Kapitanski, Kansas State University, and Clarence Eugene Wayne, Pennsylvania State University.
Numerical Analysis and Computational Mathematics (Code: AMS SS L1), Huanan Yang and Qisu Zou, Kansas State University.
Pictorial Methods in Low Dimensional Topology (Code: AMS SS B1), David R. Auckly, University of California, Berkeley.
Quantum Groups and Applications (Code: AMS SS J1), Volodymyr V. Lyubashenko and Ya S. Soibelman, Kansas State University.
Quantum Topology (Code: AMS SS K1), Louis Crane and David N. Yetter, Kansas State University.
Recent Progress in Elementary Geometry (Code: AMS SS P1), Clark Kimberling, University of Evansville, and John E. Wetzel, University of Illinois at Urbana-Champaign.
Representation Theory of Lie Algebras, Algebraic Groups and Quantum Groups (Code: AMS SS E1), Zongzhu Lin, Kansas State University, and Daniel Ken Nakano, Utah State University.

Philadelphia, Pennsylvania
Temple University
April 4-6, 1998

Meeting #933
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: February 1998
Program issue of Notices: June 1998
Issue of Abstracts: Volume 19, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: December 17, 1997
For abstracts: February 11, 1998

Invited Addresses
Tobias H. Colding, Courant Institute-New York University, Title to be announced.
Martin Davis, University of California, Berkeley, Title to be announced.
Ezra Getzler, Max-Planck-Institute and Northwestern University, Title to be announced.
Yanyan Li, Rutgers University, New Brunswick, Title to be announced.

Special Sessions
Harmonic Analysis and its Applications to PDEs (Code: AMS SS G1), Cristian E. Gutierrez, Temple University, and Guozhen Lu, Wright State University.
Heat Kernel Analysis on Lie Groups (Code: AMS SS H1), Leonard Gross, Cornell University, and Omar Hijab, Temple University.
Mathematical Pedagogy (Code: AMS SS I1), Orin N. Chein, Temple University.
Modular Identities and Q-Series in Number Theory (Code: AMS SS A1), Boris Datkovsky and Marvin I. Knopp, Temple University.
Nonlinear Partial Differential Equations (Code: AMS SS K1), Yanyan Li, Rutgers University.
Meetings & Conferences

**PDEs in Several Complex Variables** (Code: AMS SS B1), Shiferaw Berhanu and Gerardo Mendoza, Temple University.

**Radon Transforms and Tomography** (Code: AMS SS C1), Eric L. Grinberg, Temple University, and Eric Todd Quinto, Tufts University.

**Rings and Representations** (Code: AMS SS E1), Maria E. Lorenz, Ursinus College, and Martin Lorenz, Temple University.


**Sparse Matrix Computations** (Code: AMS SS M1), Jesse Barlow, Pennsylvania State University, and Daniel B. Szyld, Temple University.

**The History of American Mathematics** (Code: AMS SS D1), Karen H. Parshall, University of Virginia, and David E. Zitarelli, Temple University.

**Topology of Manifolds and Varieties** (Code: AMS SS F1), Sylvain E. Cappell, Courant Institute-New York University, and Georgia Triantafillou, Temple University.

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**Davis, California**  
**University of California**  
**April 25-26, 1998**

**Meeting #934**  
Western Section  
Associate secretary: William A. Harris Jr.  
Announcement issue of *Notices*: February 1998  
Program issue of *Notices*: June 1998  
Issue of *Abstracts*: Volume 19, Issue 2

**Deadlines**

For organizers: Expired  
For consideration of contributed papers in Special Sessions: January 7, 1998  
For abstracts: March 4, 1998

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**Chicago, Illinois**  
**DePaul University-Chicago**  
**September 12-13, 1998**

**Meeting #935**  
Central Section  
Associate secretary: Susan J. Friedlander  
Announcement issue of *Notices*: June 1998  
Program issue of *Notices*: November 1998  
Issue of *Abstracts*: Volume 19, Issue 3

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**Winston-Salem, North Carolina**  
**Wake Forest University**  
**October 9-10, 1998**

**Meeting #936**  
Southeastern Section  
Associate secretary: Robert J. Daverman  
Announcement issue of *Notices*: August 1998  
Program issue of *Notices*: December 1998  
Issue of *Abstracts*: Volume 19, Issue 3

**Deadlines**

For organizers: January 6, 1998  
For consideration of contributed papers in Special Sessions: June 23, 1998  
For abstracts: August 18, 1998

**Special Sessions**

**Noncommutative Algebra** (Code: AMS SS C1), Ellen Kirkman and James Kuzmanovich, Wake Forest University.  
**Recent Results on the Topology of Three-Manifolds** (Code: AMS SS D1), Hugh Nelson Howards, Wake Forest University.
State College, Pennsylvania
Pennsylvania State University
October 24-25, 1998

Meeting #937
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1998
Program issue of Notices: January 1999
Issue of Abstracts: Volume 19, Issue 4

Deadlines
For organizers: January 22, 1998
For consideration of contributed papers in Special Sessions: July 7, 1998
For abstracts: September 1, 1998

Invited Addresses
Jeffrey Adams, University of Maryland, College Park, Title to be announced.
Nigel D. Higson, Pennsylvania State University, Title to be announced.
Tasso J. Kaper, Boston University, Title to be announced.
Kate Okikiolu, University of California, San Diego, and MIT, Title to be announced.

Special Sessions

San Antonio, Texas
San Antonio Convention Center
January 13-16, 1999
Joint Mathematics Meetings, including the 105th Annual Meeting of the AMS, 82nd Meeting of the Mathematical Association of America (MAA), and annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: October 1998
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: April 14, 1998
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Gainesville, Florida
University of Florida
March 12-13, 1999
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: June 11, 1998
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Urbana, Illinois
University of Illinois, Urbana-Champaign
March 18-21, 1999
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Meetings & Conferences

Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: June 18, 1998
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Las Vegas, Nevada
University of Nevada-Las Vegas

April 10–11, 1999
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: January 6, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Buffalo, New York
State University of New York at Buffalo

April 24–25, 1999
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: January 6, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Michele M. Audin, University Louis Pasteur, Strasbourg, Title to be announced.
Jeff Smith, Purdue University, Title to be announced.
Alexander A. Voronov, Massachusetts Institute of Technology, Title to be announced.
Gregg J. Zuckerman, Yale University, Title to be announced.

Providence, Rhode Island
Providence College

October 2–3, 1999
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: January 6, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Austin, Texas
University of Texas-Austin

October 8–10, 1999
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: January 6, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Washington, District of Columbia
Sheraton Washington Hotel and Omni Shoreham Hotel

January 19–22, 2000
Joint Mathematics Meetings, including the 106th Annual Meeting of the AMS, 83rd Meeting of the Mathematical Association of America (MAA), with minisymposia and other special events contributed by the Society for Industrial and Applied Mathematics (SIAM), and the annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: William A. Harris Jr
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced
Deadlines
For organizers: April 20, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Lowell, Massachusetts
University of Massachusetts, Lowell
April 1-2, 2000
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 1, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Notre Dame, Indiana
University of Notre Dame
April 7-9, 2000
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 7, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

New Orleans, Louisiana
New Orleans Marriott and ITT Sheraton New Orleans Hotel
January 10-13, 2001
Joint Mathematics Meetings, including the 107th Annual Meeting of the AMS, 84th Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: April 11, 2000
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Williamstown, Massachusetts
Williams College
October 13-14, 2001
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: January 11, 2001
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
Presenters of Papers

Albuquerque, New Mexico; November 8-9, 1997

Numbers following the name indicate the speaker's position on the program.

- AMS Invited Lecturer, * Special Session Speaker, ▶ Graduate Student

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Program of the Sessions
Albuquerque, New Mexico, November 8-9, 1997

Saturday, November 8

Meeting Registration

7:30 AM - 4:30 PM  Location To Be Announced

Special Session on Commutative Algebra, I

8:00 AM - 10:50 AM  Laguna Room, DoubleTree Hotel
Organizers: Scott Thomas Chapman, Trinity University
             Alan Loper, Ohio State University, Newark
8:00 AM  Factorization properties of the normset. Preliminary report.
         (1) James B. Coykendall, IV, North Dakota State University (928-13-104)
8:30 AM  Prime ideals in birational extensions. Preliminary report.
         (2) Serpil Saydam and Sylvia M. Wiegand*, University of Nebraska-Lincoln (928-13-116)
9:00 AM  Integral domains with no atoms. Preliminary report.
         (3) Jim Coykendall, North Dakota State University,
             David Dobbs, University of Tennessee, and
             Bernadette Mullins*, Youngstown State University (928-13-114)
9:30 AM  Seminormal and t-closed Rees rings. Preliminary report.
         (4) Gabriel Picavet, Université de Clermont 2 (928-13-24)
10:00 AM  GCD-Sets in integral domains.
          (5) David F. Anderson, D D. Anderson and Jeanam Park*, Mathematics Department (928-13-88)
10:30 AM  Finiteness theorems for faithfully flat descent. Preliminary report.
          (6) Roger Wiegand, University of Nebraska (928-13-48)

AMS Exhibit and Book Sale

8:00 AM - 4:30 PM  Location To Be Announced

Special Session on Difference and Differential Equations, I

8:30 AM - 10:50 AM  Tesuque Room, DoubleTree Hotel
Organizers: Saber N. Elaydi, Trinity University
           Robert J. Sacker, University of Southern California
10:00 AM  A new approach to asymptotic diagonalization of
           linear differential systems. Preliminary report.
           (13) Sigrun I. Pabst* and Robert J. Sacker, University of Southern California, Los Angeles, CA 90089

The time limit for each contributed paper in the sessions is ten minutes. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (•) have been designated by the author as being of possible interest to undergraduate students.

Abstracts of papers presented in the sessions at this meeting will be found in Volume 18, Issue 4 of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings. The middle two digits, e.g., 897-20-1136, refer to the Mathematical Reviews subject classification assigned by the individual author. Groups of papers for each subject are listed chronologically in the Abstracts. The last one to four digits, e.g., 897-20-1136, refer to the receipt number of the abstract; abstracts are further sorted by the receipt number within each classification.

Found in November 1997
NOTICES OF THE AMS  1405
Program of the Sessions – Albuquerque, NM, Saturday, November 8 (cont’d.)

Special Session on Diophantine Geometry, I

8:30 AM - 10:50 AM

Apache Room, DoubleTree Hotel

Organizer: Alexandru Buium, University of New Mexico

8:30AM

Canonical lifts of elliptic curves and applications.

Jose-Felipe Voloch (928-14-10)

9:00AM

Applications of canonical lifts of elliptic curves to coding theory.

Jose-Felipe Voloch, University of Texas - Austin, and Judy L. Walker*, University of Nebraska - Lincoln (928-11-39)

9:30AM


Adrian Vasiu, University of California, Berkeley CA 94720 (928-11-90)

10:00AM

Number of generic points on curves in semiabelian varieties. Preliminary report.

Anand Pillay, Univ. Illinois at Urbana-Champaign (928-11-62)

10:30AM

The invariant A.

Antonios Broumas, Mathematical Sciences Research Institute (928-14-22)

Special Session on Localization and Other Multiple Scattering Phenomena of Classical Waves, I

8:30 AM - 10:40 AM

Santo Domingo Room, DoubleTree Hotel

Organizers: Alexander Figotin, University of North Carolina at Charlotte
Abel Klein, University of California, Irvine

8:30AM

Transport theory for waves and applications.

George C. Papainicolaou, Stanford University (928-86-153)

9:15AM

Magnetotelluric probing. Preliminary report.


10:00AM

The bispectral problem and some of its applications in mathematical physics.

F. Alberto Grunbaum, University of California, Berkeley (928-33-99)

Special Session on Quaternions in Global Riemannian and Algebraic Geometry, I

8:30 AM - 10:50 AM

Zuni Room, DoubleTree Hotel

Organizers: Charles P. Boyer, University of New Mexico
Galicki Krzysztof, University of New Mexico

8:30AM

Positively curved cohomogeneity one manifolds. Preliminary report.

Karsten Grove*, University of Maryland, College Park, Maryland, and Wolfgang Ziller, University of Pennsylvania, Philadelphia, Pennsylvania (928-53-140)

9:00AM

Cohomogeneity one Einstein metrics.

Andrew S. Dancer, McMaster University (928-53-67)

9:30AM

Quantization formula for singular reductions.

Youliang Tian*, CUNY Graduate Center and Courant Institute, and Weiping Zhang, Nankai Institute of mathematics (928-53-96)

10:00AM

Asymptotic metrics for monopoles with maximal symmetry breaking.

Roger Bielawski, Max-Planck-Institut für Mathematik (928-53-52)

10:30AM

New Weitzenboeck formulas on quaternionic curved cohomogeneity one manifolds and lower bounds for the spectrum of the Dirac operator.

Uwe Semmelmann, Max-Planck-Institut für Mathematik, Bonn, Germany (928-53-118)

Special Session on Computational Mathematics, I

9:00 AM - 10:50 AM

Isleta Room, DoubleTree Hotel

Organizer: Richard C. Allen Jr., Sandia National Laboratories

9:00AM

Combinatorial algorithms in scientific computing. Preliminary report.

Bruce A. Hendrickson, Sandia National Labs (928-68-150)

9:30AM

Hexahedral mesh generation via the dual arrangement of surfaces.

Scott A. Mitchell* and Timothy J. Tautges, Sandia National Laboratories (928-68-145)
Invited Address

11:15 AM - 12:05 PM Taos Room, DoubleTree Hotel

Localizaion of classical waves.
Abel Klein, University of California, Irvine
(928-78-115)

Invited Address

1:45 PM - 2:35 PM Taos Room, DoubleTree Hotel

Gregory Beylkin, University of Colorado

Special Session on Computational Mechanics, I

9:00 AM - 10:50 AM Nambe Room, DoubleTree Hotel

Organizer: D. L. Sulsky, University of New Mexico

9:00AM
(119)
Progress toward robust, high-resolution finite volume methods for three-dimensional solidifying flows on unstructured meshes.
Douglas B. Kothe, Los Alamos National Laboratory (928-65-163)

9:30AM
(120)
A computational technique for moving boundary problems in multiphase systems with phase change.
Damir Juric, Los Alamos National Laboratory (928-76-55)

10:00AM
(121)
A hybrid numerical method for moving interface problems.
Zhilin Li, North Carolina State University (928-65-51)

10:30AM
(122)
Application of the conjugate gradient algorithm to thin sheet forming problems.
Martin W. Heinstein, Sandia National Laboratories (928-73-164)

Special Session on Geometry and Analysis of Foliations, I

9:00 AM - 10:50 AM Jemez Room, DoubleTree Hotel

Organizers: Efth L. Park, Texas Christian University
Kenneth S. Richardson, Texas Christian University

9:00AM
(40)
Riemannian foliations and eigenvalue comparison.
Jeffrey M. Lee*, Texas Tech University, and Ken Richardson, Texas Christian University (928-58-46)

9:40AM
(41)
Metric fibrations in Euclidean space.
Detlef Gromoll and Gerard Walschap* (928-53-18)

10:20AM
(42)
Leafwise heat flow and applications.
Jesus A. Alvarez-Lopez (928-58-09)

Special Session on Commutative Algebra, II

3:00 PM - 4:00 PM Laguna Room, DoubleTree Hotel

Organizers: Scott Thomas Chapman, Trinity University
Alan Loper, Ohio State University, Newark

3:00PM
(45)
Zero-divisor graphs of commutative rings.
Preliminary report.
David F. Anderson, University of Tennessee (928-13-47)

3:30PM
(46)
Weak normalization and t-closure. Preliminary report.
Martine Picavet-L'Hermitte, Universite de Clermont II (928-13-25)

4:00PM
(47)
Armendariz rings and Gaussian rings.
D. D. Anderson* and Victor Camillo, The University of Iowa (928-13-05)

4:30PM
(48)
Decomposition of modules.
Stephen J. McAdam, The University of Texas at Austin (928-13-20)

5:00PM
(49)
Zero sequences and sets of lengths. Preliminary report.
Scott T. Chapman, Trinity University, and William W. Smith*, University of North Carolina at Chapel Hill (928-13-65)

5:30PM
(50)
Representation type of commutative Noetherian rings. Preliminary report.
Lee C. Klinger*, Florida Atlantic University, and Lawrence S. Levy, University of Wisconsin-Madison (928-13-42)

6:00PM
(51)
Weak subintegrality of elements and ideals. Preliminary report.
David C. Lantz, Colgate University (928-13-146)

Special Session on Computational Mathematics, II

3:00 PM - 4:50 PM Isleta Room, DoubleTree Hotel

Organizer: Richard C. Allen Jr., Sandia National Laboratories

3:00PM
Discussion: Mathematics of Molecular Science

Special Session on Computational Mechanics, II

3:00 PM - 4:50 PM Nambe Room, DoubleTree Hotel

Organizer: D. L. Sulsky, University of New Mexico

3:00PM
(52)
Forces on a bin of granular material: The effect of random friction. Preliminary report.
E. Bruce Pittman, State University of New York (928-73-87)

3:30PM
(53)
Adaptive mesh refinement and front tracking for shear bands in granular flow.
Xabier Garaizar*, Lawrence Livermore National Laboratory, and John Trangenstein, Duke University (928-39-98)

4:00PM
(54)
Overview of a particle-in-cell method for continuum mechanics.
Deborah L. Sulsky, UNM (928-73-86)

4:30PM
(55)
Material point calculations of static and dynamic stress bridging in granular material.
Scott G. Bardenhagen*, Jeremiah U. Brackbill, Los Alamos National Laboratory, Los Alamos, NM, and Deborah L. Sulsky, University of New Mexico, Albuquerque, NM (928-73-89)
Program of the Sessions – Albuquerque, NM, Saturday, November 8 (cont’d.)

Special Session on Difference and Differential Equations, II

3:00 PM – 5:20 PM
Teseque Room, DoubleTree Hotel
Organizers: Saber N. Elaydi, Trinity University
Robert J. Sacker, University of Southern California

3:00PM (56)
On some mathematical models in population dynamics. Preliminary report.
Jia Li, University of Alabama (928-39-157)

3:30PM (57)
Switching predator and prey dominance in discrete predator-prey systems with dispersion. Preliminary report.
Abdul-Aziz Yakubu, Howard University (928-34-34)

4:00PM (58)
Deterministic and stochastic SIS and SIR models in discrete time. Preliminary report.
Linda J. S. Allen, Texas Tech University (928-39-160)

4:30PM (59)
Global qualitative analysis of Gauss-type ratio-dependent predator-prey system. Preliminary report.
Yang Kuang, Arizona State University (928-34-154)

5:00PM
Global and local behavior of solutions of Royama's logistic model. Preliminary report.
Vjaldk L. Koci, Xavier University of Louisiana (928-39-123)

Special Session on Diophantine Geometry, II

3:00 PM – 4:50 PM
Apache Room, DoubleTree Hotel
Organizer: Alexandru Buium, University of New Mexico

3:00PM (61)
Rational points on algebraic curves that change genus.
Sangtae Jeong, The University of Texas at Austin, TX (928-11-32)

3:30PM (62)
Rational points and curves on certain K3 surfaces. Preliminary report.
Arthur Baragar, UNLV (928-14-40)

4:00PM (63)
Purely inseparable points on higher genus curves.
Minhlyong Kim, University of Arizona (928-11-78)

4:30PM (64)
Differential algebraic groups.
Phyllis J. Cassidy, Smith College, Northampton MA 01063 (928-14-92)

Special Session on Geometry and Analysis of Foliations, II

3:00 PM – 4:50 PM
Jemez Room, DoubleTree Hotel
Organizers: Efton L. Park, Texas Christian University
Kenneth S. Richardson, Texas Christian University

3:00PM (65)
An extension of Pestov's identity to the frame bundle. Preliminary report.
Maung Min-oo (928-55-13)

3:40PM (66)
Quasigeodesic flows on hyperbolic 3-manifolds which fiber over the circle.
Diane Hoffoss, UC Santa Barbara (928-57-21)

4:20PM (67)
Entropy rigidity for foliations.
Christopher G. Connell* and Jeffrey R. Boland, University of Michigan (928-53-36)

Special Session on Harmonic Analysis, II

3:00 PM – 5:50 PM
Acoma Room, DoubleTree Hotel
Organizers: Jay B. Epperson, University of New Mexico

3:00PM
Hardy spaces and time-frequency analysis for canonical bilinear operators. Preliminary report.
Andrea Nahmod*, Institute for Advanced Study, and John E. Gilbert*, The University of Texas at Austin (928-42-128)

3:30PM
Boundedness results for bilinear operators with non-smooth symbols. Preliminary report.
Andrea Nahmod*, Institute for Advanced Study, and John E. Gilbert, The University of Texas at Austin (928-42-127)

4:00PM
Pointwise convergence of Fourier-Bessel series with general boundary conditions.
Mark A. Pinsky, Northwestern University (928-42-137)

4:30PM
Geometric asymptotics and analysis on Lie groups. Preliminary report.
William Beckner, University of Texas at Austin (928-58-23)

5:00PM
Six sided self crossing figures problem. Preliminary report.
Nets H. Katz, University of Edinburgh (928-28-81)

5:30PM
A Selberg integral formula and an application to trilinear fractional integral inequalities. Preliminary report.
Loukas Grafakos*, and Carlo Morpurgo, (928-42-139)

Special Session on Localization and Other Multiple Scattering Phenomena of Classical Waves, II

3:00 PM – 5:55 PM
Santo Domingo Room, DoubleTree Hotel
Organizers: Alexander Figotin, University of North Carolina at Charlotte
Abel Klein, University of California, Irvine

3:00PM (74)
Spectral properties of classical waves in high contrast periodic media.
Alexander Figotin*, University of North Carolina at Charlotte, and Peter Kuchment, Wichita State University (928-78-110)

3:45PM (75)
Spectral properties of high contrast band-gap materials and operators on graphs.
Peter Kuchment* and Leonid Kunyansky, Wichita State University (928-35-64)

4:30PM (76)
Localization of elastic and other classical waves. Preliminary report.
Andrew J. Koines* and Abel Klein, University of California, Irvine (928-35-130)

5:15PM (77)
2D tunable photonic crystals. Preliminary report.
Yuri A. Godin, University of North Carolina at Charlotte (928-78-55)

Special Session on Quaternions in Global Riemannian and Algebraic Geometry, II

3:00 PM – 5:20 PM
Zuni Room, DoubleTree Hotel
Organizers: Charles P. Boyer, University of New Mexico
Galicki Krzysztof, University of New Mexico

3:00PM (78)
Hypercomplex structures from 3-Sasakian structures.
Charles P. Boyer, University of New Mexico, Krzysztof Galicki*, University of New Mexico and MPI-Bonn, and Benjamin M. Mann, University of New Mexico (928-53-57)
Session on Contributed Papers

3:00 PM - 4:40 PM Navajo Room, DoubleTree Hotel

3:00PM (83) A study of groups in a partially ordered linear algebra.
Donald E. Beken*, University of North Carolina at Pembroke, and Ralph E. DeMarr, University of New Mexico (928-06-37)

3:30PM (84) Decompositions in quantum logic.
John R. Harding, New Mexico State University (928-06-71)

3:45PM (85) Renewal processes with long-tailed interrenewal times and long-tailed rewards. Preliminary report.
Joshua Levy, Embry-Riddle Aeronautical University (928-60-107)

4:00PM (86) Quaternions in quantum theory. Preliminary report.
Charles P. Luehr, NMERI-The University of New Mexico (928-81-41)

4:15PM (87) Graphs with degree sets of maximal cardinality.
Diane M. Spresser, James Madison University (928-05-75)

4:30PM (88) On a series.
Florentin Smarandache, Pima Community College (928-40-01)

Special Session on Harmonic Analysis, III

8:00 AM - 10:50 AM Acoma Room, DoubleTree Hotel
Organizers: Jay B. Epperson, University of New Mexico
Christina Pereya, University of New Mexico

8:00AM (95) Sampling of distributions and error analysis. Preliminary report.
Rodolfo H. Torres, University of Kansas (928-42-95)

8:30AM (96) Paraproducts from the Martingale and Wavelet Point of View. Preliminary report.
James E. Daly and Keith L. Phillips*, University of Colorado (928-43-101)

9:00AM (97) Spectra of pseudo-differential operators in the Hörmander class. Preliminary report.
Josefina Alvarez, New Mexico State University (928-42-50)

10:00AM (99) Continuity of pseudo-differential operators with generalized homogeneity. Preliminary report.
David B. Emery, New Mexico State University (928-43-49)

10:30AM (100) Weak type estimates for certain Calderón-Zygmund singular integral operators. Preliminary report.
Atanas G. Stefanov, University of Missouri-Columbia (928-42-45)

AMS Exhibit and Book Sale

8:00 AM - 11:30 AM Location To Be Announced

Special Session on Difference and Differential Equations

8:30 AM - 10:50 AM Tesuque Room, DoubleTree Hotel
Organizers: Saber N. Elaydi, Trinity University
Robert J. Sacker, University of Southern California

8:30AM (101) A new robustness theorem for the existence of dichotomies. Preliminary report.
George Sell, University of Minnesota (928-34-156)
Program of the Sessions – Albuquerque, NM, Sunday, November 9 (cont’d.)

Special Session on (Multi) Wavelets and Numerical PDEs, II

8:30 AM – 10:50 AM Navajo Room, DoubleTree Hotel
Organizer: Peter R. Massopust, Sandia National Laboratories

8:30 AM An adaptive wavelet ADI methods for two dimensional flame propagation.
Wei Cai, University of North Carolina at Charlotte (928-65-134)

9:00 AM Multiple refinable function interpolation and approximate solutions of elliptic PDE.
E. B. Lin, University of Toledo (928-35-91)

9:30 AM Extensions and applications of positive wavelet expansions. Preliminary report.
David K. Ruch* and Patrick Van Fleet, Sam Houston State University (928-42-141)

10:00 AM A fast transform for spherical harmonics.
Martin J. Mohlenkamp, Yale University (928-65-16)

10:30 AM Multiwavelet prefilters: Orthogonal prefilters preserving approximation order p ≤ 3.
Douglas P. Hardin, Vanderbilt University, and David W. Roach*, Sandia National Laboratories (928-41-152)

Special Session on Localization and Other Multiple Scattering Phenomena of Classical Waves, III

8:30 AM – 10:40 AM Santo Domingo Room, DoubleTree Hotel
Organizers: Alexander Figotin, University of North Carolina at Charlotte
Abel Klein, University of California, Irvine

8:30 AM Localization bounds and the integral quantum hall effect.
Michael Aizenman, Princeton University (928-47-151)

9:15 AM Anderson localization for random Schrödinger operators with long range interactions.
Werner Kirsch, Ruhr University, Bochum, Germany, Peter Stollmann, Frankfurt University, Germany, and Günter Stolz*, University of Alabama at Birmingham (928-81-93)

10:00 AM Ultracontractivity and cluster expansions.
William G. Faris, University of Arizona (928-82-82)

Special Session on Quaternions in Global Riemannian and Algebraic Geometry, III

8:30 AM – 10:50 AM Zuni Room, DoubleTree Hotel
Organizers: Charles P. Boyer, University of New Mexico
Galiczi Krzysztof, University of New Mexico

8:30 AM Self-duality and scalar curvature.
Claude LeBrun, State University of New York (928-53-162)

9:00 AM Legendre imbeddings of the Calabi (Veronese) submanifolds in CP2n+1. Preliminary report.
David E. Blair, Michigan State University (928-53-31)

9:30 AM Normal almost contact 3-structures.
Walter Allan Kehowski, University of New Mexico (928-53-100)

10:00 AM Hyperkaehler manifolds and Boothby-Wang fibrations.
Brendan J. Foreman, Case Western Reserve University (928-53-144)

10:30 AM Sharp bounds for eigenvalues and multiplicities on surfaces of revolution.
Martin F. Engman, UNM (928-58-17)

Special Session on Diophantine Geometry, III

9:00 AM – 10:50 AM Apache Room, DoubleTree Hotel
Organizer: Alexandru Buium, University of New Mexico

9:00 AM On a conjecture of B. Gross. Preliminary report.
John Tate, The University of Texas at Austin (928-11-122)

9:30 AM Lifting forms with singularities (after Borcherds). Preliminary report.
Fernando Rodriguez-Villegas, University of Texas at Austin (928-11-58)

10:00 AM Diophantine approximation on higher dimensional varieties. Preliminary report.
Michael J. Nakamaye, Harvard University (928-11-72)

10:30 AM Transcendence results by automata techniques.
Dinesh S. Thakur, University of Arizona (928-11-84)

Special Session on Geometry and Analysis of Foliations, III

9:00 AM – 10:50 AM Jemez Room, DoubleTree Hotel
Organizers: Efton L. Park, Texas Christian University
Kenneth S. Richardson, Texas Christian University

9:00 AM Infinite dimensional symmetric spaces and the Novikov conjecture. Preliminary report.
Guoliang Yu, University of Colorado (928-19-19)

9:40 AM Transverse groupoids and transverse foliations. Preliminary report.
Jerome Kaminker, Department of Mathematical Sciences, IUPUI, Indianapolis, IN, 46202 (928-58-66)

10:20 AM Heat kernel asymptotics on foliations.
Ken Richardson, Texas Christian University (928-58-15)

1410 NOTICES OF THE AMS VOLUME 44, NUMBER 10
Albuquerque, NM, Sunday, November 9 - Program of the Sessions

Invited Address
11:15 AM - 12:05 PM Taos Room, DoubleTree Hotel
(130) Quaternionic geometry and Einstein manifolds. Charles P. Boyer, University of New Mexico (928-53-149)

Special Session on Computational Mathematics, III
2:00 PM - 3:50 PM Isleta Room, DoubleTree Hotel
Organizer: Richard C. Allen Jr., Sandia National Laboratories
2:00PM Optimization using surrogate objectives - A sabbatical in industry. Preliminary report. John E. Dennis, Jr., Rice University (928-90-148)
2:30PM On the convergence of evolutionary pattern search algorithms. William E. Hart, Sandia National Labs (928-90-111)
3:00PM A hybrid Newton-PDS method for parallel optimization. Preliminary report. Patricia D. Hough and Juan C. Meza, Sandia National Labs (928-90-109)

Special Session on Difference and Differential Equations, IV
2:00 PM - 4:20 PM Tesuque Room, DoubleTree Hotel
Organizers: Saber N. Elaydi, Trinity University Robert J. Sacker, University of Southern California
2:00PM Modelling the growth of individual organisms: A dynamic energy budget approach. Konstadina Liakas, Univ. of Calif, Santa Barbara (928-34-161)
3:00PM Periodic solutions of 2-dim forced systems: The Massera theorem and its extension. Paresh Murthy, Mount Saint Mary's College, Los Angeles, CA 90049 (928-34-138)
3:30PM Discrete dynamical systems as stroboscopic snapshots of PDEs. Preliminary report. Shandelle M. Henson, University of Arizona (928-39-158)
4:00PM On development of global bifurcation theory in polynomial dynamical systems. Preliminary report. Valery A. Galko, Belarus State University of Informatics & Radioelectronics (928-34-80)

Special Session on Geometry and Analysis of Foliations, IV
2:00 PM - 3:50 PM Jemez Room, DoubleTree Hotel
Organizers: Efton L. Park, Texas Christian University Kenneth S. Richardson, Texas Christian University
2:40PM The index of operators on foliated bundles. Victor Nistor, Penn State University (928-58-103)
3:20PM Spectrum of foliation geometric operators and leaf dynamics. Preliminary report. Steven E. Hurder, University of Illinois at Chicago (928-58-142)

Special Session on Harmonic Analysis, IV
2:00 PM - 4:50 PM Acoma Room, DoubleTree Hotel
Organizers: Jay B. Epperson, University of New Mexico Christina Pereya, University of New Mexico
2:00PM Existence and uniqueness of solutions for a modified Navier-Stokes equation on $\mathbb{R}^2$. Suzanne Toussonville (928-35-14)
2:30PM Parabolic PDE's in non-cylindrical domains. Steve C. Hoffmann, University of Missouri at Columbia (928-42-135)
3:00PM Criteria of solvability for multidimensional Riccati's equations. Kurt Hansson, Vladimir Maz'ya, University of Linköping, and Igor Verbitsky, University of Missouri (928-35-79)
3:30PM Poisson's equation and boundary layers on Sobolev-Besov spaces. Eugene Fabes, University of Minnesota, Osvaldo Mendez and Marius Mitrea, University of Missouri (928-42-83)
4:00PM Discussion

Special Session on Localization and Other Multiple Scattering Phenomena of Classical Waves, IV
2:00 PM - 4:55 PM Santo Domingo Room, DoubleTree Hotel
Organizers: Alexander Figotin, University of North Carolina at Charlotte, Abel Klein, University of California, Irvine
2:00PM Impurity localized polaritons. Lev I. Deych, Victor S. Podolsky and Alexander A. Lisyansky, Queens College of City University of New York (928-78-70)
2:45PM Frequency band gap structures, localization and defects in 2-D periodic elastic waves. Brian DeFaco* and Sankar Chakraborty, Missouri University (928-78-112)
3:30PM Exact solutions for the dispersion relation in a wide class of periodic media with complex moduli. Preliminary report. Graeme W. Milton, The University of Utah (928-78-133)
4:15PM Finite frequency Kramers-Kronig relations: Bounds on the dispersion. David J. Eyre, Graeme W. Milton, University of Utah, and Joseph V. Mantese, General Motors Corp. (928-78-129)

William A. Harris
Associate Secretary
Los Angeles, California
Conferences

Joint Summer Research Conferences in the Mathematical Sciences

Mount Holyoke College
South Hadley, Massachusetts
June 21–July 23, 1998

The 1998 Joint Summer Research Conferences in the Mathematical Sciences will be held at Mount Holyoke College in South Hadley, Massachusetts, from June 21–July 23, 1998. The topics and organizers for the five conferences were selected by the AMS, the Institute of Mathematical Statistics (IMS), and the Society for Industrial and Applied Mathematics (SIAM) Committee on Joint Summer Research Conferences in the Mathematical Sciences. The selections were based on suggestions made by the members of the committee and individuals submitting proposals. The committee considered it important that the conferences represent diverse areas of mathematical activity, with emphasis on areas currently especially active, and that careful attention be paid to subjects in which there is important interdisciplinary activity at present. It is anticipated that the series of conferences will be supported by grants from the National Science Foundation and other agencies. If supported, funding will be available for a limited number of participants in each conference. In addition to those funded, others will be welcome, within the limitations of the facilities of the campus. In the spring a brochure of information will be mailed to all who are requesting to attend the conferences. The brochure will include information on room and board rates, the residence and dining hall facilities, travel, local information, and a Residence Housing Form to request on-campus accommodations. Information on off-campus housing will also be included in the brochure. Participants will be responsible for making their own housing and travel arrangements. Each participant will be required to pay a conference fee.

Those interested in attending one of the conferences should send the following information to the Summer Research Conference Coordinator, Conferences Department, American Mathematical Society, P.O. Box 6887, Providence, RI 02940; phone: 401-455-4142; e-mail rgc@ams.org.

Please type or print the following:
1. Title and dates of conference desired
2. Full name
3. Mailing address
4. Area code and phone number for office, home, and Fax
5. E-mail address
6. Scientific background relevant to the topic of the conference
7. Financial assistance requested (or indicate if support is not required)

The deadline for receipt of requests for information is March 1, 1998.

After the deadline of March 1, requests to attend will be forwarded to the Organizing Committee for each conference for consideration. All applicants will receive a formal invitation, brochure of information, notification of financial assistance, and a tentative scientific program (if the chair has prepared one in advance; otherwise, programs will be distributed at on-site registration) from the AMS by May 1. Funds available for these conferences are limited, and individuals who can obtain support from other sources should do so. The allocation of grant funds is administered by the AMS office, and the logistical planning for the conferences is also done by the AMS. However, it is the responsibility of the chair of the Organizing Committee of each conference to determine the amount of support participants will be awarded. This decision is not made by the AMS. Women and minorities are encouraged to participate in these conferences.

Any questions concerning the scientific portion of the conference should be directed to the chair or any member of the Organizing Committee. For further information, including details supplied by organizers of individual conferences, see the Meetings and Conferences page on e-MATH, http://www.ams.org/committee/meetings/.

The Joint Summer Research Conferences in the Mathematical Sciences are under the direction of the AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences. The following committee members chose the topics for the 1997 conferences: Alejandro Adem, Katalin Bencsath, Mary Ellen Bock, James Demmel, Percy Deift, Alan F. Karr, Barbara Keyfitz (chair), Andre Mantius, Bart Ng, Douglas Simpson, Clifford Taubes.

N.B. Lectures begin on Sunday morning and run through Thursday. Check-in for housing begins on Saturday. No lectures are held on Saturday.

$q$-Series, Combinatorics and Computer Algebra

Sunday, June 21–Thursday, June 25

Mourad E. H. Ismail, University of South Florida, co-chair

Dennis Stanton, University of Minnesota, co-chair

The area of special functions, and $q$-series in particular, has seen significant advances in the last twenty years. The idea that generating functions for integer partitions are $q$-
series goes back to Euler, but there are many new classical applications to integer partitions. For example recently Ono and Granville solved the $t$-core conjecture, while Milne has new expansions for powers of the eta function. There are also a variety of recent problems in combinatorics, analysis and algebra related to $q$-series.

One major event is the discovery of the Askey-Wilson polynomials and the multivariable generalization to root systems by Macdonald. These polynomials are being studied analytically, combinatorially, and via quantum groups. Several distinct research teams have established polynomiality in $q,t$ of the $q,t$-Kostka polynomials, but positivity of the coefficients remains open. It is a very active area and the multiplicity of viewpoints will offer much insight to all.

This is closely related to enumeration of tableaux by $q$-statistics, and thus to classical enumeration. Andrews's $q$-Dyson conjecture (a precursor to the Macdonald conjectures) was solved using combinatorial techniques by Zeilberger-Bressoud. The interaction between special functions and enumeration problems has benefited both areas. The evolution of practical and theoretical computer algebra has made it possible to confirm the validity of many identities in special cases and provide proofs of new results for which analytical proofs were found at a later time. Bill Gosper has made many fascinating conjectures based on computer experiments. P. Paule, C. Krattenthaler and D. Zeilberger have prepared very useful packages. There is an ongoing Web project to develop applets for the Askey tableau of orthogonal polynomials and recurrence relations.

The subjects of $q$-series and orthogonal polynomials have found applications in physics. Such applications include quantum oscillators, random matrix models, models for insulation and conduction. The Macdonald polynomials also appear in quantum field theory. A sample of these physical applications will be covered.

Quantum Cohomology

Sunday, June 28–Thursday, July 2

Aaron Bertram, University of Utah, co-chair
Yongbin Ruan, University of Wisconsin, co-chair

During the last several years, the theory of quantum cohomology has grown from seeds sown by string theorists into an exciting subject spanning diverse areas of mathematics. A variety of new concepts and techniques have been developed which give quantum cohomology a solid mathematical foundation. These new ideas have had far-reaching consequences in algebraic geometry, mathematical physics, and symplectic topology. For example, they led to a proof of the famous Arnold conjecture. Our aim is to have a comprehensive conference on quantum cohomology, our idea being to foster interaction among experts in the various aspects of the subject. Specifically, our aim is to attract researchers with interests in one or more of the following topics (as well as other related topics which we have surely missed):

**Symplectic Topology:** Gromov's theory of pseudo-holomorphic curves, rigorous foundation for quantum cohomology in this context, generalizations and applications, including the proofs of Arnold's conjecture, deformation classification of symplectic manifolds, symplectic extremal rays and relations with Seiberg-Witten theory. Equivariant quantum cohomology and the mirror conjecture. Gromov-Witten invariants and symplectic surgeries.

**Algebraic Geometry:** Stable maps, virtual classes and applications to enumerative geometry. Generalizations and related problems including the degrees of Severi varieties and the problem of making effective computations using Bott residue theory on orbispaces. Related questions, such as Clemens's conjectures on the nature of rational curves on a general quintic three-fold.

**Mirror Symmetry:** The physics behind the mirror conjecture for Calabi-Yau three-folds, mirror symmetry for complete intersections in toric varieties and homogeneous spaces, various generalizations of the mirror conjecture to non-Calabi-Yau's.

**Other Topics:** Frobenius manifolds, recent generalizations of the Witten conjecture for $M_{g,n}$ to Gromov-Witten invariants and applications to the positive genus invariants, Virasoro algebra and quantum cohomology, $S$-duality.

During the five day period, we will have several expository lectures each day as well as lectures by experts on their current research.

Geometric Group Theory and Computer Science

Sunday, July 5–Thursday, July 9

Robert Gilman, Stevens Institute of Technology, chair

Over the last several years the study of groups given by generators and relations has been invigorated by an influx of ideas from geometry, topology, and computer science; the resulting collection of techniques and points of view has become known as geometric group theory. Our workshop is devoted to computer theoretic aspects of this new field. It seems that a fruitful area for research is emerging here related to combinatorial group theory, computational group theory, and the theory of automata and formal languages.

**Automatic Groups and Word Hyperbolic Groups**

Automatic groups and word hyperbolic groups are perhaps the best known products of geometric group theory. At the beginning of the century Max Dehn solved the word and conjugacy problems for fundamental groups of orientable surfaces by making use of the underlying hyperbolic geometry. Dehn's ideas led to the theory of small cancellation groups and more recently to some striking
connections between geometry and finite automata. The geometry of the known compact 3-manifolds is reflected by restrictions on the structure of their fundamental groups, and in many cases the spirit of these restrictions is captured by the fact that multiplication in the fundamental group can be carried out by finite automata. This fact leads to the definition of automatic groups and to previously unsuspected connections with computer science.

Word hyperbolic groups are algebraic analogs of groups acting cocompactly on spaces of negative curvature. They are defined by imposing geometric conditions on the Cayley diagram of a group. It is remarkable that these groups are also characterized by concepts from computer science. They are precisely the groups whose word problem can be solved by a length reducing rewriting system confluent at the identity.

Further Connections with Computer Science

Another line of research, initiated by computer scientists, concerns the structure of a group and the language theoretic properties of its word problem. Here word problem means the formal language of all words defining the identity with respect to a fixed set of generators. This program has produced a number of interesting results, among them the characterization of groups with a free subgroup of finite index as those groups whose word problem is a context-free language, and a complexity-theoretic analog of the Higman Embedding Theorem.

Geometric group theory has also inspired new approaches to computation with finitely presented groups. It is well known that almost all questions about these groups are recursively unsolvable. In practice this unsolvability means that one writes programs which give the correct answer sometimes but never stop in other cases. The computational challenge is to devise programs which will work often enough to be useful. For example, the theory of automatic groups includes both a procedure of theoretical interest for verifying that a finite presentation presents an automatic group and a practical procedure which is useful for actual computation but which might fail to show that a group is automatic when in fact it is. The latter procedure makes use of rewriting methods like those mentioned above, and it is the basis of a method to enumerate the cosets of finitely generated subgroups of finitely presented groups. The well-known Todd-Coxeter method works for subgroups of finite index, but the new method works for some subgroups of infinite index as well. Of course it cannot explicitly list infinitely many coset representatives. Rather its output is a finite description of such a list, namely a finite automaton which can test whether or not a word in the generators is on the list.

The topics to be covered will include:

1. classical $q$-series, number theory, and orthogonal polynomials,
2. multivariable polynomials and quantum groups,
3. applications of computer algebra packages to combinatorial problems,
4. applications of $q$-series to physical problems.

Preliminary list of speakers:

GEORGE ANDREWS, Pennsylvania State University

RICHARD ASKEY, University of Wisconsin

PAVEL ETINGHOF, Harvard University

DOMINIQUE FOATA, Université Louis Pasteur

GEORGE GASPER, Northwestern University

IRA GESSEL, Brandeis University

R. WILLIAM GOSPER, MACSYMA division

CHRISTIAN KRATTENTHALER, University of Vienna

TOM KOORNWINDER, University of Amsterdam

STEVE MILNE, Ohio State University

KEN ONO, Institute for Advanced Study

Doron Zeilberger, Temple University.

Mathematical Methods in Inverse Problems for Partial Differential Equations

Sunday, July 5–Thursday, July 9

William Rundell, Texas A&M University, chair

Inverse problems in mathematics are as old as the discipline itself; from earliest times questions have been posed that require the determination of an underlying structure from auxiliary information. However, inverse problems in differential equations have a much more recent history. While the concept of a differential equation dates from the time of Newton and the main analytic techniques for solving them are at least a hundred years old, the study of inverse problems in differential equations is, in reality, less than fifty years old with a real explosion only in the last ten or twenty years.

From a mathematical standpoint the development of nonlinear functional analysis and of modern, sophisticated numerical analysis was a key factor. The other driving force was an increase in the number of important applications of inverse problems; these applications now span the entire range of applied science.

This conference will have three main themes:

Perhaps the central mathematical issue in any inverse problem is the question of uniqueness— Is the additional data provided sufficient to uniquely determine the unknown coefficient or parameter? Of course, the optimal situation would be to determine the exact amount of overposed data to answer the uniqueness question in the affirmative. For all but the simplest problems, this is extremely difficult. There have been many important breakthroughs in recent years and we now have an expanded set of tools. It is important that techniques that were effective in one application are brought to the attention of researchers working in others.

Algorithms for effective reconstruction of the coefficient are also clearly important. Here consideration must always be given to the fact that the unknown coefficient to data map is usually both highly nonlinear and compact; standard optimization schemes generally fail due to the presence of many local minima and Newton-type iteration.
Nonlinear PDEs, Dynamics and Continuum Physics

Sunday, July 19–Thursday, July 23

Jerry Bona, University of Texas, co-chair
Katarzyna Saxton, Loyola University, co-chair
Ralph Saxton, University of New Orleans, co-chair

Historically, it has been the custom to use evolution equations to provide a direct description for the phenomena of continuum physics. On analyzing the resulting partial differential equations, however, it can become necessary to incorporate physical aspects absent from the original modelling, an approach often employed in the theory of conservation laws—much of which is based on specialized considerations of gas dynamics. With the introduction of physically relevant additional terms, it becomes possible to avoid problems of multi-valuedness, identify admissible solutions, and resolve issues of nonuniqueness. While modern techniques of nonlinear analysis rely on this type of approach combined with the study of approximate solution sequences to obtain global existence results, such sequences may nevertheless lead to different weak limits depending on the perturbations employed. When considering more general field theories, this illustrates both the problem of choosing physically well-motivated perturbations and the need for a mathematically extensive theory of perturbations and weak limits—two of several issues in the interaction of analysis and physics having important consequences for materials science.

The aim of the meeting will be to consider recent advances in nonlinear partial differential equations connected with the physics of continuous media, and bring together researchers working in the theory of conservation laws and other areas of applied mathematics with those in continuum physics. The focus will be on classical and weak solutions to models obtained by rigorous use of basic physical principles. This is intended to take in physical models from elasticity, viscoelasticity, plasticity, granular media, fluid dynamics, multi-fluid flow, gas dynamics, plasma physics and related areas, with an emphasis on convergence of limits. Mathematical topics to be covered will also include analysis of the lifetime and asymptotic behaviour of solutions to nonlinear wave equations, effects of damping, mechanisms of breakdown, and singular solutions.

These topics may be broadly classified as follows:

Nonlinear Waves

The focus will encompass problems of classical solutions to nonlinear wave equations such as existence, regularity, lifetime, blow up and other types of singularity formation, and stability. In the case of fluid dynamics, issues of finite-time singularity development and long-time behavior of solutions represent fundamental open problems. In semilinear, quasilinear, hyperbolic-parabolic, and dispersive wave equations, the types of questions to be addressed will include obtaining sharp conditions for the global existence and stability of stationary and travelling wave solutions. Further topics will include analysis of the dynamics of geometrically exact models for three-dimensional motion in continuous media.

Singular Solutions

Various forms of singular solutions will be discussed, from those occurring as shocks in solids or gases, shock-like solutions in nonconservative equations, to weak solutions responsible for cavity formation in solids or fluids. The latter arise, for example, in the formation of holes due to low levels of laser light in optical fibers, and are responsible for major failure mechanisms. From the physical point of view, further important questions lie in the possible distinction between measures of regularity of solutions in Eulerian and Lagrangian descriptions of the motion, which becomes particularly significant when the connection between these coordinate systems involves weak solutions. An example of sufficient conditions for the equivalence of the two descriptions at the level of distributions exists when the coordinate transformation connecting them is a bi-Lip-
Free Probability Theory

Dan-Virgil Voiculescu,
University of California, Berkeley

Free probability theory is a highly noncommutative probability theory, with independence based on free products instead of tensor products. The theory models random matrices in the large \( N \) limit and operator algebra free products. It has led to a surge of new results on the von Neumann algebras of free groups.

This is a volume of papers from a workshop on Random Matrices and Operator Algebra Free Products, held at The Fields Institute for Research in the Mathematical Sciences in March 1995. Over the last few years, there has been much progress on the operator algebra and noncommutative probability sides of the subject. New links with the physics of masterfields and the combinatorics of noncrossing partitions have emerged. Moreover there is a growing free entropy theory.

The idea of this workshop was to bring together people working in all these directions and from an even broader free products area where future developments might lead.

Fields Institute Communications, Volume 12; 1997; 312 pages; Hardcover; ISBN 0-8218-0675-0; List $79.95; Individual member $64; order code AST/236NA

Hommage à
P. A. Meyer et J. Neveu

This tribute to Paul André Meyer and Jacques Neveu displays their wide influence on modern probability theory by gathering nineteen original research papers, drawn from a large range of topics: potential theory, classical stochastic processes and their laws, non-commutative probability, estimates of heat kernels, entropy, ergodic theory, phase transition, stochastic models in financial markets, and excursion theory.

Titles in this series are published by the Societé Mathématique de France and distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 87, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Astérisque, Number 236; 1996; 308 pages; Softcover; List $61; Individual member $49; order code FIC/121NA

Conferences

schitz homeomorphism. This leads to consistency of conservation laws and the possibility of taking advantage of the different aspects of the two settings in examining weakly convergent sequences.

Limiting Properties

Approximation schemes to be considered may give rise to embedding into settings which introduce dispersive as well as dissipative effects, as in the viscosity-capillarity admissibility criterion used to study phase transitions in nonstrictly hyperbolic equations. An important distinction between dispersive approximations, such as that in the KdV small dispersion limit, and dissipative approximations as in viscosity methods, lies in the fact that solution sequences to the first generally converge weakly to modulation equations rather than to weak solutions of the original PDE. Investigations in this direction provide insight into the underlying notion of physical admissibility.

Further aspects under consideration come from an examination of shocks and mechanisms of possible shock prevention in the presence of frictional damping in quasilinear hyperbolic equations. Recent results compare asymptotic properties of the solution to hyperbolic equations with damping to corresponding nonlinear diffusion equations. As an example, classical solutions of the Cauchy problem for isentropic gas flow through porous media have been found to tend time-asymptotically to self-similar solutions of a diffusion equation with Darcy’s law. A related investigation will be into weak solutions to systems of hyperbolic equations with damping and their singular convergence to the solution of reduced parabolic problems as their inertial term tends to zero.

Preliminary List of Speakers

STUART ANTMAN, University of Maryland
JERRY BONA, University of Texas
CONSTANTINE DAFERMOS, Brown University
JONATHAN GOODMAN, Courant Institute
LING HSIAO, Academia Sinica
CHRISTOPHER JONES, Brown University
SATYANAD KICHENASSAMY, University of Minnesota
MICHAEL RENARDY, Virginia Polytechnic Institute
BRUNO RUBINO, University degli Studi di L’Aquila
MICHAEL SHEARER, North Carolina State University
MARSHALL SLEMMOD, University of Wisconsin
SCOTT SPECTOR, Southern Illinois University, Carbondale
WALTER STRAUSS, Brown University
STEPHANOS VENAKIDES, Duke University
DAVID WAGNER, University of Houston
# Baltimore Advance Registration/Housing Form

## Registration Fees

<table>
<thead>
<tr>
<th>Joint Meetings</th>
<th>by Dec 19</th>
<th>at mtg</th>
</tr>
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<tbody>
<tr>
<td>Member AMS, ASL, CMS, MAA</td>
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<td>$202</td>
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<tr>
<td>Nonmember</td>
<td>$240</td>
<td>$312</td>
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<tr>
<td>Undergraduate</td>
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<td>High School Student</td>
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<td>Temporarily Employed</td>
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<td>$125</td>
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<tr>
<td>Developing Countries Special Rate</td>
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<td>Emeritus Member of AMS or MAA</td>
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<td>$45</td>
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<tr>
<td>High School Teacher</td>
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<tr>
<td>Librarian</td>
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<tr>
<td>One-day Member</td>
<td>—</td>
<td>$121</td>
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<tr>
<td>One-day Nonmember</td>
<td>—</td>
<td>$172</td>
</tr>
</tbody>
</table>

**AMS Short Course on Singular Perturbation Concepts for Differential Equations.**

Registration for the Joint Meetings is not required for the Short Course.

- Member, Nonmember: $75
- Student, Unemployed, Emeritus: $35

## Employment Register

Registration for the Joint Meetings is required for participation. Applicant résumé forms and employer job listing forms will be on e-MATH in September and in the October issues of Notices and Focus.

- Employer—First Table
  - Regular: $200
  - Self-scheduled: $250
- Employer—Second Table
  - Regular: $50
  - Self-scheduled: $75
- Employer—Posting Only
  - Regular: $50
  - Self-scheduled: $50
- Applicant
  - $40
  - Self-scheduled: $75

## Payment

- Joint Meetings fee(s)
- AMS Short Course
- Employment Register
- Event tickets
- Hotel deposit (only if paying by check)

**Total amount paid** $ (Please note that a $5 processing fee will be charged for each returned check or invalid credit card.)

## Events

### Events with Tickets

- AMS Banquet: Regular: $32
- MER Banquet: Regular: $32
- NAM Banquet: Regular: $32

**Total** $32

### Student Activities

- Matchats: (no charge)
- MAA Student Workshop: (no charge)

## Statistical/Other Information

**Mathematical Reviews field of interest #**

- I am a mathematics department chair.
- How did you hear about this meeting? Check one:
  - Notices
  - Focus
  - WWW
  - Colleague(s)
  - Special Mailing
- Please do not include my name on any mailing list used for promotional purposes.
- Please check this box if you have a disability that requires special services.

## Deadlines

- November 7, 1997
- November 20, 1997
- December 8, 1997
- December 19, 1997
- January 2, 1998

**Method of Payment**

- Check: Make checks payable to the AMS. Checks drawn on foreign banks must be in equivalent foreign currency at current exchange rates.
- Credit Card: VISA, MasterCard, AMEX, Discover. (no others accepted)

**Card Number:**

**Exp. Date:**

**Zipcode of credit card billing address:**

**Signature:**

**Name on card:**

**Purchase Order #:** (please enclose copy)
# Hotel Reservations

To ensure accurate assignments, please rank hotels in order of preference by writing 1, 2, 3, etc., in the spaces at the left of the form and by circling the requested room type and rate. If the rate or the hotel requested is no longer available, you will be assigned a room at a ranked or unranked hotel at a comparable rate. Participants are urged to call the hotels directly for details on suite configurations, sizes, etc. Reservations at the following hotels must be made through the MMSB to receive the convention rates listed. All rates are subject to a 12.5% sales occupancy tax. **Guarantee requirements:** First night deposit by check (add to payment on reverse of form) or a credit card guarantee.

- **Deposit enclosed**
- **Hold with my credit card**

**Date and Time of Arrival**

**Date and Time of Departure**

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<th>Name of Other Room Occupant</th>
<th>Arrival Date</th>
<th>Departure Date</th>
<th>Spouse</th>
<th>Child (give age)</th>
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<th>Triple 2 beds</th>
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<th>Quad 2 beds</th>
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<td>$105</td>
<td>$155</td>
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</table>

* Limited Availability

**Special Housing Requests:**

- **I have disabilities as defined by the ADA that require a sleeping room that is handicap accessible.**

My needs are:

If you are a member of a hotel frequent-travel club and would like to receive appropriate credit, please include the hotel chain and card number here: ____________________________

Other requests: ____________________________________________________________

**If you are not making a reservation, please check off one of the following:**

- **I plan to make a reservation at a later date.**
- **I will be making my own reservations at a hotel not listed. Name of hotel: ____________________________**
- **I live in the area or will be staying privately with family or friends.**
- **I plan to share a room with ____________________________, who is making reservations.**
# Meetings and Conferences of the AMS

### Associate Secretaries of the AMS

**Western Section:** William A. Harris Jr., Department of Mathematics, University of Southern California, Los Angeles, CA 90089-1113; e-mail: wharris@math.usc.edu; telephone: 213-740-3794.

**Central Section:** Susan J. Friedlander, Department of Mathematics, University of Illinois at Chicago, 851 S. Morgan (M/C 249), Chicago, IL 60607-7045; e-mail: susan@math.nwu.edu; telephone: 312-996-3041.

**Eastern Section:** Lesley M. Sibner, Department of Mathematics, Polytechnic University, Brooklyn, NY 11201-2990; e-mail: lsibner@magnus.poly.edu; telephone: 718-260-3505.

**Southeastern Section:** Robert J. Daverman, Department of Mathematics, University of Tennessee, Knoxville, TN 37996-1300; e-mail: daverman@novell.math.utk.edu; telephone: 423-974-6577.

The Meetings and Conferences section of the Notices gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. Up-to-date meeting and conference information is available on the World Wide Web via the Internet at URL http://www.ams.org/.

### Meetings:

**1997**

- **November 8–9:** Albuquerque, New Mexico. p. 1396
- **December 4–7:** Oaxaca, Mexico. p. 1396

**1998**

- **January 7–10:** Baltimore, Maryland. Annual Meeting. p. 1397
- **March 20–21:** Louisville, Kentucky. p. 1398
- **March 27–28:** Manhattan, Kansas. p. 1398
- **April 4–6:** Philadelphia, Pennsylvania. p. 1399
- **April 25–26:** Davis, California. p. 1400
- **September 12–13:** Chicago, Illinois. p. 1400
- **October 9–10:** Winston-Salem, No. Carolina. p. 1400
- **October 24–25:** State College, Pennsylvania. p. 1401
- **November 14–15:** Tucson, Arizona. p. 1401

**1999**

- **January 13–16:** San Antonio, Texas. Annual Meeting. p. 1401
- **March 12–13:** Gainesville, Florida. p. 1401
- **March 18–21:** Urbana, Illinois. p. 1401
- **April 10–11:** Las Vegas, Nevada. p. 1402
- **April 24–25:** Buffalo, New York. p. 1402
- **October 2–3:** Providence, Rhode Island. p. 1402
- **October 8–10:** Austin, Texas. p. 1402

**2000**

- **January 19–22:** Washington, DC. Annual Meeting. p. 1402
- **April 1–2:** Lowell, Massachusetts. p. 1403
- **April 7–9:** Notre Dame, Indiana. p. 1403

**2001**

- **January 10–13:** New Orleans, LA. Annual Meeting. p. 1403
- **October 13–14:** Williamstown, MA. p. 1403

### Important Information Regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 183 in the January issue of the Notices for general information regarding participation in AMS meetings and conferences.

### Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of TeX is necessary to submit an electronic form, although those who use plain TeX, AMS-TeX, LaTeX, or AMS-LaTeX may submit abstracts with TeX coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html or send mail to abs-submit@ams.org, typing help as the subject line, and descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Abstracts Coordinator, AMS, P.O. Box 6887, Providence, RI 02940. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

### Conferences:

(See http://www.ams.org/meetings/ for the most up-to-date information on these conferences.)

**1998:**

- **January 5–6:** AMS Short Course on Singular perturbation concepts for differential equations. See pp. 1262–1265 for details.
Instructions for Applicant and Employer Forms

Applicant forms submitted for the Employment Register by the November 20 deadline will be reproduced in a booklet titled Winter List of Applicants. Employer forms submitted by the November 20 deadline will be reproduced for the Winter List of Employers.

Please use the electronic versions of Applicant and Employer forms (http://www.ams.org/emp-reg/). Paper forms should be submitted only by those who do not have access to e-MATH.

If submitting a paper form, please type carefully. Do not type outside the box or beyond the lines indicated. Extra type will be omitted.

All forms must be received by the Society by November 20, 1997, in order to appear in the Winter List. If you are attending the meeting, the Advance Registration/Housing Form printed in this issue should accompany the form.

00 General
01 History and biography
03 Mathematical logic and foundations
04 Set theory
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra, matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
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22 Topological groups, Lie groups
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28 Measure and integration
30 Functions of a complex variable
31 Potential theory
32 Several complex variables and analytic spaces
33 Special functions
34 Ordinary differential equations
35 Partial differential equations
39 Finite differences and functional equations
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43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations

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47 Operator theory
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JANUARY 7-9, 1998  
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<td>E-mail address (one only)</td>
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<td>URL (if applicable)</td>
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Number of tables needed in the regular scheduled Employment Register only __

Name(s) of Interviewer(s) 1. ________________________  
2. ________________________  
3. ________________________  
4. ________________________

Specialties sought ________________________  
____________________  
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Title(s) of position(s) ________________________  
____________________  
____________________  
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Number of positions ________________________

Starting date ________________________ / _____________  
Term of appointment ________________________ / _____________

Renewal ________________________ / _____________  
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Oceanic Possible  
Impossible  
Yes  
No  
Teaching hours per week ________________________

Degree preferred ________________________  
Degree accepted ________________________

Duties ________________________  
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Experience preferred ________________________  
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Able to hire for this position:  
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The Embedding Problem in Galois Theory

V. V. Ishkhanov, B. B. Lur'e, and D. K. Faddeev, Russian Academy of Sciences, St. Petersburg

This book is based on D. K. Faddeev's lectures on embedding theory at Petersburg University and contains the main results on the embedding problem. All stages of development are presented in a methodical and unified manner.

Translations of Mathematical Monographs, Volume 165; 1997; 104 pages; Hardcover: ISBN 0-8218-0566-X; List $59; Individual member price $59; Order code MMONO/165NA

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V. G. Osmolovskii, St. Petersburg State University, Russia

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\[ Lu = c(y)u + C u', \]

one can under certain conditions regard the operator \( L \) as a compact perturbation of the operator div.

This book presents results on boundary-value problems for \( L \) and the theory of nonlinear perturbations of \( L \). Specifically, necessary and sufficient solvability conditions in explicit form are found for various boundary-value problems for the operator \( L \). An analog of the Weyl decomposition is proved.

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E. I. Gordon, Nizhny Novgorod State University, Russia

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J. Borwein, P. Borwein, L. Jorgenson, Simon Fraser University, Burnaby, BC, Canada, and R. Corless, University of Western Ontario, London, Canada

Contained in this work is a collection of articles on experimental and computational mathematics contributed by leading mathematicians around the world. The papers span a variety of mathematical fields—from number theory to numerical analysis. Many of the papers contain some of the latest developments in the field and are intended to be of interest to mathematicians in other fields.


Sign-Based Methods in Linear Statistical Models

M. V. Boldin, G. I. Simanova, and Yu. N. Tyurin, Moscow State University, Russia

In this work, sign-based methods in the framework of linear models are developed. In the first part of the book, there are linear and factor models involving independent observations. In the second part, linear models of time series, primarily autoregressive models, are considered.

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**DESIRED POSITION:**

- Academic:  [ ] Research  [ ] University Teaching  [ ] College Teaching:  [ ] 4-year  [ ] 2-year
- Would you be interested in nonacademic employment?  [ ] Yes  [ ] No
- Available no.  ______/yr.
- Significant requirements (or restrictions) which would limit your availability for employment

**PROFESSIONAL ACCOMPLISHMENTS:**

Significant achievements, research or teaching interests

Paper to be presented at this meeting or recent publication

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<th>Institution</th>
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