

Notices

of the American Mathematical Society

September 2001

Volume 48, Number 8

Quantum Spaces and
Their Noncommutative
Topology

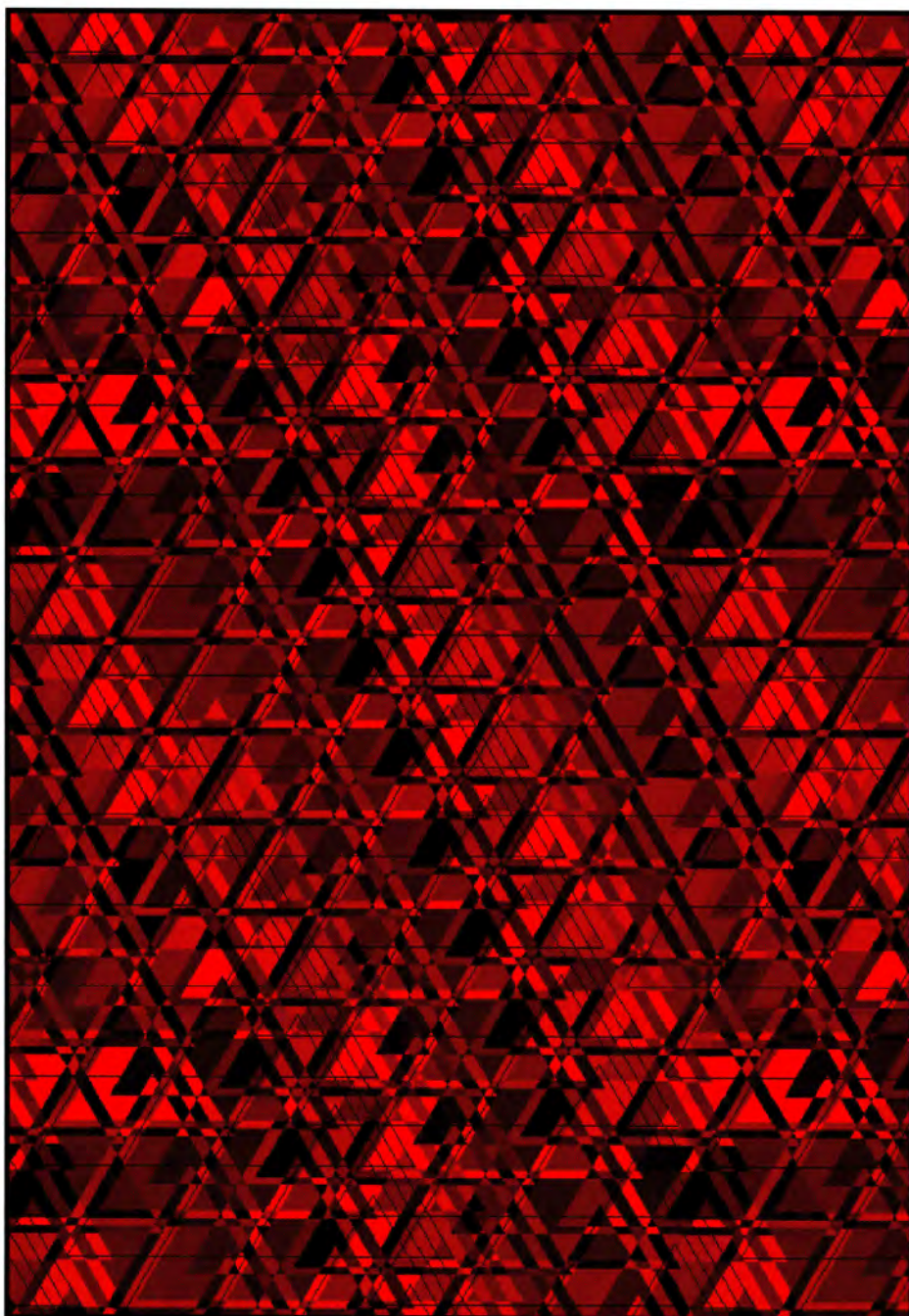
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George Keith Batchelor
(1920–2000) and Daniel
George Crighton
(1942–2000) Applied
Mathematicians

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Irvine Meeting

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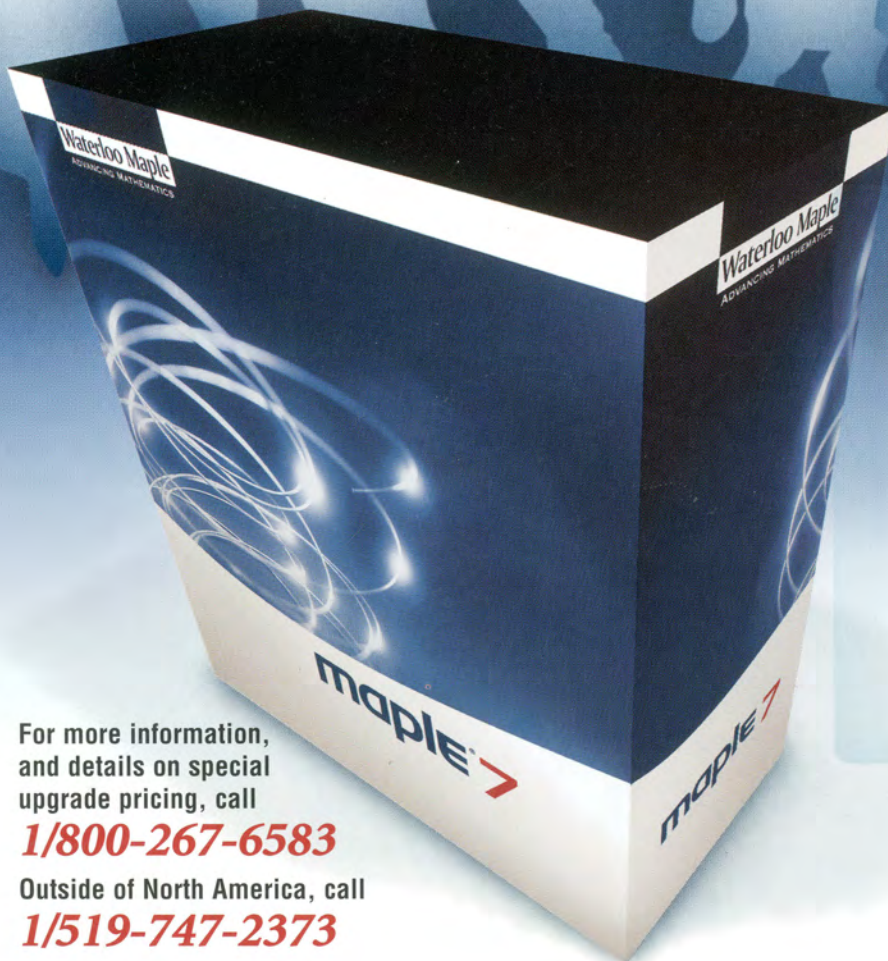


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New Titles from the AMS

The Schur Algorithm, Reproducing Kernel Spaces and System Theory

Daniel Alpay, *Ben-Gurion University of the Negev, Beer-sheva, Israel*

From a review of the French edition:

This excellent survey showing a rich interplay between functional analysis, complex analysis and systems science is very informative and can be highly recommended to functional analysts curious about the systems science impact of their discipline or to theoretically inclined systems scientists, in particular those involved in the realization theory.

—Zentralblatt für Mathematik

In this book, Alpay looks at matrix-valued Schur functions and their applications from the unifying point of view of spaces with reproducing kernels. This approach is used here to study the relationship between the modeling of time-invariant dissipative linear systems and the theory of linear operators. The inverse scattering problem plays a key role in the exposition. The point of view also allows for a natural way to tackle more general cases, such as nonstationary systems, non-positive metrics, and pairs of commuting nonself-adjoint operators. This is the English translation of a volume originally published in French by the Société Mathématique de France. Translated by Stephen S. Wilson.

SMF/AMS Texts and Monographs, Volume 5; 2001; 150 pages; Softcover; ISBN 0-8218-2155-5; List \$49; All AMS members \$39; Order code SMFAMS/5NT109

Recommended Text

Theta Constants, Riemann Surfaces and the Modular Group

An Introduction with Applications to Uniformization Theorems, Partition Identities and Combinatorial Number Theory

Hershel M. Farkas, *The Hebrew University, Jerusalem, Israel*, and Irwin Kra, *State University of New York, Stony Brook*

In this book, Farkas and Kra, well-known masters of the theory of Riemann surfaces and the analysis of theta functions, uncover interesting combinatorial identities by means of the function theory on Riemann surfaces related to the principal congruence subgroups $\Gamma(k)$. For instance, the authors use this approach to derive congruences discovered by Ramanujan for the partition function, with the main ingredient being the construction of the same function in more than one way. The authors also obtain a variant on Jacobi's famous result on the number of ways that an integer can be represented as a sum of four squares, replacing the squares by triangular numbers and, in the process, obtaining a cleaner result.

Highlights of the book include systematic studies of theta constant identities, uniformizations of surfaces represented by subgroups of the modular group, partition identities, and Fourier coefficients of automorphic functions.

Prerequisites are a solid understanding of complex analysis, some familiarity with Riemann surfaces, Fuchsian groups, and elliptic functions, and an interest in number theory. The book contains summaries of some of the required material, particularly for theta functions and theta constants.

Readers will find here a careful exposition of a classical point of view of analysis and number theory. Presented are numerous examples plus suggestions for research-level problems. The text is suitable for a graduate course or for independent reading.

Graduate Studies in Mathematics; 2001; approximately 552 pages; Hardcover; ISBN 0-8218-1392-7; List \$69; All AMS members \$55; Order code GSM/37NT109

Recommended Text

Linear Algebra and Differential Equations

Alexander Givental, *University of California, Berkeley*

This is based on the course, "Linear Algebra and Differential Equations", taught by the author to sophomore students at UC Berkeley.

Specific material in the book is organized as follows: Chapter 1 discusses geometry on the plane, including vectors, analytic geometry, linear transfor-

mations and matrices, complex numbers, and eigenvalues. Chapter 2 presents differential equations (both ODEs and PDEs), Fourier series, and the Fourier method. Chapter 3 discusses classical problems of linear algebra, matrices and determinants, vectors and linear systems, Gaussian elimination, quadratic forms, eigenvectors, and vector spaces. The book concludes with a sample final exam.

Berkeley Mathematical Lecture Notes, Volume 11; 2001; 132 pages; Softcover; ISBN 0-8218-2650-9; List \$19; All AMS members \$15; Order code BMLN/11NT109

Geometric Asymptotics for Nonlinear PDE. I

V. P. Maslov, *Moscow State University, Russia*, and G. A. Omel'yanov, *Moscow Institute of Electronic Engineering, Russia*

The study of asymptotic solutions to nonlinear systems of partial differential equations is a very powerful tool in the analysis of such systems and their applications in physics, mechanics, and engineering. In the present book, the authors propose a new powerful method of asymptotic analysis of solutions, which can be successfully applied in the case of the so-called "smoothed shock waves", i.e., nonlinear waves which vary fast in a neighborhood of the front and slowly outside of this neighborhood. The proposed method, based on the study of geometric objects associated to the front, can be viewed as a generalization of the geometric optics (or WKB) method for linear equations. This volume offers to a broad audience a simple and accessible presentation of this new method. Included are many figures illustrating the various physical effects.

Translations of Mathematical Monographs, Volume 202; 2001; 285 pages; Hardcover; ISBN 0-8218-2109-1; List \$99; Individual member \$59; Order code MMONO/202NT109

Supplementary Reading

Smooth Ergodic Theory and Its Applications

Anatole Katok, *Pennsylvania State University, University Park*, Rafael de la Llave, *University of Texas at Austin*, and Yakov Pesin and Howard Weiss, *Pennsylvania State University, University Park*, Editors

During the past decade, there have been several major new developments in smooth ergodic theory, which have attracted substantial interest to the field from mathematicians as well as scientists using dynamics in their work. In spite of the impressive literature, it has been extremely difficult for a student—or even an established mathematician who is not an expert in the area—to acquire a working knowledge of smooth ergodic theory and to learn how to use its tools.

Accordingly, the AMS Summer Research Institute on Smooth Ergodic Theory and Its Applications (Seattle, WA) had a strong educational component, including ten mini-courses on various aspects of the topic that were presented by leading experts in the field. This volume presents the proceedings of that conference.

The book serves a two-fold purpose: first, it gives a useful gateway to smooth ergodic theory for students and nonspecialists, and second, it provides a state-of-the-art report on important current aspects of the subject. The book is divided into three parts: lecture notes consisting of three long expositions with proofs aimed to serve as a comprehensive and self-contained introduction to a particular area of smooth ergodic theory; thematic sections based on mini-courses or surveys held at the conference; and original contributions presented at the meeting or closely related to the topics that were discussed there.

Proceedings of Symposia in Pure Mathematics, 2001; 867 pages; Hardcover; ISBN 0-8218-2682-4; List \$164; Individual member \$98; Order code PSPUM-PESINNT109



MATHEMATICS

from Birkhäuser

Forthcoming!

Y. Nievergelt, *E. Washington University, Cheney, WA*

Foundations of Logic and Mathematics Applications to Computer Science and Cryptography

This modern introduction to the foundations of logic and mathematics answers many questions that usually remain unanswered: Why is the truth table for implication so bizarre? Why are there no recipes to design proofs? Where do these numerous mathematical rules come from? And the perennial question: In what ways are we going to use this material?

Foundations of Logic and Mathematics takes into account not only theory, but also treats applications that have substantial impact on everyday life: bar codes, public cryptography (Rivest-Shamir-Adelman codes), transportation networks.

Additional topics covered: truth tables, propositional and predicate calculi, set theory, theory and practice of basic arithmetic, cardinality, well-formed sets, completeness and incompleteness of various logics, number theory, combinatorics, and graph theory. A key strength of the presentation is the continuous thread from logic to applications, without gaps. Thus, material that is necessary for logical coherence—omitted from most texts—is found here.

The text is a college level introduction to logic, proofs, sets, number theory, and graph theory for undergraduates majoring in mathematics, computer science, and computer information systems.

OCTOBER 2001/APPROX. 480 PP./HARDCOVER/ISBN 0-8176-4249-8/\$64.95 (TENT.)

More from Nievergelt

R. Narasimhan, *University of Chicago, Illinois* and
Y. Nievergelt

Complex Analysis in One Variable Second Edition

"An excellent, carefully written and thematically rich book... Well-suited as a textbook either for sophisticated beginners or as a sequel to a one-semester introductory course." —*Jahresbericht der DMV (on the 1/e)*
2000/400 PP., 17 ILLUS./HARDCOVER/ISBN 0-8176-4164-5/\$59.95

Y. Nievergelt

Wavelets Made Easy

"Explains in a nice way the nature and computation of mathematical wavelets..." —*Jrnl. of Information and Optimization Sciences*

1999/2001, 2ND PRINTING/320 PP., 53 ILLUS./HARDCOVER
ISBN 0-8176-4061-4/\$39.95

New!

Y. Zheng, *Indiana University, Bloomington, IN*

Systems of Conservation Laws Two-Dimensional Riemann Problems

Introductory text for graduate students and researchers working in the area of partial differential equations with a focus on problems involving conservation laws. Emphasizes more recent results that will prepare readers to meet modern challenges in the subject, i.e., to carry out theoretical, numerical, and asymptotical analysis.

PROGRESS IN NONLINEAR DIFFERENTIAL
EQUATIONS AND THEIR APPLICATIONS, VOL. 38
2001/336 PP., 143 ILLUS./HARDCOVER
ISBN 0-8176-4080-0/\$69.95

Forthcoming!

R. Schinazi, *University of Colorado, Colorado Springs, CO*

Probability with Statistical Applications

This concise text is intended for a one-semester course, and offers a practical introduction to probability for undergraduates at all levels with different backgrounds and views towards applications. Many undergraduate programs in biology, computer science, engineering, physics, and mathematics have traditionally required such a course. Only basic calculus is needed, however, the book is written so that the calculus difficulties of students do not obscure the probability content in the first six chapters. Thus, the exposition initially focuses on fundamental probability concepts and an easy introduction to statistics. Motivation, theory, and explanations are kept to a minimum throughout, the striking feature being numerous exercises and examples.

AUGUST 2001/APPROX. 224 PP./SOFTCOVER
ISBN 0-8176-4247-1/\$44.95 (TENT.)

Also by Schinazi

Classical and Spatial Stochastic Processes

"An appetizing textbook for a first course in stochastic processes... All essential facts are presented with clear proofs, illustrated by beautiful examples... A good balance of mathematical rigorosity and user-friendly explanation."

—*Biometric Journal*

1999/178 PP./HARDCOVER/ISBN 0-8176-4081-9/\$54.95

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Forthcoming!

F.H. Hehl, *University of Cologne, Germany* and
Y.N. Obukhov, *Moscow Lomonosov State University, Russia*

Foundations of Classical Electrodynamics

Presents the foundations of classical electrodynamics with particular attention to mathematical axioms based on physical concepts at a level suitable for advanced undergraduates and graduates. Basic mathematical tools that motivate and supply the framework of the book are developed in introductory chapters. More advanced material at the forefront of current research is presented in later chapters. Includes rigorous proofs, examples, open questions, exercises, bibliography, and index.

PROGRESS IN MATHEMATICAL PHYSICS
NOVEMBER 2001/APPROX. 320 PP., 20 ILLUS./HARDCOVER
ISBN 0-8176-4222-6/\$69.95 (TENT.)

Forthcoming!

B.S.W. Schröder, *Louisiana Tech University, Ruston, LA*

Ordered Sets An Introduction

An introduction to the basic tools of the theory of (partially) ordered sets such as visualization via diagrams, subsets, homomorphisms, important order-theoretical constructions and classes of ordered sets. Using a thematic approach, the author presents open or recently solved problems to motivate the development of constructions and investigations for new classes of ordered sets. A wide range of material is presented from classical results to more recent results such as the Li-Milner Structure Theorem. Rich in exercises and open problems, *Ordered Sets* will be a valuable text for undergraduate/graduate students and an excellent resource for the researcher.

NOVEMBER 2001/APPROX. 420 PP., 35 ILLUS./HARDCOVER
ISBN 0-8176-4128-9/\$49.50 (TENT.)

New!

L.A. Peletier, *Leiden University, Leiden, The Netherlands* and
W.C. Troy, *University of Pittsburgh, Pittsburgh, PA*

Spatial Patterns Higher Order Models in Physics and Mechanics

Offers a study of nonlinear higher order model equations central to the description and analysis of spatio-temporal pattern formation in the natural sciences. Through a unique combination of results obtained by rigorous mathematical analysis and computational studies, the text exhibits the principal families of solutions, such as kinks, pulses and periodic solutions, and their dependence on critical eigenvalue parameters. The exposition first focuses on a single equation to achieve optimal transparency, and then branches out to wider classes of equations. Intended for mathematicians, mathematical physicists, and graduate students.

PROGRESS IN NONLINEAR DIFFERENTIAL
EQUATIONS AND THEIR APPLICATIONS, VOL. 45
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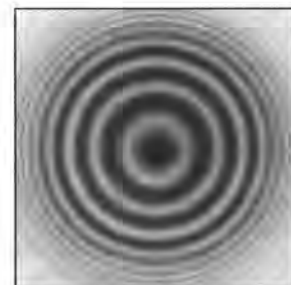
of the American Mathematical Society

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793 Quantum Spaces and Their Noncommutative Topology

Joachim Cuntz

The author explains a uniform approach to two fundamental theories of noncommutative geometry: namely, cyclic homology and bivariant topological K-theory.



800 George Keith Batchelor (1920-2000) and David George Crighton (1942-2000) Applied Mathematicians

G. I. Barenblatt

Last year, British mathematics lost two major figures, who are here remembered.



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Reviewed by Martin Davis

Notices

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SUBSCRIPTION INFORMATION: Subscription prices for Volume 48 (2001) are \$340 list; \$272 institutional member; \$204 individual member. (The subscription price for members is included in the annual dues.) A late charge of 10% of the subscription price will be imposed upon orders received from nonmembers after January 1 of the subscription year. Add for postage: Surface delivery outside the United States and India—\$17; in India—\$38; expedited delivery to destinations in North America—\$35; elsewhere—\$70. Subscriptions and orders for AMS publications should be addressed to the American Mathematical Society, P.O. Box 845904, Boston, MA 02284-5904. All orders must be prepaid.

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[*Notices of the American Mathematical Society* is published monthly except bimonthly in June/July by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2294. Periodicals postage paid at Providence, RI, and additional mailing offices. POSTMASTER: Send address change notices to *Notices of the American Mathematical Society*, P.O. Box 6248, Providence, RI 02940-6248.] Publication here of the Society's street address and the other information in brackets above is a technical requirement of the U.S. Postal Service. Tel: 401-455-4000 e-mail: notices@ams.org.

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Archimedes and the Internet

Gedanken sind zollfrei, Martin Luther is supposed to have said—thoughts are toll-free. What about knowledge, in its modern electronic form? Should there be tolls on the information superhighway? Two recent experiences got me thinking about this question in the context of mathematical publication.

A colleague wandered into my office the other day, scratching his head in puzzlement. “I just got an e-mail from someone in Romania who wants a reprint of my paper in [well-known journal]. But the paper isn’t published yet! How in the world did someone find out about it?” I clicked the left mouse button in my Web browser exactly six times. “Eureka!” I cried, echoing Archimedes, “I have found it. Although the text of that journal is not online, the table of contents of the next issue is, and it lists your forthcoming article.”

The next day I received from Australia an e-mail request for an English translation that I published in 1983 of an article in the Russian mathematical literature. No electronic copy of that paper exists: the back issues of the journal have never been digitized, and in 1983 I was still using a typewriter. I had to write back asking for a postal address to which I could send a photocopy of the article.

These stories illustrate the state of electronic publication today. To *locate* scientific information by electronic means is typically straightforward, but to *obtain* the information electronically is often impossible. Sitting at the computer in my office, I can learn that my university holds a copy of Ver Eecke’s French translation of the works of Archimedes, but to read the text I must walk to the library and pull the physical book off the shelf. Will this situation soon change?

Tantalizing hints of an affirmative answer are already visible in MathSciNet (<http://www.ams.org/mathscinet/>), the electronic version of *Mathematical Reviews*, and in its European counterpart, the Zentralblatt MATH database (<http://www.emis.de/ZMATH/>). These compendia of reviews exploit the interconnectivity of the World Wide Web to provide links to the full text of many online articles at various publishers’ websites. Most publishers, however, restrict access to the articles to subscribers or to subscribing institutions.

Another vision of the future of electronic availability of scientific publications is the arXiv (<http://arXiv.org/>). Many physics preprints of the past decade are available there, and the mathematics collection is growing rapidly. Several journals, notably including the *Annals of Mathematics*, now contribute their articles to the arXiv after publication, thus guaranteeing that their contents will remain permanently and freely available in electronic form. If a large number of journals were to follow this lead, the arXiv

could metamorphose from a preprint archive into a comprehensive digital library of the periodical mathematical literature.

Is such a development a realistic possibility? Some believe that it is not only achievable but inevitable, not only in mathematics but in other sciences also. To increase the momentum, thousands of researchers have signed an open letter at <http://www.publiclibraryofscience.org/> calling on publishers of scientific periodicals to allow the full text of articles that appear in their journals to be included in free online public libraries within six months of publication. The plea is backed by a threat that uncooperative publishers will lose not only the subscriptions of signatories but also their free services as authors, reviewers, and editors. Scientific researchers dedicate their lives to building up the edifice of human knowledge. Surely it is reasonable—so goes the argument—that once publishers recoup the expenses they incur in helping to paint the structure, they should then relinquish any claim to ownership of the building.

The value of a public database of journal articles goes far beyond easy access to the literature. The “killer application” of such a database will be electronic searching of the full text of articles. For example, I recently became curious about the history of an old chestnut of integral calculus: Find the volume of the intersection of two right circular cylinders of equal radius whose axes meet at right angles. An electronic search at JSTOR (a subscription service at <http://www.jstor.org/>) located numerous variations of this problem in the *American Mathematical Monthly*, the earliest in 1895. But too little of the scientific literature is currently available in searchable electronic form to yield definitive answers to such historical questions. Indeed, the problem about the intersecting cylinders actually dates back over two millennia to the *Method* of Archimedes, the only extant source for which is a palimpsest auctioned at Christie’s in 1998 for \$2 million.

I prefer to think of scientific knowledge as a shared public resource rather than as a commodity to be sold to the highest bidder. The success of T_EX, the freely available, high-quality software that we mathematicians use to write our papers, provides a model for the triumph of generous collegiality over greedy commercialism. “Give me a place to stand,” Archimedes is supposed to have said, describing the principle of the lever, “and I will move the world.” How much leverage will we apply to move the world toward online public repositories of our common scientific knowledge?

—Harold P. Boas, Editor

Letters to the Editor

Foundations of Mathematics

My colleagues and I working in foundations of mathematics and in mathematical logic were pleased to see that Saharon Shelah has been recognized by the Wolf Prize. His prolific achievements in model theory and set theory are truly remarkable.

I would only add that the prize jury's citation, as reported in the *Notices* (May 2001, pages 502-3), contains a somewhat inaccurate characterization of Shelah's impressive work as "foundations of mathematics and mathematical logic." The distinction between these two fields is crucially important to a large number of logicians and philosophers and needs to be better understood in the mathematical and wider intellectual communities. "Foundations of mathematics" is the study of the most basic concepts and logical structure of mathematics as a whole. "Mathematical logic" is a set of related technical tools and research directions, many of which have taken on a life of their own, independent of the original foundational aims.

Harvey Friedman and I in 1997 jointly founded an e-mail list for discussing foundations of mathematics. It can be accessed at <http://www.math.psu.edu/simpson/fom/>.

—Stephen G. Simpson
 Pennsylvania State University

(Received May 17, 2001)

Refereeing and Reviewing

In an October 1998 commentary (*Notices* 45, p. 1117), Steven G. Krantz noted that mathematicians in general see no evil and speak no evil on certain important subjects. I am willing to take the risk of expressing a criticism of the present state of the processes of refereeing and reviewing. As Mary Beth Ruskai was bold enough to review "Featured Reviews" (*Notices*, May 1999, p. 517), most of my comments will be directed at journal editing.

In an August 2000 article (*Notices* 47, pp. 770-4), Joan S. Birman states that "In mathematics, papers are refereed in a careful and serious way.... Consultations will be made to locate a referee who has the skill and time to do the job.... The refereeing process adds value to the paper...." This is how ideally the system should work. We all read mathematical papers and



submit ones, most of us referee at least occasionally, many of us served as editors or members of editorial boards. Does the picture portrayed by Birman conform to our first-hand experiences?

How often did you read a trivial paper and question the expertise of the referee who accepted it? On the other hand, how often did you encounter (as an author) malicious, arrogant, or outright ignorant referees? How frequently did the refereeing process "add value" to your paper? (My own estimate, based upon my own papers, lies between 5 and 10 percent—and this does not at all mean that my other papers could not benefit significantly from serious refereeing.) As a result, a typical author feels relieved rather than exhilarated when the paper is finally accepted (sometimes after a struggle which has lasted several years).

Now a person waits apprehensively for the review in *Mathematical Reviews* (MR). Most likely, the review is

not something to look forward to. Worst are those where MR decided that the author's summary is enough. The interpretation lies somewhere between "The author has done such a super job, it will be difficult for a reviewer to surpass it" and "We do not feel that this lousy paper in a tenth-rate miserable subject deserves spending the precious time and efforts of our hard-pressed referees." I leave it as an exercise to determine which interpretation is closer to the truth (or at least to the perception generated by MR).

Of course we all know that editors in chief are, generally speaking, honest, dedicated, and hard-working individuals. We are also aware of the difficulty in finding competent referees who are willing to invest the required effort. At the end compromises are made and errors of all types (accepting papers which should not be accepted, rejecting good papers) are abundant. The same applies to the agonizing decisions which have to be made by the editors of *Mathematical Reviews*. However, since promotions, tenure, and scientific careers

are often at stake, it would be far better if the system would operate more equitably than it does. (The horror story told by Abraham A. Ungar in a letter (*Notices*, December 2000, p. 1358) shows that problems exist in peer reviews of grant proposals as well.)

A simple solution is not at hand. Perhaps editors, referees, and reviewers should be both better compensated and more accountable than at present. One feels that, far from being satisfied with our system, our profession should think hard of ways and means to correct its most obvious deficiencies.

—Yakar Kannai
 The Weizmann Institute of Science
 Rehovot, Israel

(Received May 22, 2001)

The *Notices* invites readers to submit letters and opinion pieces on topics related to mathematics. Electronic submissions are preferred; see the masthead for addresses. Opinion pieces are usually one printed page in length (about 800 words). Letters are normally less than one page long, and shorter letters are preferred.

Council Inaction: Eugene Gutkin and the University of Southern California

The purpose of this letter is to bring the following sequence of related events to the attention of the membership of the Society.

1. On March 16, 2000, University of Southern California (USC) president Steven Sample dismissed Eugene Gutkin, a *tenured* professor of mathematics.

2. The Society's Committee on Academic Freedom, Tenure and Employment Security (CAFTES) was asked to intervene in the dispute between USC and Gutkin and submitted a report to the Council for its January 2001 meeting calling for specific action.

3. During the first portion of an executive session of the Council's January 2001 meeting, CAFTES and USC were represented, but Gutkin was not. USC counsel also sent a letter to the secretary of the Society that, to the best of our knowledge, has not been seen by CAFTES members.

4. In the second portion of the same executive session of the Council's January 2001 meeting, it decided to neither accept nor reject the CAFTES report. President Browder asked CAFTES members to keep its report and a memorandum it prepared on "The Findings of Fact" strictly confidential.

5. On March 22, 2001, CAFTES requested that the Council reopen the USC/Gutkin matter and that the published Council minutes show that the CAFTES report dealt with the dismissal of a tenured faculty member by USC. A "stronger" minority report by the undersigned was also submitted to the Council.

6. At the April 2001 meeting of the Council, the CAFTES proposal was defeated. The minority report never made it to the floor.

7. In early March the undersigned were informed that their tenure on CAFTES had ended on January 31. Two new members were appointed. The undersigned were *not* asked if they wished to be reappointed, as is the practice for many AMS committees. In late April, James Heitsch resigned his position as chairman of CAFTES.

—Irwin Kra
SUNY at Stony Brook
—Seymour Schuster
Carleton College

(Received May 30, 2001)

Response to Kra-Schuster Letter

The sensitive personnel issues treated by CAFTES are examined in closed executive session of the Council and do not appear in the Society's open records. Respecting that tradition, I cannot comment about particulars of the matter addressed by Kra and Schuster except to mention that, while recognizing CAFTES acted diligently and in good faith, after lengthy presentations and careful study the Council decided not to adopt the committee's recommendations but instead to refer the matter to the AAUP [American Association of University Professors].

—Robert J. Daverman
AMS Secretary

(Received June 13, 2001)

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Quantum Spaces and Their Noncommutative Topology

Joachim Cuntz

Noncommutative geometry studies the geometry of “quantum spaces”. Put a little more prosaically, this means the “geometric properties” of noncommutative algebras (say, over the field \mathbb{C} of complex numbers). Such algebras include, for instance,

- algebras of pseudodifferential operators, algebras of leafwise differential operators on foliated manifolds, algebras of differential forms, group algebras or convolution algebras for groupoids;
- noncommutative or “quantized” versions of familiar algebras such as algebras of functions on spheres, on tori, on simplicial complexes, or on classifying spaces;
- genuinely new noncommutative algebras, for instance, ones motivated by quantum mechanics.

The underlying philosophy is based on the observation that various categories of spaces can be completely described by the (commutative) algebras of functions on them (a locally compact space by the algebra of continuous functions, a smooth manifold by the algebra of smooth functions, an affine algebraic variety by its coordinate ring). The idea then is that a noncommutative algebra can be viewed as an algebra of functions on a virtual “noncommutative space”. This approach is very flexible: for instance, it covers the algebra of functions on a manifold, the algebra of pseudo-

differential operators, and the algebra of differential forms all on the same footing.

Now, what is a “geometric” property of a noncommutative algebra? How can one describe characteristic classes or additional structures like a Riemannian metric for a noncommutative algebra? These questions are what noncommutative geometry is all about; see the fascinating book by Connes [5].

The two fundamental “machines” of noncommutative geometry are cyclic homology and (bivariant) topological K -theory. Cyclic theory can be viewed as a far-reaching generalization of the classical de Rham cohomology, while bivariant K -theory includes the topological K -theory of Atiyah-Hirzebruch as a very special case.

Bivariant K -theory was first defined and developed by Kasparov on the category of C^* -algebras, thereby unifying and decisively extending previous work by Atiyah-Hirzebruch, Brown-Douglas-Fillmore, and others. Kasparov also applied his bivariant theory to obtain striking positive results on the Novikov conjecture. Very recently, it was discovered that bivariant topological K -theories can be defined on a wide variety of topological algebras ranging from discrete algebras and very general locally convex algebras to Banach algebras or C^* -algebras.

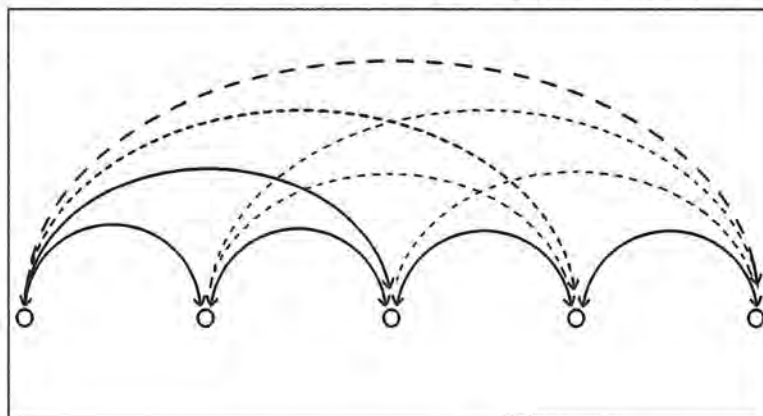
Cyclic theory is a homology theory developed independently by Connes and by Tsygan, who were motivated by different aspects of K -theoretic constructions. It was immediately realized that cyclic homology has close connections with de Rham theory, Lie algebra homology, group cohomology, and index theorems.

Joachim Cuntz is professor of mathematics at the Universität Münster, Germany. His e-mail address is cuntz@math.uni-muenster.de.

It is important to note that the new theories are by no means simply generalizations of classical constructions. In fact, in the commutative case they provide a new approach and a quite unexpected interpretation of the well-known classical theories. Essential properties of the two theories become visible only in the noncommutative category. For instance, both theories have certain universality properties in this setting.

Let us have a look at the kind of geometric information that the two theories give us for a number of simple "quantum spaces". The formal definition of the cyclic and K -theory classes mentioned in these examples will be explained in the subsequent section. The technical definition is not necessary for an intuitive grasp of the situation.

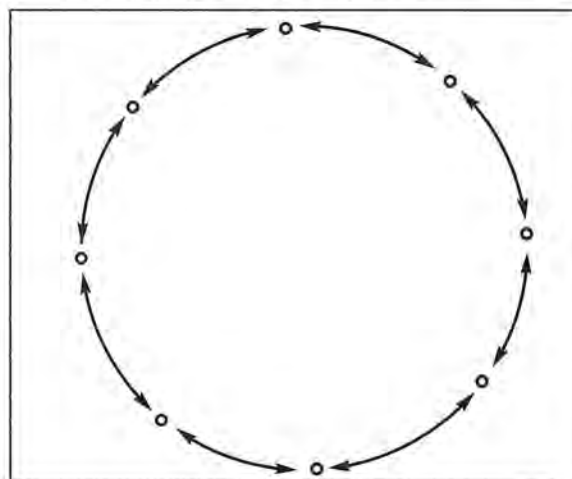
1. **The space with n points and noncommutative connections.** This space has n points and arrows between every two points. As an algebra it is described by the algebra $M_n(\mathbb{C})$ of $n \times n$ -matrices (the functions on the n points corresponding to the diagonal matrices). Both



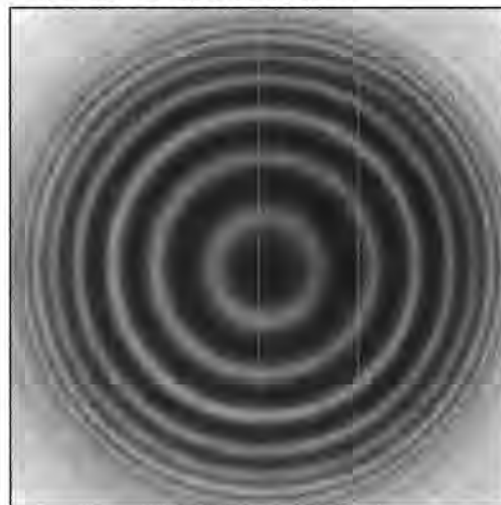
K -theory and cyclic theory see one even cohomology class and no odd classes. In both theories the nontrivial even class is 0-dimensional, and there are no higher cohomology classes. Since there is one class representing the equivalence class of the n points and no higher dimensional classes, $M_n(\mathbb{C})$ looks like a connected 0-dimensional space.

This is the simplest case of a convolution algebra for a groupoid. In general a (topological) groupoid consists of a space of objects and a family of (invertible) arrows which can be considered as above as noncommutative paths between the objects. For the noncommutative homology theories, different points connected by an arrow will be homologous. Higher homology classes can also arise from configurations of arrows (like a loop of arrows), from mixed configurations involving arrows and objects, or even from linear combinations of such things. Consider, for instance, the algebra determined by linear combinations of all

possible paths in the following graph. It possesses, besides the 0-dimensional class given by the equivalence class of the points, a one-dimensional class coming from the path around the circle (contrary to the case of $M_n(\mathbb{C})$, we assume here that this path is different from the trivial path).



2. **The phase space in quantum mechanics.** This is described by the unital algebra $A(p, q)$ generated by two generators p and q satisfying the Heisenberg relation $pq - qp = 1$ (sometimes this is called the Weyl algebra). There is at present no calculation of the K -theory for this algebra (or its C^∞ -completion). The cyclic theory sees one two-dimensional cohomology class and no classes in dimensions different from 2. Thus we have here a noncommutative space that is two-dimensional (say, looks like a 2-plane). However, not only does this "space" have no points, it does not even have any equivalence class of a point.

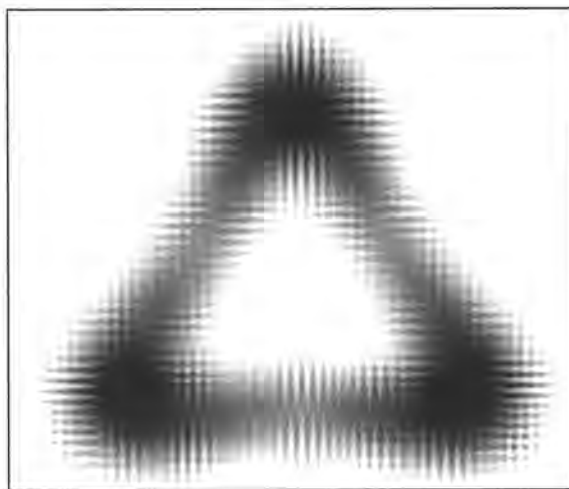


3. **The noncommutative 2-torus.** This is the involutive unital algebra A_θ given by power

series with rapidly decreasing coefficients in two generators u and v satisfying the relations $uu^* = u^*u = vv^* = v^*v = 1$ and $vu = e^{2\pi i\theta}uv$ for a fixed real number $\theta \in [0, 1]$. Each pair $\{u, u^*\}$ and $\{v, v^*\}$ of generators generates a commutative subalgebra isomorphic to the algebra of C^∞ -functions on the circle. If $\theta = 0$, then these subalgebras commute and A_θ will be isomorphic to the algebra of C^∞ -functions on the 2-torus $S^1 \times S^1$. The K -theory for A_θ contains two even- and two odd-dimensional classes. The cyclic theory shows more precisely that one of the even classes is 0-dimensional and the other one is 2-dimensional. The two odd classes are both 1-dimensional (and are represented by the 1-forms $u^{-1}du$ and $v^{-1}dv$). Thus, from this point of view the noncommutative torus looks exactly like an ordinary 2-torus.



dimension of a cyclic cohomology class for C_Σ is, however, much larger than the dimension d of the corresponding commutative homology class (it is of the order of 3^d). There is also a degree filtration on the K -homology for locally convex algebras. The K -homology degree of a K -homology class for C_Σ is the same as the dimension of the corresponding commutative homology class.



In these examples the K -theory and the cyclic classes have been used to describe the “shape” of a noncommutative space. This is by no means the only function of these invariants. They also are the main tool to describe other topological information, such as gluing data in extensions and indices of operators.

4. **Noncommutative simplicial complexes.** Let Σ be a finite simplicial complex given by its set of vertices V and by its simplices, represented by finite subsets F of V . We can associate with Σ a noncommutative algebra C_Σ in the following way. Let C_Σ be the unital algebra given by power series with rapidly decreasing coefficients in generators h_s ($s \in V$) satisfying the following relations:

- $\sum_{s \in V} h_s = 1$;
- if $\{s_0, s_1, \dots, s_n\}$ is not in Σ , then the product $h_{s_0}h_{s_1} \dots h_{s_n}$ is zero.

(Note that when we introduce the additional relation that the generators commute, we get an algebra isomorphic to an algebra of C^∞ functions on the geometric realization of Σ .) The K -theory and the periodic cyclic homology for C_Σ are isomorphic respectively to the K -theory and the $\mathbb{Z}/2$ -graded singular cohomology of the geometric realization of Σ . The

In this article we sketch a uniform approach to cyclic theory and bivariant K -theory, which in fact can be made to work for many different categories of algebras. This approach emphasizes the analogy of cyclic theory with de Rham theory and the connection between K -theory and extensions. It leads in a natural way to the fundamental properties of both theories. We will also explain the construction of the bivariant Chern-Connes character taking bivariant K -theory to bivariant cyclic theory. The existence of this multiplicative transformation has been obtained in full generality only very recently (important special cases had been considered by Connes and others, e.g., [4], [12]) as a result of progress both on the cyclic homology side and on the K -theory side [9], [6]. It is a vast generalization of the classical Chern character in differential geometry and allows one to associate “characteristic classes” with K -theoretic objects.

I am indebted to my sons, Nicolas and Michael, for the illustrations to the examples above. Since these pictures have no technical meaning, they are only meant to provide a kind of suggestive visualization of the corresponding quantum spaces.

**The Noncommutative de Rham Complex—
or How to Extract Commutative
Information from a Quantum Space**

Any noncommutative algebra A can be abelianized by dividing out the ideal generated by all commutators. This procedure, however, destroys the relevant information in nearly all interesting cases. In fact, the abelian quotient typically is zero (this is the case in examples 1, 2, and 3 above).

A more promising approach consists in dividing only by the linear space of commutators or, dually, in considering traces on A . A trace is by definition a linear functional f on A such that

$$f(xy) = f(yx)$$

for all x and y in A . To describe topological information, the strategy then is to consider homotopy classes of traces. What is homotopy for traces, and how can this be formulated algebraically?

An answer is provided by the simple X -complex introduced by Quillen [14] in connection with differential graded algebras and then used systematically in [7], [8], [9].

Let A be an algebra. The space $\Omega^1 A$ of abstract 1-forms over A is defined as the bimodule consisting of linear combinations of expressions of the form $xd(y)$ with $x \in \tilde{A}$ and $y \in A$, where \tilde{A} is the unitization of A . The bimodule structure is given by the rules

$$a(xdy) = axdy \quad (xdy)a = xd(ya) - xyda, \quad a \in A$$

(that is, one introduces the relation $d(xy) = xdy + d(x)y$). A trace on $\Omega^1 A$ is a linear functional f such that $f(aw) = f(\omega a)$ for $a \in A$ and $\omega \in \Omega^1 A$.

The (dual) X -complex $X'(A)$ is the $\mathbb{Z}/2$ -graded complex

$$\{\text{functionals on } A\} \xrightarrow{\beta} \{\text{traces on } \Omega^1 A\}.$$

The boundary operators are defined by $(\delta f)(x) = f(dx)$ and $(\beta f)(xdy) = f([x, y])$. It is straightforward to check that $\beta\delta = \delta\beta = 0$.

This complex has only two homology groups, namely, the even and the odd homology. The even homology HX^{ev} is the space of traces—linear functionals on A that vanish on commutators—divided by the space of “derivatives” of traces—linear functionals of the form $f \circ d$, where f is a trace on $\Omega^1 A$. This quotient can be considered rightfully as the space of homotopy classes of traces on A . Arguing similarly for the odd homology, we obtain

$$HX^{ev}(A) = \{\text{homotopy classes of traces on } A\}$$

$$HX^{od}(A) = \{\text{classes of closed traces on } \Omega^1 A\}$$

where a trace f is closed if $f \circ d = 0$.

There is a natural complex $X(A)$ for which $X'(A)$ is the dual: namely,

$$A \xrightarrow{\delta} \Omega^1 A \xrightarrow{\beta}$$

where $\Omega^1 A \xrightarrow{\beta}$ is the quotient $\Omega^1 A/[A, \Omega^1 A]$ of $\Omega^1 A$ by commutators, $\beta : \Omega^1 A \rightarrow \Omega^1 A \xrightarrow{\beta}$ is the quotient map, and the boundary operators are defined by $\delta(x) = dx$ and $\beta(\xi(xdy)) = [x, y]$.

It is certainly somewhat surprising that the extremely simple complex $X(A)$ should play the role of the de Rham complex in noncommutative geometry. In the commutative case it obviously does not reduce to the de Rham complex. Its analogy with the de Rham complex will now be explained. This also leads to a new interpretation for the classical de Rham theory.

The starting point is that even though taking traces is a much milder procedure than abelianizing, it still leads to trivial results for many noncommutative algebras. Indeed, there are natural examples of algebras A for which no nontrivial traces exist. One is led to consider also traces on algebras related to A via an extension. An extension of A is an algebra E that admits A as a quotient (by an ideal I) or, in short, an exact sequence

$$0 \rightarrow I \rightarrow E \rightarrow A \rightarrow 0,$$

where the arrows are algebra homomorphisms. Extensions play a fundamental role in noncommutative geometry.

An algebra A is called quasi-free if in any extension of A where the ideal I is nilpotent (that is, $I^k = 0$ for some k), there is a homomorphism $A \rightarrow E$ that is a left inverse for the quotient map $E \rightarrow A$. This condition is formally nearly identical to the condition of smoothness introduced for commutative algebras and algebraic varieties by Grothendieck. Any free algebra is quasi-free.

The periodic cyclic cohomology $HP^*(A)$ of an algebra A , where $*$ = ev/od , is obtained by representing A as a quotient of a quasi-free algebra T by an ideal I and then writing

$$HP^*(A) = \varinjlim_n HX^*(T/I^n).$$

It is an important fact that this definition does not depend on the choice of the quasi-free resolution T . The homology $HX^*(T/I^n)$ is essentially the (non-periodic) ordinary cyclic cohomology $HC^{2n+*}(A)$.

It is not very difficult to see that one can alternatively obtain HP^* by the formula

$$(1) \quad HP^*(A) = \varinjlim_n HX^{*+1}(I^n)$$

where $ev + 1 = od$ and vice versa. In this picture a cyclic cocycle (of dimension $2n - 1$) is described by a trace on the n -th power of the ideal in an extension of A .

This definition of cyclic homology is manifestly quite different from the original definition by Connes or Tsygan. The proof that both definitions give the same result is nontrivial. Note that any

algebra A has a canonical quasi-free (even free) resolution given by the tensor algebra TA over A .

There is a striking analogy between periodic cyclic homology and Grothendieck's notion of infinitesimal homology which describes the topology of nonsmooth varieties in algebraic geometry. In this analogy quasi-free algebras play the role, in the noncommutative category, of smooth varieties, and the X -complex corresponds to the de Rham complex.

In fact, in algebraic geometry the infinitesimal cohomology is defined by writing the coordinate ring A of the variety as a quotient S/I of the coordinate ring of a smooth variety S and by taking the de Rham cohomology of the completion $\hat{S} = \varprojlim^n S/I^n$. It can be shown that this does not depend on the choice of the embedding into a smooth variety. This procedure is exactly analogous to the definition of periodic cyclic cohomology above, where we write A as a quotient of a quasi-free algebra T and then take the homology $HX^*(\hat{T})$.

Given two algebras A_1 and A_2 , we can also define the bivariate periodic cyclic theory $HP_*(A_1, A_2)$, where $*$ = 0, 1, as the homology of the Hom-complex between the X -complexes associated with quasi-free extensions for A_1 and A_2 . There is a natural composition product

$$HP_i(A_1, A_2) \times HP_j(A_2, A_3) \longrightarrow HP_{i+j}(A_1, A_3).$$

Any algebra homomorphism $\alpha : A \rightarrow B$ determines an element $HP(\alpha)$ in $HP_0(A, B)$.

The periodic cyclic theory $HP_i(A_1, A_2)$ has very good properties. It can be shown that it is invariant under differentiable homotopies and under Morita invariance in both variables. Moreover, by [9] it satisfies "excision" in the following sense.

Let D be any algebra. Every extension $0 \rightarrow I \xrightarrow{i} A \xrightarrow{q} B \rightarrow 0$ induces exact sequences in $HP_*(D, \cdot)$ and $HP_*(\cdot, D)$ as follows:

$$\begin{array}{ccccc} HP_0(D, I) & \xrightarrow{HP(i)} & HP_0(D, A) & \xrightarrow{HP(q)} & HP_0(D, B) \\ \uparrow & & & & \downarrow \\ HP_1(D, B) & \xrightarrow{HP(q)} & HP_1(D, A) & \xrightarrow{HP(i)} & HP_1(D, I) \end{array}$$

and

$$\begin{array}{ccccc} HP_0(I, D) & \xrightarrow{HP(q)} & HP_0(A, D) & \xrightarrow{HP(i)} & HP_0(B, D) \\ \downarrow & & & & \uparrow \\ HP_1(B, D) & \xrightarrow{HP(i)} & HP_1(A, D) & \xrightarrow{HP(q)} & HP_1(I, D) \end{array}$$

Special cases of these exact sequences had been obtained before in [10] and [16]. They are one of the main tools in the computation of the cyclic homology invariants.

Embedding Quantum Spaces into Smooth Spaces—Extensions and K -Theory

Over the years (see, e.g., [3], [11], [4], [6]) it has become evident that the single most important notion in noncommutative topology is the one of an extension. As already mentioned above, an extension of an algebra A is an exact sequence

$$0 \rightarrow I \rightarrow E \rightarrow A \rightarrow 0$$

where the arrows are algebra morphisms. Dually, and intuitively, such an extension corresponds to embedding the quantum space corresponding to A into the quantum space corresponding to E .

To illustrate the kind of topological information contained in an extension, we mention that the content of the Atiyah-Singer index theorem [1] may be viewed as the determination of the class of the extension defined by the pseudodifferential operators on a compact manifold. Other index theorems are concerned with more complicated extensions.

We are now going to sketch a general construction, based on extensions, of (bivariate) topological K -theory that works for many categories of noncommutative algebras and fits nicely with the definition of cyclic theory outlined above. As a result there will be a natural transformation, the bivariate Chern-Connes character, from topological K -theory to cyclic theory.

To be more specific, we will assume from now on that all our algebras are topological algebras with a complete locally convex structure given by a family of seminorms (p_α) satisfying $p_\alpha(xy) \leq p_\alpha(x)p_\alpha(y)$ for all x and y in the algebra. For any such locally convex algebra A , the algebraic tensor algebra $A \oplus A^{\otimes 2} \oplus A^{\otimes 3} \oplus \dots$ has a natural completion TA which is a locally convex algebra. There is a canonical algebra homomorphism $TA \rightarrow A$ mapping $x_1 \otimes \dots \otimes x_n$ to the product $x_1 x_2 \dots x_n$. We denote the kernel by JA , so that we get a free resolution for A of the form

$$0 \rightarrow JA \rightarrow TA \rightarrow A \rightarrow 0,$$

which can be viewed as an embedding of the quantum space corresponding to A into the smooth quantum space corresponding to TA . The ideal corresponds to the complement of the image of the quantum space for A . Since JA is again a locally convex algebra, we can iterate the construction and form $J^2A = J(JA)$ and, inductively, $J^nA = J(J^{n-1}A)$.

With a locally convex algebra B , we can also associate the algebra $M_\infty(B)$ of infinite matrices $(b_{ij})_{i,j \in \mathbb{N}}$ with rapidly decreasing matrix elements in B . The corresponding quantum space looks like the one in example (1) of the introduction. It has infinitely many points, which are labeled by \mathbb{N} , and arrows between the points, which are labeled by all possible elements of B . A fundamental extension, using pseudodifferential operators on

the circle, shows that for any A there exists a canonical homomorphism $J^2A \rightarrow M_\infty(B)$. This map can be used to form the inductive limit in the following definition.

Let A and B be locally convex algebras, and $*$ = 0 or 1. We define

$$kk_*(A, B) = \varinjlim_k [J^{2k+*}A, M_\infty(B)],$$

where $[J^{2k+*}A, M_\infty(B)]$ denotes the set of (differentiable) homotopy classes of homomorphisms $J^{2k+*}A \rightarrow M_\infty(B)$. Provided with the ordinary direct sum addition of maps into matrices, $kk_*(A, B)$ is an abelian group.

Since taking the homology of the X -complex is an algebraic version of taking homotopy classes, this definition is formally remarkably similar to the definition of periodic cyclic theory in equation (1) in the preceding section.

This bifunctor kk_* has the same abstract properties as HP^* (see the preceding section). In particular:

- Every homomorphism $\alpha : A \rightarrow B$ induces an element $kk(\alpha)$ in $kk_0(A, B)$.
- There is an associative product $kk_i(A, B) \times kk_j(B, C) \rightarrow kk_{i+j}(A, C)$ (where $i, j \in \mathbb{Z}/2$, and A, B , and C are locally convex algebras) that is additive in both variables and that satisfies $kk(\alpha)kk(\beta) = kk(\alpha\beta)$ for two homomorphisms α and β .
- kk_* is homotopy invariant and satisfies excision in both variables (as described in the preceding section). The canonical map $B \rightarrow M_\infty(B)$ induces an isomorphism in both variables of kk_* .

In fact, one can show that kk_0 is the universal functor from the category of locally convex algebras as above into an additive category satisfying the third property.

Even though this construction of K -theory looks really different from the usual approach using projections or projective modules, it turns out that when we specialize the first variable to a point, i.e., to the algebra \mathbb{C} of complex numbers, $kk_*(\mathbb{C}, B)$ is nothing but the usual K -group in the case where B is a Banach algebra [2] or a Fréchet algebra [13] (the cases in which the usual K -theory is defined).

Another important property is that any extension, or more generally any “ n -step” extension of the form

$$0 \rightarrow B \rightarrow E_1 \rightarrow \cdots \rightarrow E_n \rightarrow A \rightarrow 0,$$

gives an element in $kk_n(A, B)$ where n is counted modulo 2. In homological algebra one uses a well-known product on such extensions, known as the Yoneda product, which consists simply in splicing together two such extensions. This product is compatible with the product

$$kk_n(A, B) \times kk_m(B, C) \rightarrow kk_{n+m}(A, C).$$

The pseudodifferential operators on a smooth compact manifold give rise to an extension

$$0 \rightarrow \Psi_{-1} \rightarrow \Psi_0 \rightarrow C^\infty(S^*M) \rightarrow 0,$$

where Ψ_{-1} and Ψ_0 denote the algebras of pseudodifferential operators of order -1 and 0 , respectively, and $C^\infty(S^*M)$ denotes the algebra of smooth functions on the cosphere-bundle of M . The problem solved by the Atiyah-Singer index theorem is exactly the determination of the class in $kk_1(C^\infty(S^*M), \Psi_{-1})$ defined by this extension.

The Bivariant Chern-Connes Character

The most important ingredient in the construction of a bivariant multiplicative transformation from kk_* to the bivariant theory HP_* on the category of locally convex algebras is the universality property of kk_0 mentioned at the end of the preceding section.

Since HP_0 satisfies the properties for which kk_0 is universal, we immediately obtain a transformation

$$ch : kk_0(A, B) \rightarrow HP_0(A, B)$$

which is compatible with the product.

In trying to extend this to a multiplicative transformation from the $\mathbb{Z}/2$ -graded theory kk_* to HP_* , one faces the problem that the product of two odd classes is defined differently in kk_* and in HP_* . It turns out that one has to introduce (somewhat arbitrarily) a factor of $\sqrt{2\pi i}$. With this proviso one does then obtain a transformation

$$ch : kk_*(A, B) \rightarrow HP_*(A, B)$$

which is multiplicative in full generality.

Both the cyclic cohomology $HP^*(A)$ and the K -homology $kk_*(A, \mathbb{C})$ have a natural (dimension) filtration due to their definitions as inductive limits. This dimension filtration was alluded to in the examples in the introduction.

The behaviour of these filtrations under the Chern-Connes character is well understood due to a very delicate analysis of the boundary map in the cyclic homology long exact sequence by M. Puschnigg and by R. Meyer. Given an element α in $kk_*(A, \mathbb{C})$, the dimension of $ch(\alpha)$ is bounded by 3^d , where d is the K -theoretic dimension of α . This estimate is optimal.

To close this article, we want to emphasize that despite their seemingly abstract definition, the cyclic theory and K -theory invariants can be computed very explicitly for a large variety of noncommutative algebras. Some typical examples were described in the introduction.

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About the Cover

The image on this month's cover arose from Joachim Cuntz's effort to render into visible art his own internal vision of a noncommutative torus, an object otherwise quite abstract. His original idea was then implemented by his son Michael in a program written in Pascal. More explicitly, he says that the construction started out with a triangle in a square, then translated the triangle by integers times a unit along a line with irrational slope; plotted the images thus obtained in a periodic manner; and stopped just before the figure started to seem cluttered.

Many mathematicians carry around inside their heads mental images of the abstractions they work with, and manipulate these objects somehow in conformity with their mental imagery. They probably also make aesthetic judgments of the value of their work according to the visual qualities of the images. These presumably common phenomena remain a rarely explored domain in either art or psychology.

—Bill Casselman (covers@ams.org)



George Keith Batchelor (1920–2000) and David George Crighton (1942–2000) Applied Mathematicians

G. I. Barenblatt

This is a memorial article about two great applied mathematicians, and I would like to start with a few words about the nature of applied mathematics. At the opening of the Congress on Industrial and Applied Mathematics at Hamburg, 3 July 1995, V. I. Arnold, unquestionably one of the most authoritative mathematicians of our time, said (see [1]),

A common (though commonly suppressed) opinion both of pure mathematicians and theoretical physicists concerning “industrial and applied” mathematics is that it consists of a mafia of weak thinkers, unable to produce any important scientific results, but simply exploiting the achievements of pure mathematicians of past generations, and that the members of this mafia are more interested in cash than in science and are hopelessly corrupted by this.

“They are so modest,” a pure mathematician once said, “that they do not hope to achieve anything in a direct honest way; they distance themselves from mathematicians simply to avoid honest competition.”

G. I. Barenblatt is professor of mathematics at UC Berkeley and mathematician, Lawrence Berkeley National Laboratory. His e-mail address is gibar@math.berkeley.edu.

I do not think that this characterization of applied mathematics was *completely* deserved. The achievements of Galileo devoted to business evoke no less admiration than the results of the pure philosopher Pascal.

The difference between pure and applied mathematics is not scientific but only social. A pure mathematician is paid for uncovering new mathematical facts. An applied mathematician is paid for the solution of quite specific problems.

In fact, the characterization of “industrial and applied” mathematics by unnamed pure mathematicians and theoretical physicists mentioned by V. I. Arnold is *completely* untrue. Also, what was said by Arnold himself about the purely social difference between pure and applied mathematicians is to say the least doubtful. Indeed, according to this characterization, Andrew Wiles, who proved the Fermat Theorem, would be an applied mathematician, whereas Pierre Fermat himself would not be a mathematician at all, because his paid profession was as a judge. Also, Pascal’s law, fundamental in hydrostatics, allows us to consider Blaise Pascal as an explorer of nature, not just as a pure philosopher.

In fact, the key to a correct understanding of the subject of applied mathematics and of the role and responsibilities of applied mathematicians lies in the famous saying of J. W. Gibbs:

Mathematics is also a language.

All people use language. However, we may distinguish among users of a language a particularly important group. They are the authors: poets, novelists, playwrights, essayists, etc., who create fictitious images and paradigms—idealized models of people and social phenomena. The greatest of these paradigms, like *Phaedra*, *Francesca da Rimini*, *Romeo and Juliet*, *Dr. Faust*, *Natasha Rostova*, *Anna Karenina*, and the events that surrounded them, continue to live for centuries. They transform human culture and, in particular, language itself.

To a certain extent, a similar role is played by applied mathematicians. Using the language of mathematics, developing and transforming it when necessary, applied mathematicians create their paradigms: models of phenomena, both in nature and in technology. These models give idealized but rather complete images of phenomena as a whole, enabling their mathematical analysis. The purpose of these models is to predict the behavior in unexplored ranges of the systems under study. When this goal is achieved, it leads to practical applications.

It is appropriate to cite here the opinion of John von Neumann [20]:

The sciences do not try to explain, they hardly even try to interpret, they mainly make models. By a model is meant a mathematical construct which, with the addition of certain verbal interpretation, describes observed phenomena. The justification of such a mathematical construct is solely and precisely that it is expected to work—that is, correctly to describe phenomena from a reasonably wide area.

Applied mathematicians create such models. It is difficult and exciting work to make models. This work is done through trial and error, starting and finishing by analysis of observations and experiments, both physical and numerical. It gives no less excitement and satisfaction than proving theorems in pure mathematics. We may say that to be a dedicated applied mathematician is an achievement, honour, and privilege. Great British applied mathematicians J. C. Maxwell, Lord Kelvin, Sir George Stokes, Sir Geoffrey Taylor, and, more recently, Sir James Lighthill created the style and atmosphere where G. K. Batchelor and D. G. Crighton lived and worked.

Turbulence

Turbulence is the state of vortex fluid motion where velocity, pressure, and other properties of the flow field vary in time and space sharply and irregularly and, it can be assumed, randomly. It remains to this day the greatest unsolved problem of classical physics. The phenomenon of turbulence was recognized and even named by Leonardo

da Vinci. Osborne Reynolds performed the first fundamental studies of turbulence in the late 1800s. Since that time an army of researchers has participated in these studies, including, without any exaggeration, the best minds of mankind: A. N. Kolmogorov, W. Heisenberg, L. Onsager, L. Prandtl, G. I. Taylor, and Th. von Kármán. Nevertheless, up to now almost nothing has been obtained in the theory of turbulence from first principles, i.e., from the Navier-Stokes equations, which definitely should be applicable to describe the phenomenon for a wide class of fluids and external conditions. The phenomenon of turbulence is of basic importance; this is recognized even by laymen. At the same time, our fundamental and practical knowledge of turbulence is insufficient to say the least. This is a rather strange situation: we know more about the structure of remote stars than about the flow of water in the pipes in our homes!

The year 1941 marks a fundamental event in turbulence studies: A. N. Kolmogorov and his student of the time, A. M. Obukhov, were able to understand the local structure of “developed” turbulent flows, i.e., turbulent flows at large Reynolds number.¹ Their basic model of the phenomenon was as follows. Developed turbulent flow is, so to speak, stuffed by vortices. Due to the interaction of vortices in the flow (mutual cutting and self-cutting of vortices and their subsequent reconnections), an equilibrium cascade of vortices is formed in turbulent flow. (This idea was anticipated by the outstanding British physicist L. F. Richardson.) The cascade covers all scales of the vortices, from the largest ones determined by global flow configuration, to the length scale where the viscous dissipation of energy into heat becomes essential (now called the Kolmogorov length scale), to even lower scales. For flows having very large Reynolds numbers, this cascade should embrace a very large range of scales. The first basic idea was that the lower part of this cascade is stochastically universal for all developed turbulent flows. From universality follows statistical steadiness, local isotropy, and homogeneity of the relative motions of fluid particles. At the same time, according to the second basic assumption, the influence of viscosity in the upper part of this universal branch of the cascade is insignificant, because the vortices are still much larger than the length scale where the viscous dissipation of energy into heat becomes substantial. So energy moves through the cascade from large eddies to small ones, untouched by dissipation.

¹Reynolds number is the basic dimensionless parameter governing viscous fluid motion: the product of characteristic velocity with characteristic length of the flow divided by a property of the fluid, its kinematic viscosity.



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This paradigm together with dimensional considerations, in fact the invariance with respect to a certain renormalization group, led to remarkably simple universal laws for the mean specific energy K of relative motions in turbulent flows at very large Reynolds numbers:

$$K = \frac{1}{2} \overline{(\mathbf{u}(\mathbf{x} + \mathbf{r}) - \mathbf{u}(\mathbf{x}))^2} = C(\epsilon r)^{2/3}$$

(Kolmogorov's law of two thirds), where \mathbf{u} is the fluid velocity, \mathbf{r} is the vector connecting two points, the bar denotes ensemble averaging, and ϵ is the energy dissipation rate per unit mass. In Fourier representation the following law was obtained for spectral energy density:

$$E(k) = C_1 \epsilon^{2/3} k^{-5/3}$$

(Kolmogorov-Obukhov law of five thirds). Here k is the wave number, while C and C_1 should be universal constants by the very logic of model construction.

Turbulent Times

It is impossible now to trace how the papers by Kolmogorov and Obukhov came to arrive at the Library of Cambridge University. They were published at the worst time of Hitler's invasion of the Soviet Union. Later, in September 1941, convoys delivering weapons and war materiel for the Soviet Union cruised from Britain to Murmansk and Archangel, ports in the north of Russia. On their way back the ships needed some ballast. Very often as part of the ballast books were used, in particular scientific publications of the USSR Academy of Sciences. It was apparently in this way that the volumes of *Doklady* with papers by Kolmogorov and Obukhov reached the Library at Cambridge University. From the other side of the world, in early 1945, before the end of the war, young George Batchelor traveled in a similar convoy of eighty ships from his

native Australia to Cambridge in order to work with G. I. Taylor and to study turbulence.²

And so the great papers found a great reader! G. K. Batchelor studied Kolmogorov's short notes and published two papers [3], [4] explaining Kolmogorov's theory in detail. This required a titanic effort.³ These papers, especially the first one,⁴ made the Kolmogorov-Obukhov theory generally understandable and very popular. It is enough to mention that in the fifties and early sixties even students in the Soviet Union used Batchelor's paper as an introduction to the subject and that in 1991 the Royal Society of London published a special volume of Proceedings, edited by J. R. C. Hunt, now Lord Hunt of Chesterton, under the title *Fifty Years of Kolmogorov's Ideas in Turbulence*. G. K. Batchelor's role in disseminating and developing these ideas was of decisive value. The destiny of this theory would have been different without him!

For a long time (about twenty years) turbulence became his basic subject of research. At that time G. I. Taylor's interest moved from turbulence to other fields, so the work of G. K. Batchelor in turbulence was to a large extent independent.⁵ Soon he understood that theoretical work in turbulence is impossible without permanent contact with experiment. He wrote to his friend and close colleague, A. A. Townsend, who remained in Australia: "You will come to Cambridge, study turbulence, and work with G. I. Taylor." The answer came immediately: "I agree, but I have two questions: what is turbulence and who is G. I. Taylor?" Townsend came and soon revealed himself as one of the most remarkable experimentalists working in turbulence. This shows what a strong personality G. K. Batchelor had; otherwise it would have been impossible to create the Department of Applied Mathematics and Theoretical Physics

²Up to the end of his days, Batchelor remained an Australian citizen. This gave him some trouble in obtaining a French visa, in spite of his being a Foreign Associate of the French Academy of Sciences.

³A characteristic detail: G. K. Batchelor claimed in his paper that he was able to reproduce all the details of Kolmogorov's calculations except one: he was unable to derive the relation between longitudinal and normal components of structure functions without the simplifying assumption of complete isotropy of the flow; in Kolmogorov's paper there was the claim that this simplification is unnecessary. Up to now, as far as I know, no one has been able to perform the derivation free of this assumption, although no one doubts that such a derivation is possible.

⁴There was also a short preliminary publication in *Nature* in 1946. It is interesting that this publication immediately attracted the attention of J. von Neumann.

⁵GKB once told the author that he also considered A. N. Kolmogorov to be his teacher.

(DAMTP), the *Journal of Fluid Mechanics*, and *Euromech* (see below).

New Directions

In the late forties and fifties G. K. Batchelor's activity in the study of turbulence was enormous, and it entered as a fundamental part of the subject in monographs and textbooks (see, e.g., [17]). Rather early he came to the conclusion that a book describing new ideas in turbulence was needed. His book [5], *The Theory of Homogeneous Turbulence*, was published by Cambridge University Press in 1953 when the author was thirty-three years old. In this book in particular the idea of two-dimensional turbulence appeared, which later attracted wide attention from fluid dynamicists, both theoreticians and experimentalists. The idea was very natural for the asymptotic description of atmospheric and oceanic turbulence: it seemed at that time that because the vertical length scale of atmospheric and oceanic motion is much less than the horizontal scale, the large scale turbulent motions can be considered to be two-dimensional.

G. K. Batchelor discovered that the events in the vortex cascade in two-dimensional turbulence should be completely different from the three-dimensional case: the energy flux goes from small to large eddies (inverse cascade). Therefore, the Kolmogorov-Obukhov "5/3" spectrum should be observed at small, not large, wave numbers. Later this work was continued by R. H. Kraichnan and other researchers and was confirmed by numerical and physical experiments. Apparently it was the first explicit demonstration of the fact, which became gradually evident, that two-dimensional fluid dynamics, and in particular two-dimensional turbulence, cannot represent real three-dimensional phenomena: the basic mechanism of the real phenomenon, the interaction of vortices, is missing in its two-dimensional counterpart. This interaction is the root of tremendous difficulties in mathematical investigations of the solutions to the three-dimensional Navier-Stokes equations.

It is impossible to present in this paper a complete picture of Batchelor's achievements of this period, but I can refer the reader to a forthcoming paper of H. K. Moffatt [16] where these results are presented in detail. The only thing I want to emphasize here is his interest and direct participation in experiments, in particular in the experiments (together with A. A. Townsend) concerning the turbulence decay behind the grid in a wind tunnel, which, after G. I. Taylor, was considered as a model of isotropic homogeneous turbulence. The variety of scaling laws of this decay continues to attract attention now, fifty years after the experiments were performed.

In the beginning of the sixties Batchelor stopped his work in turbulence rather abruptly and started

a new project: for several years he wrote a treatise [6], *An Introduction to Fluid Mechanics*. This book reflected his experience in the new approach to the subject. It was published by Cambridge University Press in 1967 and since that time has been republished many times; now it is the most widely used textbook in fluid mechanics. At the end of his life Batchelor wanted to recast the book, but a severe illness did not give him much opportunity.

After the textbook Batchelor's research moved to a new direction, and so it happened that he became one of the founding fathers of *micromechanics* [7], an entirely new approach in continuum mechanics. According to the micromechanical approach, properties of the material microstructure, directly or indirectly observable, do not remain invariable; therefore they are explicitly introduced into consideration. The equations of macroscopic motions and those of the kinetics of microstructural transformations are considered simultaneously. Batchelor advanced this idea for fluid motions and applied it to shape the hydrodynamics of suspensions. In a parallel but unrelated series of works, American applied mathematician B. Budiansky advanced an analogous approach in application to solids. Nowadays micromechanics seems to be the most perceptive direction in all branches of continuum mechanics. It is apparent that this approach will give adequate mathematical models of many unexpected and sometimes counterintuitive phenomena that occur in the motions of suspensions, polymeric solutions and melts, biological fluids, etc.

New Institutions

Batchelor's organizing activity occupied much of his time, and here also he was successful. In 1959 he was able to create at (the very conservative, in the best sense of the word) Cambridge University a new Department of Applied Mathematics and Theoretical Physics, the now famous DAMTP. I want to emphasize that in this department there existed practically from the very beginning an experimental laboratory, something absolutely unexpected at Cambridge before, where the general idea was that mathematicians should work in college rooms or at home using only pen and paper. Such a combination of theoretical work and experiment happened to be very fruitful, and for a long time DAMTP was a Mecca for fluid mechanicians, both from Britain and from overseas.

Batchelor's second major creation was the *Journal of Fluid Mechanics*, launched in 1956, nowadays the central journal in the field. It was also a very complicated task: leading journals like the *Proceedings of the Royal Society* feared strong competition, and with good reason.

Batchelor also created and chaired for twenty years the European Mechanics Committee, now the European Mechanics Society (*Euromech*), and



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stimulated a wide program of colloquia covering new aspects of fluid and solid mechanics. His role in establishing scientific relations with scientists behind the Iron Curtain should be emphasized too.

Of substantial importance was the propaganda for G. I. Taylor's work and research style. Batchelor published G. I. Taylor's collected papers at Cambridge University Press in four volumes [19] and wrote a remarkable book [8] surveying Taylor's life and legacy. I definitely think that without Batchelor's activity the memory of Taylor's unique research style and his scientific achievements would decay in today's modern turbulent scientific ocean.⁶ Nowadays they live on and continue to influence new generations.

New Leadership

In 1983, rather unexpectedly, Batchelor retired from his position as professor of applied mathematics at Cambridge University and head of DAMTP. His natural successor was his student and close collaborator for many years, H. K. Moffatt. I had a chance to present a survey of Moffatt's achievements at the last IUTAM Congress in September 2000, but since it is inappropriate to speak of Moffatt here, I mention only that it was he who proposed *helicity*, a new invariant in fluid mechanics, and shaped its new branch, topological fluid dynamics. He inherited the best features of Batchelor, and under his leadership

⁶Compare G. I. Taylor with Sir Harold Jeffreys, also a great applied mathematician. For instance, it was Jeffreys who invented the WKB method fifteen years before Wentzel, Kramers, and Brillouin, but his priority remains unnoticed. Such a situation is inconceivable in the case of G. I. Taylor.

the traditions established by Batchelor were carefully preserved and developed at DAMTP and outside of it. Now Moffatt is the director of the Isaac Newton Institute for Mathematical Sciences at Cambridge.

In 1991 Moffatt stepped down, and David George Crighton became the third head of DAMTP. Soon it became clear that there was no better choice throughout the world. Since 1986 Crighton had been professor of applied mathematics at Cambridge, following Batchelor. Before Cambridge he worked for twelve years at Leeds and created there a strong group of applied mathematicians.

Asymptotics

David Crighton was an applied mathematician in genuine British style. He was a student of John E. Ffowcs Williams, who was at that time at Imperial College in London, later at the engineering department at Cambridge. When David came to his future mentor for the first time, he was asked a natural question, "What do you want to study?" The answer was "Turbulence." "Walk away" was the immediate response. Of course, this was a clear exaggeration; Crighton was accepted, and soon they became close friends. John's speech at Crighton's memorial service at Great St. Mary University Church in Cambridge was unforgettable. Two other eminent persons were considered by Crighton as his mentors: Joseph B. Keller and Sir James Lighthill. Indeed, Crighton's first two papers [13], [14] (with J. E. Ffowcs Williams) were related to turbulence. However, turbulence did not enter his basic scientific life, although he was always interested in the events in turbulence studies. His basic subject became fluid-mechanical acoustics, which he shaped (see especially his essay [10]), although a strong diversity was characteristic of his creative work.

Crighton used diverse mathematical methods in his research, but his basic tools in applied mathematics were asymptotic methods. In his hands asymptotic methods were like a piano in the hands of Vladimir Horowitz.⁷ I strongly advise the reader to read Crighton's paper [11] devoted to asymptotic methods in applied mathematics. This paper was published in the proceedings of a conference on Mathematics in Industry and is not as well known as it deserves: I think that this paper was to a certain extent his scientific "credo".

⁷This comparison is by no means an accident: Crighton's second passion besides mathematics was music. His colleagues knew that every year he disappeared for two weeks to the Bayreuth Wagner Festival. His fiftieth birthday was celebrated in Cambridge by a concert by Russian pianist Tatyana Nikolaeva, which he sponsored. Three weeks before his tragic death he conducted the orchestra of Jesus College (where he was Master), performing the overture to *Tannhäuser*; listeners were deeply impressed.

Several examples: Using asymptotic methods, Crighton was able to construct a model of noise radiation by a propeller—a practical problem of immense importance. He proposed the “large-blade-number asymptotics” (later it appeared that in fact these asymptotics work very well already for the number of blades equal to four: such situations happen in applications of asymptotic methods). Crighton and his students were able (see [12], [18]) to find which section of the propeller blade produces major acoustic radiation. They were able to propose to designers, in particular those of the renowned Rolls Royce Company, detailed recommendations on how to reduce noise both in subsonic and supersonic propellers and in so-called propfans (systems of counterrotating blade rows). I want to emphasize that the asymptotic analysis performed was free of additional assumptions, and technically very complicated, but the final results appeared in a transparent form. Important results were obtained by Crighton and his students in hydro-aeroacoustics, also a field of high practical importance: sound generation due to interaction of fluid with deformable bodies (structures). Here I would like to mention a characteristic paper [2] where a model of vibration of submerged elastic bodies was proposed. It was shown (again by elegant application of asymptotic methods) that the vibrational modes generally speaking depend upon properties of the entire flow-body system; they cannot be separated into “solid modes” and “fluid modes”. It was also demonstrated that the system of vibrational modes is incomplete, a practically important mathematical property.

The diversity of Crighton’s scientific activity can be demonstrated by two papers [15], [9]. In the first paper an asymptotic model of void formation in fluidized beds was proposed. “Fluidized bed” (a layer of catalytic particles suspended by rising flow) is an important technological process in many branches of the chemical industry. If voids are formed, the efficiency of the process drops drastically. Here again an elegant asymptotic method was used and the final result was obtained in transparent form. In [9] the asymptotic method, based on an expansion in a small parameter ($\gamma - 1$) (γ being an adiabatic index), was used in modeling ignition of a combustible mixture by a shock wave.

Apropos: A Comment on Cash

The textbook Batchelor wrote was very successful financially. The royalties it has generated were bequeathed for the purpose of organizing a fluid dynamics laboratory at DAMTP, which will be named after him. He also left large sums to help research students at Cambridge and in his native Melbourne and to organize annual Batchelor lectures in the Department, where distinguished

fluid dynamicists will lecture every year about their new achievements.

Both Batchelor and Crighton had strong fundraising abilities. They collected large amounts of money to create new chairs at DAMTP and to construct new buildings for the department. Leading industrial giants like Rolls Royce and Schlumberger generously participated, because they had seen how useful applied mathematics could be for their business.

Now Cambridge University has established the G. K. Batchelor and David Crighton Memorial Funds. A steady flow of contributions goes to these funds, from modest donations by students to generous contributions by industrial companies and Cambridge Colleges. All are welcome.

The Legacy at DAMTP

The situation at DAMTP nowadays is to a certain extent similar to the situation at another distinguished Cambridge body, Cavendish Laboratory, after the unexpected death of Lord Rutherford in 1937. Cambridge University was lucky to choose Sir Lawrence Bragg. The new Cavendish professor had, according to Freeman Dyson, a definite strategy: he did not try to restore the previous fame related to “smashing the atom”, and he did not start investigations in fashionable directions only because they were fashionable. Also, he did not pay attention to the mockeries of more traditional physicists, especially theorists. What he really did was to attract talented people (he was able to make a precise selection), supporting them and giving them freedom to work in their own directions. Batchelor was one of these people, and together with Batchelor a constellation of bright young people of different specialties was collected at Cavendish. At first such a transformation of the laboratory repelled devoted physicists from it, but later a remarkably large number of Nobel Prizes and other exceptional recognitions for Cavendish researchers persuaded the scientific community that Sir Lawrence had serious reasons for doing as he did.

Now Cambridge University has made its choice: Professor Timothy Pedley, whose field is biological fluid mechanics. He shaped this new branch of fluid mechanics together with Sir James Lighthill. Pedley, a Cambridge man, replaced David Crighton at Leeds, and during his time the applied mathematics there achieved further development. He returned to Cambridge to become G. I. Taylor Professor of Fluid Mechanics in 1996.

The problems before him are enormous: DAMTP is now a huge body, around four hundred people, including graduate students. A move to new buildings will come soon. However, remarkable people are around: Stephen Hawking for one, whose name and achievements are widely known; Professors, Readers, and Lecturers of different generations; and

also bright young talents. The mathematical community can expect that like Sir Lawrence Bragg in the past, Timothy Pedley will be successful in preserving and developing the traditions of his predecessors.

George Batchelor and David Crighton were separated in age by one human generation and two scientific generations, yet they passed away nearly simultaneously. George Batchelor lived to enjoy a happy, harmonious retirement. David Crighton succumbed to cancer at the moment of liftoff into a new orbit of his distinguished career: at the time of his death he was, in addition to many other duties, president-elect of the London Mathematical Society. Both of these applied mathematicians were outstanding personalities. It is very difficult to become outstanding at Cambridge: everyone entering the great city becomes surrounded by eternal walls and eternal shadows and subject to exacting comparisons.

The lives and achievements of George Batchelor and David Crighton will inspire many generations to come. Although we grieve at their absence, we take comfort in celebrating their lives, and we rejoice in the time we were lucky enough to spend in their orbits.

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Logical Dilemmas: The Life and Work of Kurt Gödel and *Gödel: A Life of Logic*

Reviewed by Martin Davis

Logical Dilemmas: The Life and Work of Kurt Gödel

John W. Dawson Jr.
A K Peters, 1997
ISBN 1-56881-025-3
\$49.95, 361 pages

Gödel: A Life of Logic

John L. Casti and Werner DePauli
Perseus Publishing, 2000
ISBN 0-7362-0274-6
\$25.00, 224 pages

In its March 29, 1999, issue *TIME* magazine provided its picks for the twenty greatest "scientists and thinkers" of the twentieth century. Kurt Gödel was on the list along with his good friend Albert Einstein. Alan Turing was the other mathematician among the twenty. Since we may agree that Einstein should be regarded primarily as a physicist, it turns out that the mathematicians *TIME* selected as the great thinkers of the past century were a pair of logicians! Whatever one may think about these two, the work of the overwhelming majority of mathematicians has been quite unaffected by what they accomplished.

Martin Davis is a visiting scholar at the University of California, Berkeley, and a professor emeritus at New York University. His e-mail address is martin@eipye.com.

Turing's main influence on most mathematicians, and indeed on the population at large, stems from his role as progenitor of the computer (see [1]), and it was for this role that *TIME* selected him.

In Douglas Hofstadter's *TIME* article on Gödel, John von Neumann is quoted proclaiming that Gödel's "achievement...is singular and monumental...a landmark which will remain visible far in space and time..." Although Gödel did a number of other very important things, it is the "achievement" to which von Neumann referred, Gödel's incompleteness theorem, that has caught the imagination of the educated public. Indeed, Hofstadter himself played an important part in bringing Gödel's work to the attention of a general audience by writing his Pulitzer Prize-winning book [5], a whimsical, artful work, full of amusing dialogues and connections with music, art, and artificial intelligence.

Kurt Gödel was a very strange man, and his life is as interesting as his scientific work. Both of the books under review bring the two together but are intended for quite different audiences. John Dawson explains in his preface that although he has not "presumed any acquaintance with modern mathematical logic," he has assumed that his readers "possess a modicum of mathematical understanding." In fact, his book would likely be tough going for anyone who had not studied mathematics at the graduate level. John L. Casti

and Werner DePauli, on the other hand, have directed their book at a general audience. How well they have succeeded will be discussed later.

John Dawson faced a formidable task when he began writing his definitive biography of Kurt Gödel. He needed to tell the story

of a very peculiar and eccentric man in a way that did not minimize his peculiarities but did not sensationalize them either and that placed his story in the context of his time and his remarkable accomplishments. As Dawson himself puts it in his preface, "The problem is to make the ideas underlying his work comprehensible to non-specialists without lapsing into oversimplification or distortion, and to reconcile his personality with his achievements." As the official cataloger of the huge mass of documents of various kinds that Gödel left behind and as coeditor of his *Collected Works*, Dawson was uniquely suited for this responsibility. It also helped that his wife, Cheryl Dawson, had gone to the trouble of learning the obscure "Gabelsberger" shorthand that Gödel used for his personal notes.

Dawson begins with Kurt as an inquisitive child, forever asking "Why?"—in his family he was "Herr Warum" ("Mr. Why"). In Brno (then part of the Austro-Hungarian Empire, today in the Czech Republic) Kurt maintained perfect grades in the German-language schools he attended. After his bout with rheumatic fever, which left him convinced that his heart had been impaired, he became a lifelong hypochondriac. For his university

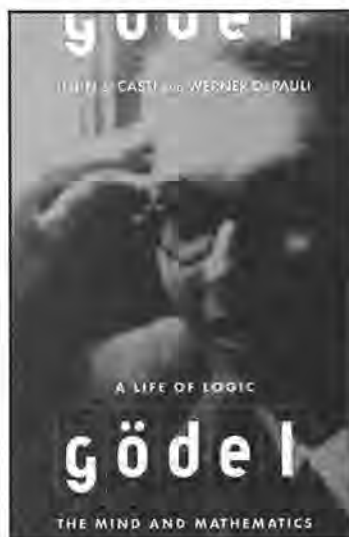
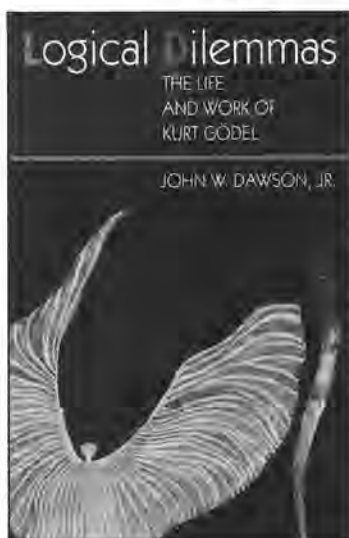
education he was drawn to Vienna, 68 miles south of Brno, where he soon decided on mathematics as his field of study.

Interrupting the biography with a chapter providing a capsule history of mathematical logic to 1928, Dawson continues with a discussion of Gödel's dissertation. The problem Gödel chose had to do with the basic rules of logical deduction used in mathematical proofs, rules that had first been worked out by Gottlob Frege in his *Begriffsschrift* of 1879. Frege's key discovery was that in addition to the propositional connectives—usually written \neg , \vee , \wedge and \supset —whose rules had been found by Boole, it was necessary to use the existential and universal quantifiers—written nowadays \exists and \forall —to uncover the logical structure of

mathematical propositions. The basic steps in a mathematical proof then can be seen as amounting to applying appropriate rules for manipulating these symbols. Of course, for very good reasons proofs are not presented at that level of detail. But in principle they could be. These rules can be given in various equivalent ways, and we needn't worry about the details. Roughly speaking, the quantifiers get in the way of taking the steps called for by the propositional connectives. So one way of thinking of the rules (logicians call this *natural deduction*) is that the rules specify how to remove quantifiers safely and how to restore them. Mathematicians do this all the time, proceeding intuitively, and don't need to know the rules. But it becomes crucial to be precise about them when one is proving theorems about what can or cannot be proved.

The problem that Gödel took as his dissertation topic, proposed by Hilbert in 1928, was to show that Frege's rules are complete, that by their means any valid inference could be justified. In the dissertation the proof of completeness used familiar methods but in a daring way. However, Gödel's epochal paper on undecidability, which also dealt with a completeness problem proposed by Hilbert, used entirely novel methods. The second problem in Hilbert's famous 1900 list asked for a consistency proof for arithmetic. Working with Hilbert's ideas, such researchers as Ackermann, von Neumann, and Herbrand had been attempting to find such a proof for a system based on Frege's rules of logic, with a language appropriate for the arithmetic of positive integers and with formal versions of Peano's postulates as axioms. In an address in Bologna in 1928, Hilbert asked for a proof that this system is complete in the sense that any proposition expressible in its language would be provable or refutable from the axioms. What Gödel proved was that not only are these systems incomplete but there is no hope for achieving arithmetic completeness by means of more powerful systems. Finally, he dealt a mortal blow to the efforts to prove the consistency of arithmetic by proving that formal systems were generally incapable of proving their own consistency.

One result of the sensation created by Gödel's incompleteness theorem was an invitation to visit the newly established Institute for Advanced Study in Princeton. Gödel arrived in the fall of 1933, three years after he had announced that theorem. In December of that year he delivered an address entitled "The present situation in the foundations of mathematics" at a joint meeting of the Mathematical Association of America and the AMS in Cambridge, Massachusetts (Dawson, p. 100; [4], vol. III, pp. 45–53). In this talk he maintained that the problem of giving an adequate foundation for the whole of mathematics that avoided the familiar paradoxes (like Bertrand Russell's class of all



those classes not members of themselves) had found a unique solution. This was to think of the sets needed for mathematics as occurring in *levels* or *types*. Beginning with a set of "individuals" (for example, the natural numbers), one can form the set consisting of these individuals together with all of the sets of these same individuals. At each new level, one can adjoin to the elements of the previous level all sets whose members are in that previous level. In this manner one obtains types V_0, V_1, \dots . But, as Gödel emphasized, there is no reason to stop there. One can go on to $V_\omega = \bigcup_{n=0}^{\infty} V_n$ and continue the process. Although Gödel did not pause to mention the fact, it turns out that there is no loss in generality in beginning the process with the empty set, and that has become the standard practice. Moreover, if one proceeds in that manner, one can define each subsequent type V' to be simply the *power set* of the previous type, V , that is, the set of all subsets of V . Writing " \mathcal{P} " for the *power set* operation, i.e.,

$$\mathcal{P}(x) = \{y \mid y \subseteq x\},$$

one has:

$$V_0 = \emptyset; \quad V_{n+1} = \mathcal{P}(V_n); \quad V_\omega = \bigcup_{n=0}^{\infty} V_n.$$

(It is not difficult to see by induction that for $n = 0, 1, \dots, V_n \subseteq V_{n+1}$.) But there is still no need to stop. One can go on to $V_{\omega+1} = \mathcal{P}(V_\omega)$, etc. Contemporary set theorists work with the *cumulative hierarchy*

$$V_0 = \emptyset; \quad V_{\alpha+1} = \mathcal{P}(V_\alpha); \\ V_\lambda = \bigcup_{\alpha < \lambda} V_\alpha \quad (\lambda \text{ a limit ordinal}).$$

Gödel explained that a suitable foundation for mathematics consists of axioms for this hierarchy of types, with Frege's rules of logical inference being used to obtain theorems from the axioms. (It may be mentioned in passing that this set-theoretic foundation for mathematics has been widely accepted, as can be seen in the introductory sections on sets and mappings in typical beginning graduate-level textbooks.) A system of axioms for set theory, he further explained, can be understood as consisting of closure properties (i.e., properties that enable one to proceed from the existence of given sets to the existence of other sets formed from them). By forming the least set closed under those operations, one obtains a set belonging to the hierarchy; however, the very existence of that set cannot be proved from those axioms. (This is because one could use the existence of this set to prove the consistency of the given axioms from those axioms, which Gödel had shown to be impossible.) This set "can be considered as a new domain of individuals and used as a starting point for creating still higher types." He

continued, explaining the relationship between this situation and his incompleteness theorem:

...we are confronted by a strange situation. We set out to find a formal system [of axioms] for mathematics and instead of that found an infinity of systems, and whichever system you choose ..., there is one...whose axioms are stronger.

But...this character of our systems...is in perfect accord with certain facts which can be established quite independently....For any formal system you can construct a proposition—in fact a proposition of the arithmetic of integers—which is certainly true if the given system is free from contradictions but cannot be proved in the given system. Now if the system under consideration (call it S) is based on the theory of types, it turns out that...this proposition becomes a provable theorem if you add to S the next higher type and the axioms concerning it ([4], vol. III, pp. 47–48).

In the years immediately following Gödel's breakthrough, his life inevitably became entangled in the sinister events developing in Germany and Austria. In 1940, when it was almost too late, he finally decided to emigrate to America. By this time he had made several extensive visits to the U.S. Suffering from depression, he had felt forced to abort one of these visits and had spent some time in mental institutions. He managed to keep secret a romance he had developed with Adele Porkert, an attractive dancer who had previously been married, so that when he and Adele married, her



Kurt Gödel

very existence came as a surprise to his friends and colleagues. Gödel only resolved to leave Vienna when, to his surprise, he was found fit for "garrison duty" in the German army. Leaving was not easy because World War II had already broken out. In addition to bureaucratic difficulties on both sides of the Atlantic, that ocean was no longer safe. Gödel with his bride traveled across Siberia (the pact between Germany and the Soviet Union still being in force), across the Pacific to

California, and finally by train to Princeton, where he was to remain for the rest of his life.

In the meantime Gödel had made another breakthrough regarding a fundamental problem: Cantor's continuum hypothesis (CH). This is the assertion that infinite sets of real numbers come in only two sizes, i.e., that each such set is either countable or has the same cardinality as the set of all real numbers. Famously, Cantor had tried very hard to prove this with no success. The status of CH was the first problem in Hilbert's famous list in his 1900 address. What Gödel was able to prove was that if the usual systems of axioms for set theory (including, in particular, the so-called Zermelo-Fraenkel axioms) are consistent, then they remain consistent if the axiom of choice and CH are added as additional axioms (Dawson, pp. 115-122). (As usual we write ZF for the Zermelo-Fraenkel axioms, and ZFC if the axiom of choice is included.)

The main tool used in the proof is a modification of the cumulative hierarchy that was discussed above. The language of set theory can be used not only to express propositions but also to define sets. For example, the formula

$$\neg(\exists y)(y \in x) \\ \vee [(\exists y)(y \in x) \wedge (\forall z)(z \in x \supset \neg(\exists y)(y \in z))]$$

can be satisfied only if x is either the empty set or contains a single element, namely the empty set. One says that this formula *defines* the set $\{\emptyset, \{\emptyset\}\}$. In general, given any set S , one can consider subsets of S definable by formulas of the language of set theory. The formulas used in these definitions are allowed to contain "parameters" standing for particular elements of S . Thus if $S = \{\emptyset, \{\emptyset\}\}$, the formula $x = \{\emptyset\}$ containing the parameter $\{\emptyset\}$ defines the subset $\{\{\emptyset\}\}$ of S . Let us write $\mathcal{D}(S)$ for the collection of all subsets of a given set S that can be defined in this manner. Evidently for any set S , $\mathcal{D}(S) \subseteq \mathcal{P}(S)$. Note that if S is countably infinite, this inclusion is proper: $\mathcal{P}(S)$ is uncountable (in fact having the cardinality of the continuum), whereas, because there are only countably many formulas, $\mathcal{D}(S)$ is countable. Now just as the cumulative hierarchy is defined by indefinitely iterating the power set operation \mathcal{P} , Gödel defined what he called the *constructible sets* as those obtained beginning with \emptyset and indefinitely iterating the \mathcal{D} operation. The precise definition is again by transfinite recursion:

$$L_0 = \emptyset; \quad L_{\alpha+1} = \mathcal{D}(L_\alpha); \\ L_\lambda = \bigcup_{\alpha < \lambda} L_\alpha \quad (\lambda \text{ a limit ordinal}).$$

The constructible sets are then those belonging to any one of the L_α . Gödel introduced the proposition

A: *Every set is constructible*

and proved the following:

- A is consistent with ZF.
- A implies the axiom of choice.
- A implies CH.
- In fact, A implies that $2^{\aleph_\alpha} = \aleph_{\alpha+1}$ (the so-called "generalized continuum hypothesis").

In his 1938 announcement in the *Proceedings of the National Academy of Sciences* ([4], vol. II, pp. 26-27), Gödel said:

The proposition A added as a new axiom seems to give a natural completion of the axioms of set theory, in so far as it determines the vague concept of an arbitrary infinite set in a definite way.

A decade later in an expository article about CH ([4], vol. II, pp. 176-187), his position was quite different. Espousing a "realist" notion of *set* based on the cumulative hierarchy, it was clear that he no longer regarded the notion as "vague". Regarding CH, he predicted that it would be found to be not only consistent with ZFC, as he had shown, but actually independent, a prediction that was fulfilled in 1962 by Paul Cohen. However, Gödel warned against accepting this independence as ending the matter. Rather, he concluded with the daring prediction:

...the continuum problem...will finally lead to the discovery of new axioms which will make it possible to disprove Cantor's conjecture.

In particular Gödel speculated that the kind of axiom that could do the trick might be a so-called *large-cardinal axiom*, that is, an axiom not provable from the Zermelo-Fraenkel axioms that implies the existence of levels of the cumulative hierarchy of enormous size. However, because of the wide applicability of Paul Cohen's methods, it became clear that large-cardinal axioms by themselves could not settle CH, and Gödel's prediction seemed increasingly far-fetched. However, very recently Hugh Woodin [10] has developed new methods that do suggest that Gödel was right after all. The two-part article "The Continuum Hypothesis," by Hugh Woodin, appeared in the June/July 2001 and August 2001 issues of the *Notices*.

Gödel returned to the theme of his 1933 Cambridge lecture in 1951 when he delivered the twenty-fifth annual Josiah Willard Gibbs Lecture at an AMS meeting in Providence.

The phenomenon of the inexhaustibility of mathematics...always is present...all of mathematics is reducible to abstract set theory....Now if one attacks [the] problem [of axiomatizing set theory], the result is quite different from what one would have expected....one is

faced with an infinite series of axioms, which can be extended further and further, without any end being visible...there can never be an end...because the very formulation of the axioms up to a certain stage gives rise to the next axiom. It is true that in the mathematics of today the higher levels of this hierarchy are practically never used...it is not altogether unlikely that this character of present-day mathematics may have something to do with...its inability to prove certain fundamental theorems, such as, for example, Riemann's hypothesis...For...the axioms for sets of high levels...have consequences even for...the theory of integers. To be more exact, each of these set-theoretical axioms entails the solution of certain diophantine problems which had been undecidable from the previous axioms (Dawson, pp. 197-200; [4], vol. III, pp. 305-308).

Making use of the work leading to the unsolvability of Hilbert's tenth problem (on Diophantine equations) [2], one can be very specific about this last comment:

Theorem. *There is a polynomial $p(a, x_1, \dots, x_n)$ with integer coefficients having the following property: Corresponding to any consistent list of axioms in the language of set theory, there is an integer z_0 such that while the equation*

$$p(z_0, x_1, \dots, x_n) = 0$$

has no solutions in natural numbers, that fact cannot be proved from those axioms.

Here, the word "list" is intended to imply that if there are infinitely many axioms, then there is an algorithm that can systematically generate them. Note that the polynomial p is fixed, so that while the unprovable fact will become provable if one appropriately strengthens the given axioms (for example, as Gödel proposed, by proceeding to the next level of the cumulative hierarchy), there will be a new unprovable fact differing from the previous one only by a change in the value z_0 of the parameter a . It should be noted that all of this is entirely constructive: the polynomial p can be given explicitly, and the number z_0 can be computed explicitly from the axioms. However, it must be admitted that the polynomial p is by no means beautiful to behold [6]. Moreover, the constant z_0 , being in effect a numerical encoding of the axioms, will be enormous.

In his Gibbs lecture, Gödel was quite willing to stick his neck out and to predict emphatically that "Some kind of set-theoretical number theory, still to be discovered, would certainly reach much further" than what can be accomplished with

"analytic number theory." Alas, forty years later this "set-theoretical number theory" still remains "to be discovered," and the working lives of number theorists remain almost entirely unaffected by Gödel's discoveries.

Two areas where one might claim that Gödel's vision of the effectiveness of axioms going beyond ZFC has been vindicated are descriptive set theory and finite combinatorics. The hierarchy of projective sets in Euclidean space can be defined as follows: one begins with the Borel sets in n dimensions (for arbitrary n) and iterates the operations of *projection* to a lower-dimensional space and *complementation* (i.e., for $E \subseteq R_n$, forming $R_n - E$). Investigations of the projective hierarchy between the world wars (mostly in Eastern Europe) came to a dead end with problems that seemed utterly out of reach. Work in the 1960s made it clear that these problems were indeed beyond the scope of the Zermelo-Fraenkel axioms. However, it turned out that a very plausible axiom ("projective determinacy") resolved all of these problems in a very satisfactory manner ([8], [7], Chap. 6). Finally it has been shown that this axiom is itself a consequence of *large-cardinal axioms*, axioms that assert the existence of levels of the cumulative hierarchy of enormous size [9].

In finite combinatorics it was in the context of Ramsey theory that examples of genuine mathematical interest were found that required "the higher levels" of the cumulative hierarchy for their proof. Harvey Friedman has found examples that even go beyond ZFC (see his paper [3], which also has references to previous work). Most recently, he has used large-cardinal axioms to obtain some particularly striking results.

As usual, let Z be the set of integers. Friedman calls a subset of Z *bi-infinite* if it has infinitely many positive elements as well as infinitely many negative elements. Given $A, B, C \subseteq Z$, one says that A, B *disjointly cover* C if

$$A \cup B \supseteq C \text{ and } A \cap B = \emptyset.$$

For $x \in Z^n$, say $x = (x_1, \dots, x_n)$, write

$$|x| = \max_{1 \leq i \leq n} |x_i|.$$

Friedman considers *multivariate functions* on the integers, i.e., functions that map Z^n into Z for some n . For such a function f and for $A \subseteq Z$, he writes

$$fA = \{f(x_1, \dots, x_n) \mid x_1, \dots, x_n \in A\}$$

and says that f is of *expansive linear growth* if for some $p, q > 1$, the inequalities $p|x| \leq f(x) \leq q|x|$ hold for all sufficiently large $|x|$. Friedman has shown that although the following proposition is not provable from ZFC, it can be proved using a large-cardinal axiom:

Bi-infinite Disjoint Cover Theorem. Let f, g be multivariate functions on Z of expansive linear growth. Then there exist bi-infinite $A, B, C \subseteq Z$ such that C, gB disjointly cover fA and C, gC disjointly cover fB .

Among the various possible variants of this theorem, it might be worth mentioning that the proof of the proposition obtained by simply replacing " C, gB " by " B, gB " not only requires no large-cardinal axiom but in fact can be carried out using axioms far weaker than ZF. Friedman sees

propositions like these in the context of a general development he calls *Boolean Relation Theory*, which he predicts will have wide ramifications, intersecting many disciplines, with the use of large-cardinal axioms frequently being necessary.

Gödel's friends and colleagues in Princeton could see that he suffered from eccentricity bordering on paranoia. On more than one occasion he seriously endangered his life by stubbornly refusing to accept medical advice. Finally, when Adele was ill and unable to prepare food he considered safe, he stopped eating and literally starved himself to death. He died on January 14, 1978, at the age of

seventy-two. Although Dawson gives a full account of these matters, he always preserves an appropriate tact. In addition to the aspects of Gödel's work discussed in this review, Dawson's masterly biography doesn't omit Gödel's other important scientific contributions: in particular, his functional-based semantics for intuitionistic logic and his novel solution of the equations of general relativity.

Because Gödel's work on undecidability is of such general interest, treatments of his life and work intended for a general audience are very desirable. The book by Casti and DePauli is an effort in this direction. Unfortunately it is deeply disappointing, being marred by serious errors sure to confuse the novice.

In order to explain the idea of proof in mathematics, the authors tell the charming tale of how Gauss as a schoolboy is said to have summed the numbers from 1 to 100 by writing the numbers

1	2	...	50
100	99	...	51

and noting that each column adds up to 101. They then show how the same method can be used to sum the numbers from 1 to n yielding the formula $n(n+1)/2$ (with the caveat that for n odd, 0 must be included). Astonishingly, readers are then told that this proof "is not a proof that the formula holds for every positive integer n ; it's just a proof for any fixed number...." This nonsense is followed by a very brief explanation of mathematical induction as the "usual" way the formula is proved. Next comes a piece of utterly gratuitous misinformation:

There are some philosophers of mathematics who argue that such nonconstructive and/or infinitary principles of inference as mathematical induction should not be admitted into mathematics as a tool of proof.

Of course constructivists have no quarrel with mathematical induction. Perhaps the authors were confusing the finitary rule of inference of mathematical induction with the infinitary nonconstructive ω -rule. The former obtains the conclusion $(\forall n)\mathcal{A}(n)$ from the two premises

$$\mathcal{A}(0) \text{ and } (\forall n)[\mathcal{A}(n) \Rightarrow \mathcal{A}(n+1)],$$

while the latter obtains that same conclusion from the infinite set of premises:

$$\mathcal{A}(0), \mathcal{A}(1), \mathcal{A}(2), \dots,$$

The ω -rule is an interesting thing for logicians to study, but as stated it is not a practical rule of proof—a mathematician ordinarily has that infinite set of premises available only when the desired conclusion has already been obtained some other way.

Unfortunately, the authors' confusion is not limited to this one example. Pages could be filled listing and correcting the errors in this book. Probably the worst is the misstatement of Gödel's incompleteness theorem. As Gödel was at great pains to emphasize and has been explained above, it is a question of *relative* incompleteness: the statement found to be undecidable in a given system is seen to be true in a more comprehensive system obtained using a natural construction. But over and over again the authors give the impression that it is a matter of *absolute* undecidability. Thus, here is their version of what can be inferred from the work on Hilbert's tenth problem:

There exists a Diophantine equation having no solution—but no theory of mathematics can prove this.

Pages could be filled listing and correcting the errors in [Casti and DePauli's] book. Probably the worst is the misstatement of Gödel's incompleteness theorem.

No such Diophantine equation is known. A correct statement (involving a system-dependent parameter) was stated above.

Although Casti and DePauli include Dawson's excellent biography in their list of references, there are many inaccuracies concerning Gödel's life and thought. The example that annoyed me most was the assertion that Gödel "first described himself as a mathematical realist in 1925." What is true is that in 1975, in replies to a questionnaire, he asserted that he had been a mathematical realist (that is, one who accepts mathematical entities such as sets as "real") since 1925. To serious Gödel scholars this is a crucial difference, since there are good reasons to doubt that his assertion was true. For example, Gödel's suggestion in 1938 that his statement "A" (to the effect that all sets are constructible) was a reasonable completion of the "vague" notion of set is not what a "realist" would say. (See also the introductory notes in [4], vol. III, by Solomon Feferman, pp. 36-44, and by me, pp. 156-163.)

To end on a positive note: Casti and DePauli spend some time discussing Gödel's interesting unsuspected solution of the equations of general relativity. In the universe specified by this solution, time travel to the past is possible in principle. I believe their discussion is accurate and interesting. The book concludes with an illuminating exposition of Gregory Chaitin's information-theoretic form of Gödel's theorem.

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Next Year, in Beijing

Planning Gears Up for ICM 2002

In August 2002 mathematicians from all over the world will gather in Beijing, China, for the International Congress of Mathematicians (ICM). Held every four years, the ICM is the premier international conference spanning all of mathematics. Of the twenty-two congresses held since the first one in Zürich in 1897, all but five were in Europe, and only one was in Asia (Kyoto, 1990). The choice of Beijing as the site for the first ICM in the new millennium is a sign of the increasing role of Asia in world mathematical development and testifies to China's efforts to build its academic and research prowess. But the choice has also been questioned on human rights grounds.

Beijing, an Educational Center

Although China is still a developing country industrially, mathematically its development goes back at least 3,000 years. Mathematics has long been an important part of education in China, and today it still commands interest and respect among the general public. "Chinese people have great admiration for scientists and mathematicians," commented Roderick Wong, chair of the mathematics department and dean of the Faculty of Science and Engineering at the City University of Hong Kong. Wong spent thirty-two years in North America, where he found the public had far less appreciation of mathematics than in China. He said that an average Chinese person can probably name at least one modern-day mathematician, such as Hua Loo Keng (L. K. Hua). Hua, who died in 1985 at age seventy-five and was a member of the U.S. National Academy of Sciences, worked in the United States before returning to China. In

1952 he became the founding director of the Institute of Mathematics at Beijing's Chinese Academy of Sciences (CAS).

The value China has traditionally placed on education can be seen in the number of institutions of higher education in Beijing, which in 1998 was a staggering sixty-three; the number has dropped to perhaps fifty in the last few years as the government merged some institutions. Among the top universities in Beijing are Beijing Normal University, Peking University, and Tsinghua University. Another high-profile institution is Nankai University in the nearby city of Tianjin, which is about 150 miles from Beijing and which has more than a dozen universities.

In China demand for higher education is strong and increasing: Last year *Asia Week* reported that in 1999, out of 30 million college-age people in China, 7 million competed for just 1.4 million university slots. The Chinese government plans to greatly expand this capacity, with the aim of making higher education available to 15 percent of the college-age population by 2010. The improvement in recent years of China's economic condition has allowed increased investment in universities. For example, between 1999 and 2001 the Chinese government stepped up funding for Peking and Tsinghua Universities by US\$225 million each. The extra money permitted the construction of new buildings with additional office space, improvement of computing facilities, and increases in salaries. A mathematics professor at one of these universities receives, in addition to a housing subsidy and free medical insurance, a salary equivalent to about \$625 to



The Great Hall of the People, Tiananmen Square in Beijing, China, site of the opening ceremonies for ICM 2002.

\$875 per month. (As a comparison, the registration fee for ICM 2002 is expected to be around \$240.)

The Chinese government has also expanded support for mathematics research. President Jiang Zemin, in an editorial in *Science* magazine last year, highlighted scientific and technological development as high priorities for China. In particular, he said that because of its limited science budget, the nation would focus on areas like mathematics that do not require large capital expenditures. Over the past three years the National Science Foundation of China has nearly doubled its funding for mathematics. The Chinese Ministry of Science and Technology has identified five "national key research projects" that have a mathematical component: mathematics mechanization and applications, core mathematics, large-scale scientific computing, nonlinear science, and information technology and high-performance software. The ministry currently spends about \$12 million per year to support about one hundred fifty mathematicians working on these projects.

Not all of the universities in Beijing and Tianjin have mathematics departments, but most have departments of "basic science" that employ mathematicians. Counting the approximately four hundred mathematicians on staff in the Academy of Mathematics and System Sciences of the CAS, one might estimate that there are two thousand mathematicians in the Beijing-Tianjin area alone. There are also two high-level mathematics research institutes that employ a small number of mathematicians and hold international conferences. One is the Nankai Institute of Mathematics at Nankai University, founded in 1985 by Shiing-Shen Chern, who is retired from the University of California, Berkeley, and currently serves as the institute's honorary director [see side bar]. The

other is the Morningside Center of Mathematics at the CAS, founded in 1996 under the directorship of Fields Medalist S.-T. Yau of Harvard University.

Planning for the Congress

The ICM is sponsored by the International Mathematical Union (IMU), which chooses the congress site and appoints committees for local organization and for the scientific program. The Local Organizing Committee for ICM 2002 is chaired by Zhi-Ming Ma, a professor at the Chinese Academy of Sciences and president of the Chinese Mathematical Society (CMS). The CMS does not have precise membership figures, but Ma estimates there are about forty thousand members across China. He also estimates that the number of Chinese mathematicians attending the ICM will be several hundred to one thousand. The total expected attendance at the congress is three thousand to four thousand.

The ICM will begin on August 20, 2002, with opening ceremonies held in the main auditorium of the Great Hall of the People in Tiananmen Square. Often used for major public events, as well as for meetings of China's National People's Congress, the Great Hall has a seating capacity of just over ten thousand. If all goes according to plan, President Jiang Zemin will be the featured speaker at the opening ceremonies. His agreement to speak came about during an unusual meeting organized by Chern in October 2000. Chern, who has known Jiang since their days together as university students, arranged for Jiang to meet with a number of prominent mathematicians from outside China. Trained as an electrical engineer, Jiang clearly has an appreciation for mathematics: the fifteen minutes set aside for his meeting with the mathematicians stretched to an hour. IMU president Jacob Palis, a professor at the

On the 2002 Congress

by Shiing-Shen Chern



Shiing-Shen Chern is one of the outstanding geometers of the twentieth century. He was born in China in 1911 and received his Ph.D. in 1936 from the Universität Hamburg, under the direction of Wilhelm Blaschke. He was on the faculty of the University of Chicago and the University of California, Berkeley, before his retirement in 1979. In 1985 he founded the Nankai Institute at Nankai University in Tianjin. He now lives in that city and serves as honorary director of the institute. Chern played an important role in the efforts to bring the ICM to Beijing in 2002. What follows are some of his thoughts on mathematics in China and on the upcoming congress.

The International Congress of Mathematicians will be held in Beijing, China, in August 2002. This event will provide perspective on the 3,000-year span of the history of Chinese mathematics. In China, mathematics has long been a part of the general education and was usually on the applied side. While there was some logical reasoning, no axiomatic foundation existed. However, throughout China's long history there were many important developments. I wish to mention a few significant facts:

1. The most important ancient book was called *Nine chapters of arithmetic*. It must have been published before the time of Christ, and it was in the form of problems and solutions. In 263 A.D. the great Chinese mathematician Liu Hui published a commentary on this book that contained many of Liu's own ideas. The exact dates of Liu's life are unknown.

2. It was known to Liu, or perhaps to others before him, that π , the ratio of the circumference of a circle to its diameter, is a constant. Its calculation naturally became a fundamental problem. Liu obtained the value $\pi = 3.14 \approx 22/7$. A further evaluation was made by Zu Chong Zhi (A.D. 420-500), who obtained $\pi \approx 355/113$ and $3.1415926 < \pi < 3.1415927$.

3. The Chinese Remainder Theorem was widely studied. There were many books consisting mainly of methods of calculation.

4. During the thirteenth and fourteenth centuries there was development of algebra by the Chinese. The method was "detached coefficients". In spite of the inefficient method, their achievements in the theory of equations and other areas of algebra were quite remarkable.

Modern mathematics had to be transported to China by students who studied in the West. The first one to obtain a Ph.D. was M. F. Hu, who received the degree from Harvard University in 1917. I studied with T. Chiang, who received a Ph.D. from Harvard in 1919, his adviser being Julian Coolidge. Another teacher of mine was Dan Sun, who received a Ph.D. from E. P. Lane at the University of Chicago. It may be amusing to note that I became Lane's successor at Chicago in 1949.

The general mathematical level in China is comparable to that of other countries, and there is interest in mathematics among the general public. In recent years China has performed exceedingly well in the International Mathematical Olympiad. The Chinese people are very anxious to be connected to the rest of the world. International conferences in China will get a favorable reception.

If you are attending the congress, I believe it makes sense to combine the trip with some travel in China. The people are friendly, and the cost could be minimal. If you are worried about language problems, you might consider engaging a Chinese companion.

I am now comfortably settled at my alma mater, Nankai University in Tianjin. I received my B.Sc. from Nankai in 1930 and my M.Sc. from Tsinghua University in Beijing in 1934. The latter was founded on the return of the Boxer Indemnity Fund by Teddy Roosevelt. It is now the leading university in China and every year gets the best students through a nationwide examination. Beijing and Tianjin are only about 150 miles apart, and there is a good mathematical atmosphere in the Beijing-Tianjin area.

On behalf of the mathematical community of China, I would like to welcome our mathematical colleagues all over the world to attend the International Congress of Mathematicians in Beijing.

Instituto de Matemática Pura e Aplicada in Brazil, was at the meeting and seized the opportunity to invite Jiang to give the opening address at the congress. "He accepted on the spot," Palis recalled.

Barring an emergency that takes Jiang away from Beijing, ICM 2002 organizers are confident he will address the congress. His speech will be

broadcast on national television and covered in the newspapers, Ma noted. "That will make our opening ceremonies very visible to the public," he said. The support Jiang has shown for the ICM no doubt helped the organizers obtain government funding of around \$1 million, about half of what they need. Efforts to raise the remaining funds through

donations from universities, industries, and private individuals are under way. In addition, support in the form of travel grants is offered by the IMU and also by the AMS through a grant from the U.S. National Science Foundation.

Following ICM tradition, the opening ceremonies will include the awarding of the Fields Medals and the Nevanlinna Prize. The rest of the congress, from August 21 to 28, will be held at the Beijing International Convention Center. The center is next to the National Olympic Sports Center, where the 2008 Summer Olympics will be held. In addition to the section and plenary lectures, the congress will feature some cultural events; one possibility is a performance by the Peking Opera. There will also be some sessions aimed at the general public on topics such as the mathematics of genomics, mathematics and the Internet, and the role of mathematics in modern society. An especially large number of the traditional ICM "satellite conferences" will be held before and after the congress in all parts of Asia and one as far afield as Moscow.

Scientific Program under Development

The scientific program for the congress will consist of about twenty plenary lectures and about one hundred fifty parallel lectures. The parallel lectures are organized into nineteen sections, each focusing on a specific mathematical area. The plenary and section speakers are chosen by the ICM Program Committee, which has around ten members and is chaired by Yuri Manin of the Max-Planck-Institut für Mathematik in Bonn. This is only the second congress for which the name of the chair of the program committee has been made public. After some deliberation the IMU decided to keep the composition of the rest of the committee secret. Were the names made public, the reasoning goes, the great prestige accorded to speaking at the ICM would lead individuals to lobby members of the committee for invitations. The present arrangement allows for the submission of suggestions to the chair but shields the full committee from undue pressures. Manin reported that he received a substantial number of suggestions sent by several national mathematical societies around the world and by one research institute, but few suggestions from individuals.

From congress to congress there are often small changes in the topics of the sections. The topics for 2002 are largely the same as for 1998, except that the section on "Control Theory and Optimization" has been dropped and a section on "Operator Algebras and Functional Analysis" has been added. To choose speakers for the sections, the program committee assembles nineteen panels, one for each section; each panel has a chair plus four to eight other members, whose names are also kept secret. The panels are asked to come

up with an ordered list of possible speakers, containing about 50 percent more names than the expected final number of speakers. The chairs of the panels also coordinate their lists of possible speakers in cases where section topics overlap. All the lists are sent to the program committee, which decides whom to invite, taking into account such considerations as geographical, topical, and gender balance. The section panels also submit to the program committee suggestions for plenary speakers.

Inherent in such a process is the possibility of conflict of interest: Those best suited to choose speakers are often the ones best suited to speak. Phillip Griffiths, director of the Institute for Advanced Study, also serves as IMU secretary. He noted that there have been cases where people serving on panels were asked to be plenary speakers. "But it's not so common," he explained, because the panels tend to consist of older, more established mathematicians, and they aim to invite younger, less established speakers. In other words, said Palis, "Members of the program committee are not choosing themselves." In fact, Manin noted, the current program committee explicitly observed this principle from the very beginning of their work.

The process of inviting speakers, receiving acceptances, and finding alternates for those who decline to speak will be largely complete by the end of August 2001. Decisions about the Fields Medals will be made later, closer to the time of the congress. According to Griffiths, the committee choosing the medalists is "small but representative," with nine members.

Human Rights Concerns

The choice of Beijing as the site for the 2002 Congress has raised concerns within the mathematical community because of perceived human rights violations in China. Detentions and mistreatment of followers of the Falun Gong religious movement have been widely reported in the media. Other cases have involved academics. For example, in spring 2001 China detained three academics who are originally from China and who had worked outside the country; one is a U.S. citizen and another is a permanent resident of the U.S. (none of the three is a mathematician). They have been charged with espionage. In the wake of the detentions, the U.S. State Department issued a public announcement cautioning that Americans, especially those originally from China, could be at risk of being detained "if they have at any time engaged in activities or published writings critical of Chinese government policies."

On June 4, 2001 (the anniversary of the uprising in Tiananmen Square in 1989), the Committee of Concerned Scientists sent to Chinese governmental officials a petition with nine hundred signatures.

The petition protests the detention of thirteen scientists, including one mathematician, Zhang Zong'ai. The petition says that Zong'ai is "serving a five-year sentence under a harsh regime imposed in 1996, and [is] reportedly ailing." The AMS Committee on Human Rights of Mathematicians has endorsed the petition. Recently the committee has had several discussions about ICM 2002, especially because of the possibility that some ICM attendees might take the occasion to speak out about human rights in China.

Will ICM participants be at risk of detention? Those interviewed for this article did not think so. "All mathematicians who want to attend the ICM, I think they will get visas freely and there will be no dangers," said Ma. "I think the U.S. State Department is too sensitive. There will be no danger, no restrictions for mathematicians." Wong, who is also a member of the ICM Local Organizing Committee, agreed. "I think this is an exaggeration," he said of the State Department announcement. He travels regularly to the mainland from Hong Kong and has not experienced problems. "It's safe to go in and out, with no questions asked," he remarked. But, he added, "I would advise people not to cause trouble—this is an academic event." He speculated that talking about human rights or Chinese government policies would not elicit much response, but more extensive actions, such as setting up a booth to distribute printed materials on these topics, could cause problems.

Stephen Smale retired from the University of California, Berkeley, six years ago and has since been on the faculty of the City University of Hong Kong. In his regular travels to the mainland, he has observed a great expansion in individual and political freedom for the Chinese people and, at the same time, the "almost desperate" attempts of the Chinese government to keep a measure of control, as demonstrated in the repression of the Falun Gong followers. But, he remarked, "I think that in general there will be no problems for ICM attendees under normal circumstances." He said he has felt free to talk about the Tiananmen Square crisis, "and the responses of mainland people are very relaxed."

Tsit-Yuen Lam of the University of California, Berkeley, is a member of the AMS Committee on Human Rights of Mathematicians. He too agreed that ICM attendees are unlikely to run into problems. For one thing, he noted, the Chinese worked hard for years for the privilege of hosting the ICM, and it would be counterproductive if detentions marred the event. Especially if President Jiang Zemin addresses the congress, "the Chinese would try all the more not to do anything to compromise their good-host image," Lam said. But if some congress participants speak out on human rights issues and criticize the Chinese government, it is not clear what the reaction would be. "There are

really too many variables out there for us to take anything on faith," Lam said. Some expressions of protest have proceeded without incident, he noted. For example, at an international mathematics conference in China in the mid-1990s, participants encountered no hindrance to organizing an unofficial session on human rights and social responsibilities of scientists or to circulating a petition on behalf of imprisoned students and academics.

Griffiths said that the IMU discussed the human rights situation in China before deciding on Beijing as the site of the 2002 congress. The IMU received assurances that the Chinese government would grant a visa to any mathematician who wished to attend. The ICM organizers are hoping that the congress attendees will focus on mathematics. "It is our hope that people will view this as a scientific activity, and if they have expressions of concern in other areas, they can exercise them in the way they see fit," Griffiths said. "But we will try to keep the congress a scientific activity, not a political one."

"We are concerned about this," said IMU president Palis, "but at the same time we are quite optimistic that the congress will be a good one in scientific terms and that there will be no serious incidents." A native of Brazil, Palis seemed to understand the aspirations of a developing country like China. "There has been progress in science, particularly in mathematics," he said, "and this is clearly a factor in favor" of having the congress in China. The increasing use of mathematics in all areas of science and technology has created a great demand for mathematics the world over, he noted. "It's a special moment, and maybe the Beijing congress will be part of this new era for mathematics."

—Allyn Jackson

International Congress of Mathematicians 2002

ICM 2002 will take place August 20–28, 2002, in Beijing, China. The official website for the Congress is <http://www.icm2002.org.cn/>. The *Notices* will publish the list of invited speakers and the full program when this information is available.

The International Mathematical Union (IMU) and the AMS are offering travel grants for mathematicians to attend the congress. For more information on the IMU grants, visit the website <http://elib.zib.de/IMU/>. For the AMS grants, see <http://www.ams.org/careers-edu/icmapp.html>.

—A.J.

2000 Annual Survey of the Mathematical Sciences

(Third Report)

Faculty Profile
Enrollment and Undergraduate Majors Profile
Graduate Student Profile

Don O. Loftsgaarden, James W. Maxwell, and Kinda Remick Priestley

Introduction

The Annual Survey of the Mathematical Sciences collects information each year about departments, faculties, and students in the mathematical sciences at four-year colleges and universities in the United States. Definitions of the various groups surveyed in the Annual Survey can be found in the box on page 828 of this report. For the second year, departments in Group Vb are no longer being surveyed. More discussion of this can be found in the 1999 First Report in the February 2000 *Notices of the AMS*. We present information about the faculties and instructional programs at the undergraduate and graduate levels in these departments for the 2000–2001 academic year. We report the same kind of information in the Third Report that was reported last year and in earlier years as part of the Second Report. Another table has been added showing time trends for non-tenure-track doctoral full-time faculty and part-time faculty for the past five years.

Information about departments and their faculties is gathered on a questionnaire, the Departmental Profile, mailed to all departments of mathematical sciences in the U.S. in Groups I, II, III, IV, and Va. Projections to the entire population have been made using the data from the responding departments within each of these groups. Since the projections are made using

This new Third Report of the 2000 Survey gives information about faculty size, departmental enrollments, majors, and graduate students for departments of mathematical sciences in four-year colleges and universities in the United States. In prior years these data were included as part of the Second Report.

The 2000 Annual Survey represents the forty-fourth in an annual series begun in 1957 by the American Mathematical Society. The 2000 Survey is under the direction of the Annual Survey Data Committee, a joint committee of the American Mathematical Society, the American Statistical Association, the Institute of Mathematical Statistics, and the Mathematical Association of America. The current members of this committee are Lorraine Denby, J. Douglas Fairies, Mary W. Gray, Alfred W. Hales, Peter E. Haskell, Ellen E. Kirkman, James M. Kister, James Lewis, Don O. Loftsgaarden (chair), James W. Maxwell (ex officio), and Yashiswini Mittal. The committee is assisted by AMS survey analyst Kinda Remick Priestley and survey coordinator Colleen Rose. Comments or suggestions regarding this Survey Report may be directed to the committee.

data from the departments who respond in a given year as opposed to a scientific random sample, biases in the projections can occur. Since the response rates for the doctoral-granting departments are high, most greater than 80%, it is felt that any biases in the projections for these groups are likely to be small.

Beginning with the 1999–2000 survey, stratified random samples of departments in Groups M and B were drawn, and projections were made from the Departmental Profile survey for Groups M and B

Highlights

Openings in fall 2000 for full-time faculty increased in all groups over 1999. There were 1,854 such openings in Groups I, II, III, M, and B, of which only 1,278 were tenure-track positions.

Of these 1,854 positions, 1,613 were open to new doctoral recipients, and of these, 1,134 were tenure-track.

The estimated total number of full-time faculty for all groups surveyed is 21,166, of which 18,000 have doctoral degrees and 4,662 are females.

The number of non-tenure-track doctoral full-time faculty, at 1,915, and the number of part-time faculty, at 7,491, continue to grow in most groups.

The number of junior/senior mathematics majors increased by 3,200, with most groups showing gains.

Full-time graduate students in Groups I, II, III, and M increased from 9,609 in 1999 to 11,388 in 2000, an increase of 18.5%. First-year full-time, female full-time, male full-time, U.S. citizen full-time, and non-U.S. citizen full-time graduate students all had substantial increases. These increases were seen in nearly all groups.

There was a total of 3,592 part-time graduate students reported, which is up by 536 from 1999. U.S. citizens account for 78.9% of the part-time graduate students.

using respondents from these stratified random samples. These projections should be more accurate and less subject to the biases that may have been present in past projections for Groups M and B, where the response rates were always low. The stratification in each group was based on the enrollment level of the school and whether it was a public or private school. Because of this change in methodology, results from the Departmental Profile Survey for years 1999 and later that involve Groups M and B may not be directly comparable to the same results from earlier years.

Faculty Profile

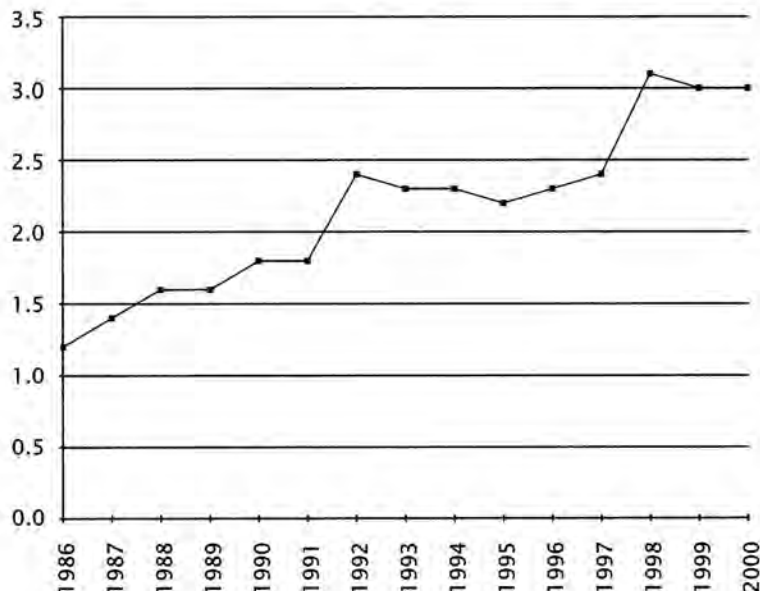
The Departmental Profile Survey, sent in fall 2000 to mathematical sciences departments at four-year colleges and universities as part of the Annual Survey, gathered information about faculties at these schools, which is reported in this section. The First Report presented data

Table 1A: Faculty Attrition,¹ Fall 2000

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Full-time faculty who retired or died										
Total number	37	22	59	60	178	25	8	174	238	590
Percentage (%)	2.3	2.4	2.5	3.0	2.6	1.8	2.3	3.6	3.1	3.0

¹ Number and percentage of full-time faculty who were in the department in fall 1999 but were reported to have retired or died by fall 2000.

Figure 1B: Percent of Full-Time Doctoral Faculty Who Retired or Died in Groups I, II, III, M, & B Combined, Fall 1986 to Fall 2000



collected earlier about faculty salaries (pages 203-7 of the February 2001 issue of the *Notices of the AMS*).

Table 1A displays losses of full-time mathematical sciences faculty due to retirements and deaths. The fall 2000 mathematics faculty attrition rate for Groups I, II, III, M, and B combined was 3.0% compared with fall 1999, 1998, and 1997 values of 3.0%, 3.1%, and 2.4%. Groups M and B had the highest attrition rates at 3.6% and 3.1% respectively. Figure 1B shows the trend in this attrition rate for mathematics departments during the years 1986 to 2000.

Table 2A contains detailed information on the number of full-time faculty positions in mathematical sciences departments under recruitment in 1999-2000 for employment beginning in the academic year 2000-2001. Among mathematics departments (Groups I, II, III, M, and

Don O. Loftsgaarden is professor emeritus of mathematics, University of Montana. James W. Maxwell is AMS associate executive director for Meetings and Professional Services. Kinda Remick Priestley is AMS survey analyst.

Table 2A: Recruitment of Doctoral Faculty, Fall 2000

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Posted Doctoral Positions										
Total number ¹	195	139	173	146	654	184	22	407	794	1854
Tenured/tenure-track	75	41	100	95	311	124	17	327	640	1278
Open to new doctoral recipients	148	107	139	134	529	147	17	378	706	1613
Tenured/tenure-track	33	22	78	86	218	78	12	320	595	1134
Open to assoc/full level	35	20	27	22	104	58	7	76	137	318
Reported Hires for Above										
Male doctoral hires	145	108	122	98	473	89	16	176	319	968
Male new doctoral hires	72	68	51	23	214	32	5	53	120	387
Female doctoral hires	30	13	18	19	79	39	1	80	145	304
Female new doctoral hires	21	10	8	7	46	23	0	26	66	139
Male nondoctoral hires	0	0	2	1	3	1	0	13	66	82
Female nondoctoral hires	0	0	0	0	0	0	0	15	76	91
Unfilled positions	20	18	32	27	98	55	5	123	187	408

¹ Number of full-time doctoral positions under recruitment in 1999-2000 to be filled for 2000-2001. Subtotals of rounded table values may exhibit rounding errors.

B), 1,854 positions were under recruitment in 1999-2000, up 22.8% compared to 1998-1999. Of those 1,854 positions, 1,613 (87.0%) were available to new doctoral recipients, and of those 1,613 positions, 1,134 (70.3%) were tenure-track positions. The 1,134 tenure-track positions open to new doctoral recipients is up substantially from the 859 such positions in 1998-1999. Table 2B provides a brief summary of Table 2A.

Figure 2C shows the number of full-time doctoral positions available in these groups, as well as the number of those that are tenured/tenure-track and the number unfilled for the years 1990 to 2000. (Note: The tenured/tenure-track status of these positions was not surveyed until 1992.) There was a sharp decrease in available positions in the first three years of the decade of the 1990s, but this number has increased significantly since 1997. Particularly interesting is the dramatic increase in tenure-track positions under recruitment.

Table 3A gives the number of faculty for six different categories of faculty broken down by group. Table 3B gives the same information for females only. The estimated total number of full-time faculty in Groups I, II, III, M and

Table 2B: A Summary of Recruitment of Doctoral Faculty, Fall 2000

	GROUP		
	I, II, III, Va, M & B	IV	Total
Posted Doctoral Positions			
Total number	1876	184	2060
Tenured/tenure-track	1293	124	1417
Open to new doctoral recipients	1630	147	1777
Reported Hires for Above			
Total doctoral hires	1289	128	1417
Male	984	89	1073
Female	305	39	344
Unfilled positions	413	55	468

Figure 2C: Number of Full-Time Doctoral Positions under Recruitment: Total, Tenured/Tenure-Track, and Unfilled in Groups I, II, III, M, & B Combined, Fall 1990 to Fall 2000

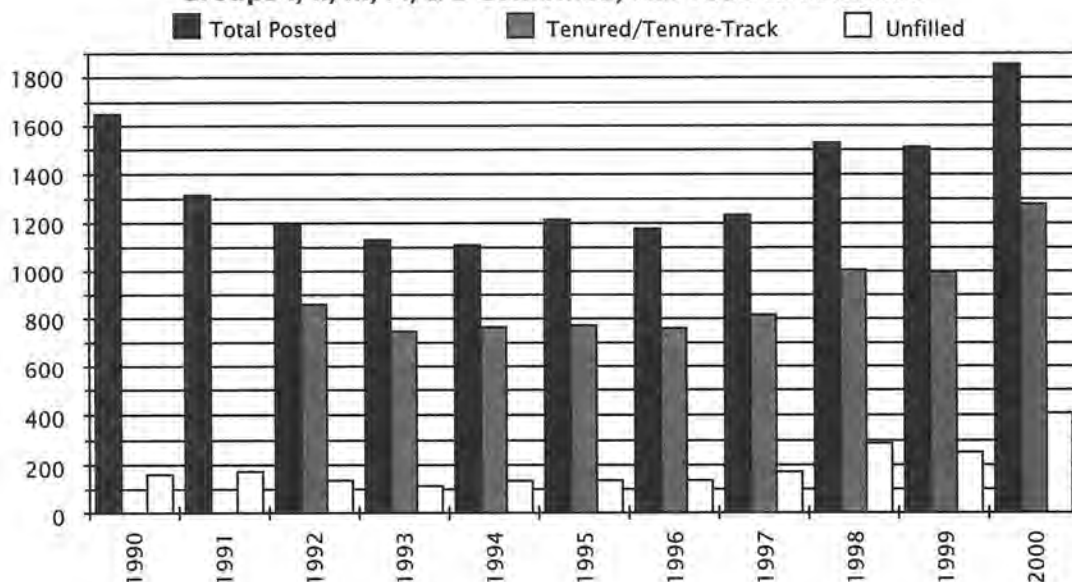


Table 3A: Faculty Size, Fall 2000

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Full-time faculty	1641	907	2393	2023	6964	1387	335	4775	7705	19444
Doctoral full-time faculty	1594	906	2197	1784	6482	1361	333	3932	5893	16306
Tenured doctoral full-time faculty	1192	550	1696	1342	4780	857	218	2851	4129	11760
Untenured, tenure-track doctoral full-time faculty	127	82	275	304	788	251	37	819	1357	2963
Non-tenure-track doctoral full-time faculty	275	275	226	138	915	253	78	262	407	1583
Part-time faculty	186	49	434	717	1386	190	13	2323	3580	7288

Table 3B: Female Faculty Size, Fall 2000

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	I, II, III, M & B
Full-time female faculty	171	81	320	390	961	316	29	1272	2084	4317
Doctoral full-time female faculty	146	79	211	256	692	305	29	847	1350	2889
Tenured doctoral full-time female faculty	73	29	111	133	346	119	9	513	799	1658
Untenured, tenure-track doctoral full-time female faculty	19	10	47	76	153	86	8	258	428	838
Non-tenure-track doctoral full-time female faculty	54	40	53	47	193	100	12	76	123	393
Part-time female faculty	61	8	173	272	514	63	4	842	1447	2803

B combined is 19,444, up 954 from the number reported last year. Group M is up 299 full-time faculty, while Group B is up 604 and Groups I, II, and III are up 51 full-time faculty. Last year was the first year in which sampling from

Groups M and B was used. Substantial drops in faculty numbers in Groups M and B were reported last year. In last year's Second Report the authors discussed this fact and felt that the reported estimates for Groups M and B were on

Table 3C: Number and Percentage of Full-Time Faculty, Fall 2000

	GROUP									Total All Groups
	I Public	I Private	II	III	IV	Va	M	B		
Full-Time Faculty										
Number	1641	907	2393	2023	1387	335	4775	7705		21166
Percentage of total full-time faculty (%)	7.8	4.3	11.3	9.6	6.6	1.6	22.6	36.4		100.0
Female Full-Time Faculty										
Number	171	81	320	390	316	29	1272	2084		4662
Percentage of female full-time faculty (%)	3.7	1.7	6.9	8.4	6.8	0.6	27.3	44.7		100.0
Female Full-Time Faculty										
Percentage female full-time faculty by group (%)	10.4	8.9	13.4	19.3	22.8	8.6	26.6	27.1		22.0

Table 3D: Number, and Percentage of Those Female, of Non-tenure-track Doctoral Full-Time Faculty and Part-Time Faculty by Group, Fall 1996 to Fall 2000

	1996	1997	1998	1999	2000
Groups I, II, & III					
Non-tenure-track doctoral full-time faculty	618	669	844	907	915
Percentage female (%)	22.7	21.8	21.2	22.7	21.1
Part-time faculty	1088	941	1088	1192	1386
Percentage female (%)	36.9	36.9	37.6	38.2	37.1
Group M					
Non-tenure-track doctoral full-time faculty	138	216	140	146	262
Percentage female (%)	23.9	29.6	27.1	56.2	29.0
Part-time faculty	1879	1612	1768	1906	2323
Percentage female (%)	41.4	45.5	42.8	35.2	36.2
Group B					
Non-tenure-track doctoral full-time faculty	419	385	427	514	407
Percentage female (%)	22.9	26.2	31.1	23.7	30.2
Part-time faculty	3055	3107	3585	3298	3580
Percentage female (%)	44.0	46.0	42.3	40.7	40.4

the low side. If that is true, the increases in faculty in Groups M and B are not as large as they appear this year. For further discussion of this matter see the 1999 Second Report in the September 2000 issue of the *Notices of the AMS*.

Table 3C gives some percentages based on the information in Tables 3A and 3B.

The number of non-tenure-track doctoral full-time faculty and the number of part-time faculty have been steadily increasing in recent years. Table 3D gives a five-year history of these two types of faculty for Groups I, II, and III combined, for Group M, and for Group B. Also shown for each number in this table is the percentage of females. This increase in non-tenure-track full-time doctoral positions continues a disturbing trend reported in "Changes in Mathematics Faculty Composition, Fall 1990-Fall 1996" (James W. Maxwell, *Notices of the AMS*, November 1997, pages 1321-3). The growth in part-time faculty appears to be more recent, since it was absent in the earlier period 1990-1996.

Table 3E: Summary of Full-Time and Part-Time Faculty by Sex, Fall 2000

	GROUP					
	I, II, & III		IV		M & B	
	Male	Female	Male	Female	Male	Female
Full-time faculty						
Number	6003	961	1071	316	9123	3356
Percentage (%)	86.2	13.8	77.2	22.8	73.1	26.9
Doctoral full-time faculty						
Number	5790	692	1057	305	7628	2197
Percentage (%)	89.3	10.7	77.6	22.4	77.6	22.4
Tenured doctoral full-time faculty						
Number	4434	346	738	119	5668	1312
Percentage (%)	92.8	7.2	86.1	13.9	81.2	18.8
Untenured, tenure-track doctoral full-time faculty						
Number	635	153	165	86	1490	686
Percentage (%)	80.6	19.4	65.8	34.2	68.5	31.5
Non-tenure-track doctoral full-time faculty						
Number	721	193	153	100	470	199
Percentage (%)	78.8	21.2	60.6	39.4	70.2	29.8
Part-time faculty						
Number	872	514	127	63	3613	2289
Percentage (%)	62.9	37.1	66.9	33.1	61.2	38.8

Faculty Profile for Females

Table 3B gives a complete breakdown of all categories of female faculty by group. The total number of full-time faculty in all groups for 2000-2001 is 21,166, of which 4,662 (22.0%) are females.

Table 3C shows the number and percentage of all full-time faculty that fall in each group for 2000-2001 and the number and percentage of all female full-time faculty that fall in each group for 2000-2001. In addition, the percentage of

Table 4A: Undergraduate and Graduate Enrollments (thousands), Fall 2000

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	Total All Groups
Undergraduate Course Enrollments Total number (thousands)	175	47	279	241	742	77	13	526	729	2087
Graduate Course Enrollments Total number (thousands)	7	4	9	9	29	24	2	14		69

Table 4B: Distribution of Undergraduate Enrollments (thousands), Fall 2000

	GROUP									
	I Public	I Private	II	III	I, II, & III	IV	Va	M	B	Total All Groups
Remedial Mathematics¹ Total number (thousands), % ²	10 6	0 0	22 8	32 13	65 9	0 0	0 1	94 18	106 15	265 13
Precalculus Total number (thousands), %	35 20	1 2	63 23	57 24	156 21	1 1	1 4	114 22	132 18	403 19
1st-Year Calculus (mainstream) Total number (thousands), %	46 26	18 39	57 20	37 15	158 21	0 0	3 23	52 10	96 13	309 15
1st-Year Calculus (nonmainstream) Total number (thousands), %	24 14	4 9	34 12	25 10	88 12	0 0	0 0	33 6	33 4	154 7
Statistics Total number (thousands), %	2 1	3 5	13 5	19 8	37 5	73 94	2 18	45 9	79 11	236 11
Computer Science Total number (thousands), %	2 1	1 2	2 1	8 3	14 2	0 0	0 0	36 7	80 11	129 6
Other Enrollments for Majors Total number (thousands), %	31 18	10 22	34 12	24 10	100 13	1 1	5 37	52 10	63 9	220 11
Remaining Undergraduate Enroll. Total number (thousands), %	24 14	9 20	53 19	39 16	125 17	2 3	2 17	101 19	141 19	371 18
Total Enrollments	175	47	279	241	742	77	13	526	729	2087

¹ Arithmetic, high school algebra, geometry.

² Percents are "column percents" describing relative enrollments within the respective survey groups of the different types of undergraduate courses.

the full-time faculty within each group who are female is given in the bottom section of Table 3C. We see that the number of females as a percentage of full-time faculty varies considerably among the groups, from 8.9% and

8.6% for Groups I Private and Va to 26.6% and 27.1% for Groups M and B respectively. Note: In Table 3C the percentages for each group in rows 2 and 4 are of the row totals. The percentages in row 5 are column percentages using the numbers in rows 1 and 3.

Table 3D contains information about non-tenure-track doctoral full-time faculty and part-time faculty for 1996 to 2000 for Groups I, II, and III combined, M, and B. This table includes the total number for each category as well as the percentage female for each number.

Table 3E gives the male/female breakdown by count and percentage for Groups I, II, and III combined for various categories of faculty in columns 2 and 3. The same breakdowns are given for Group IV in columns 4 and 5 and for Groups M and B combined in columns 6 and 7.

Table 4C: Total Undergraduate Enrollments (thousands), Fall 1996 to Fall 2000

	GROUP								Total ³
	I	I	II	III	IV	Va ²	M	B	
1996	215 ¹		245	212	98		589	705	2085
1997	173	42	247	220	69		561	701	2037
1998	182	43	258	214	78		585	741	2124
1999	182	45	271	251	92	13	568	810	2232
2000	175	47	279	241	77	13	526	729	2087

¹ Prior to 1997, Group I was not separated into Public and Private.

² Prior to 1999, Group Va was combined with Group Vb, which is no longer surveyed. Group Va figures for these years are not available.

³ Totals are sums of unrounded enrollments and may not be exactly the same as the sums of rounded figures in the table.

Table 4D: Distribution of Undergraduate Enrollments (thousands), Fall 1992 to Fall 2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Remedial Mathematics	300	294	279	275	269	274	322	281	265
Precalculus	356	341	342	336	332	303	347	429	403
1st-Year Calculus (mainstream)	315	319	298	314	312	309	325	321	309
1st-Year Calculus (nonmainstream)	127	138	131	145	144	146	148	151	154
Statistics	213	215	199	209	218	233	233	282	236
Computer Science	141	111	119	108	119	113	116	142	129
Other Enrollments for Majors	270	258	233	257	263	233	218	235	220
Remaining Undergraduate Enroll.	392	353	353	411	428	426	412	390	371
Total Enrollments¹	2114	2029	1954	2055	2085	2037	2124	2232	2087

¹ Totals are sums of unrounded enrollments and may not be exactly the same as the sums of rounded figures in the table.

Table 4E: Undergraduate and Graduate Enrollments per Full-Time Faculty Member, Fall 2000

	GROUP							
	I Public	I Private	II	III	IV	Va	M	B
Undergraduate Course Enrollments Number per full-time faculty member	107	52	117	119	56	39	110	95
Graduate Course Enrollments Number per full-time faculty member	4	5	4	4	17	7	3	

Enrollment Profile and Undergraduate Majors Profile

The Departmental Profile Survey obtained information about enrollments and distribution of instructional effort among various course groupings in mathematical sciences departments. Table 4A gives the total undergraduate and total graduate enrollments in mathematics courses for each group that is part of the Annual Survey. Each enrollment in this and other tables in this section is projected from schools responding to the survey. In fall 2000, for the second year, the projections for Groups M and B were made using the responding schools that were part of a stratified random sample for each of these groups.

Table 4B presents a further breakdown of the undergraduate enrollments into eight categories of courses. For each group the percentage of the total enrollment in each of these eight categories is also given. Column totals in Table 4B give the total enrollments for each group, and they are the numbers given in the first row of Table 4A. Table 4C gives these totals for fall 1996 to fall 2000. Row totals in Table 4B give the total enrollments in each of the eight categories of courses for all mathematical sciences depart-

ments. Table 4D shows these same enrollments for fall 1992 to fall 2000.

Total enrollments in undergraduate mathematics courses dropped 145,000 from 1999 to 2000. Most of this drop was in Groups M and B. In 1999 a switch in methodology to sampling was instituted for Groups M and B. Until more years of experience with sampling are available, year-to-year comparisons are not reliable. The authors believe that this estimate of total enrollment in 1999 was somewhat high, which

Table 4F: Undergraduate Enrollments per Full-Time Faculty Member, Fall 1996 to Fall 2000

	GROUP							
	I Public	I Private	II	III	IV	Va ²	M	B
1996	88 ¹		110	108	69		112	100
1997	110	52	115	113	57		106	96
1998	109	52	114	108	60		117	94
1999	115	54	111	122	68	43	127	114
2000	107	52	117	119	56	39	110	95

¹ Prior to 1997, Group I was not separated into Public and Private.

² Prior to 1999, Group Va was combined with Group Vb, which is no longer surveyed. Group Va figures for these years are not available.

Table 5A: Undergraduate Junior/Senior Majors (hundreds), Fall 2000

	GROUP								
	I Public	I Private	II	III	IV	Va	M	B	I, II, III, M & B
Total Undergraduate Junior/senior majors (hundreds)	51	18	49	59	8	5	158	260	594
Female Undergraduate Junior/senior majors (hundreds)	19	5	21	24	3	2	70	103	242

Table 5B: Junior/Senior Majors (hundreds) in Groups I, II, III, M & B Combined, Fall 1992 to Fall 2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Undergraduate Junior/senior majors (hundreds)	728	689	663	671	626	590	580	562	594
Female Undergraduate Junior/senior majors (hundreds)	319	299	285	284	271	255	251	246	242
Percentage female (%)	43.8	43.4	43.0	42.3	43.3	43.2	43.3	43.8	40.7

would explain a good deal about the size of the drop in the estimate of total enrollment for 2000. Group B especially seemed overprojected in 1999.

Table 4E gives the undergraduate enrollments per faculty member and the graduate enrollments per faculty member for each group. Table 4F gives the undergraduate enrollments per faculty member for fall 1996 to fall 2000.

Table 5A gives the number of junior/senior majors and the number of female junior/senior majors for each group. Table 5B gives the total number of junior/senior majors and female junior/senior majors for fall 1992 to fall 2000. The number of junior/senior mathematics majors in Groups I, II, III, M, and B dropped from 72,800 in 1992 to 56,200 in 1999, but showed an increase of 3,200 in 2000. The number of female

junior/senior majors was down 400 from 1999. The percentage of the junior/senior majors who are females has remained relatively constant, near 43%, during the years 1991 through 1999, but dropped 3.1% in 2000 to 40.7%. Although the number of female junior/senior majors dropped only 400 compared to last year, there was an increase of 3,600 male junior/senior majors in 2000, which accounts for most of the drop of 3.1% in the percentage of junior/senior majors who are female.

The reader should be aware that at least 60 of the 227 departments in the 2000 Group M population and at least 260 of the 1,018 departments in the 2000 Group B population also offer a computer science program in addition to their offerings in mathematics. In some instances, these computer science programs

Table 6A: Graduate Students, Fall 2000

	GROUP								
	I Public	I Private	II	III	I, II, & III	IV	Va	M	I, II, III, & M
Total Graduate Students									
Number who are full-time	2733	1314	2712	2143	8902	3622	735	2486	11388
Number who are first-year	722	365	790	738	2614	1188	225	971	3585
Number who are part-time	244	135	436	686	1501	948	99	2091	3592
Female Graduate Students									
Number who are full-time	726	271	935	853	2784	1773	232	1168	3952
Number who are first-year	220	68	301	290	879	670	88	456	1334
Number who are part-time	119	42	153	293	607	507	32	971	1578
U.S. Citizen Graduate Students									
Number who are full-time	1386	674	1578	1044	4682	1739	403	1502	6183
Number who are first-year	381	204	467	336	1388	596	139	509	1896
Number who are part-time	154	104	302	571	1131	765	84	1703	2834

Table 6B: Full-time Graduate Students in Groups I, II, & III by Sex and Citizenship, Fall 1992 to Fall 2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total full-time graduate students	10121	9863	9714	9140	8774	8399	8186	8016	8902
First-year full-time graduate students	2705	2602	2546	2459	2256	2229	2348	2486	2614
Female full-time graduate students	2895	2816	2772	2696	2539	2504	2568	2486	2784
Male full-time graduate students	7226	7047	6942	6444	6235	5895	5618	5530	6118
U.S. citizen full-time graduate students	5759	5497	5678	5261	5035	4608	4475	4231	4682
Non-U.S. citizen full-time graduate students	4362	4366	4036	3879	3739	3791	3711	3785	4220

account for a major fraction of the department's undergraduate majors (and even the degrees awarded by the departments.) The data on majors currently collected do not distinguish computer science majors from mathematics majors, so it is not possible to estimate the size of these computer science programs.

The 1995 CBMS survey *Statistical abstract of undergraduate programs in the mathematical sciences in the U.S.* (MAA Reports No. 2, 1997) provides a more comprehensive study of departmental majors. The 2000 CBMS survey results will be available in spring 2002.

Graduate Student Profile

Table 6A summarizes information gathered about graduate students by the 2000 Departmental Profile Survey. This table gives the number of full-time, full-time first-year, and part-time graduate students for each type of graduate department. These same numbers are also given for only female graduate students and for only U.S. citizen graduate students.

There were substantial increases in nearly all types of graduate students from 1999 to 2000. Of the 63 entries in the group columns in Table 6A, only 10 were down, most only slightly; the rest were up, and many were up substantially. Six of the decreases were in Group Va, and three were in Group III. Nearly half of this increase of 1,779 full-time graduate students in Groups I, II, III, and M was in Group M, which may have been underestimated last year.

(Note: These comparisons were made against numbers from a corrected Table 10A from the Second Report for 1999. This table, which first appeared on page 902 of the September 2000 issue of the *Notices of the AMS*, had errors in the last two columns. The corrected data are presented in a table that appears in a note on the right side of this page.)

The total number of full-time graduate students in Groups I, II, III, and M increased from 9,609 to 11,388, an increase of 18.5%. First-year full-time graduate students in Groups I, II, III, and

Correction to Table 10A in the 1999 Second Report

Table 10A in the 1999 Second Report, which appeared in the September 2000 issue of the *Notices of the AMS* on page 902, contained incorrect numbers in the last two columns. The table below contains the reported figures and the newly revised figures.

The second to last paragraph from the 1999 Second Report on page 901 uses some of these bad numbers from the original Table 10A. A corrected version of this paragraph follows:

For the first time this year the number of part-time graduate students for various categories is reported. Groups I, II, and III have a total of 1,255 part-time graduate students, with 680 (54.2%) being in Group III. For Group III, 24.1% of all graduate students are part-time. Group M schools have 1,801 part-time graduate students compared to 1,593 full-time graduate students. For Group M, 53.1% of all graduate students are part-time. For Groups I, II, and III, 73.8% of the part-time graduate students are U.S. citizens. For Group M, 88.2% of the part-time graduate students are U.S. citizens.

In addition, the third sentence in the last paragraph in the Highlights section, page 887, should read:

Group M had 1,801 part-time students, which makes up 53.1% of their graduate students.

Reported and Revised Figures for Table 10A: Graduate Students, Fall 1999

	GROUP			
	M		I, II, III, & M	
	Reported	Revised	Reported	Revised
Total Graduate Students				
Number who are full-time	2146	1593	10162	9609
Number who are first-year	696	591	3182	3077
Number who are part-time	7254	1801	8509	3056
Female Graduate Students				
Number who are full-time	954	737	3440	3223
Number who are first-year	353	297	1219	1163
Number who are part-time	2968	819	3463	1314
U.S. Citizen Graduate Students				
Number who are full-time	1442	1169	5673	5400
Number who are first-year	472	437	1780	1745
Number who are part-time	6734	1589	7661	2516

Definitions of the Groups

As has been the case for a number of years, much of the data in these reports is presented for departments divided into groups according to several characteristics, the principal one being the highest degree offered in the mathematical sciences. Doctoral-granting departments of mathematics are further subdivided according to their ranking of "scholarly quality of program faculty" as reported in the 1995 publication *Research-Doctorate Programs in the United States: Continuity and Change*.¹ These rankings update those reported in a previous study published in 1982.² Consequently, the departments which now comprise Groups I, II, and III differ significantly from those used prior to the 1996 survey.

The subdivision of the Group I institutions into Group I Public and Group I Private was new for the 1996 survey. With the increase in number of the Group I departments from 39 to 48, the Annual Survey Data Committee judged that a further subdivision of public and private would provide more meaningful reporting of the data for these departments.

Brief descriptions of the groupings are as follows:

Group I is composed of 48 departments with scores in the 3.00–5.00 range. Group I Public and Group I Private are Group I departments at public institutions and private institutions respectively.

Group II is composed of 56 departments with scores in the 2.00–2.99 range.

Group III contains the remaining U.S. departments reporting a doctoral program, including a number of departments not included in the 1995 ranking of program faculty.

Group IV contains U.S. departments (or programs) of statistics, biostatistics, and biometrics reporting a doctoral program.

Group V contains U.S. departments (or programs) in applied mathematics/applied science, operations research, and management science which report a doctoral program.

Group Va is applied mathematics/applied science; Group Vb, which is no longer surveyed as of 1998–99, was operations research and management science.

Group M contains U.S. departments granting a master's degree as the highest graduate degree.

Group B contains U.S. departments granting a baccalaureate degree only.

Listings of the actual departments which comprise these groups are available on the AMS website at www.ams.org/employment/.

¹Research-Doctorate Programs in the United States: Continuity and Change, edited by Marvin L. Goldberger, Brendan A. Maher, and Pamela Ebert Flattau, National Academy Press, Washington, DC, 1995.

²These findings were published in An Assessment of Research-Doctorate Programs in the United States: Mathematical and Physical Sciences, edited by Lyle V. Jones, Gardner Lindzey, and Porter E. Coggeshall, National Academy Press, Washington, DC, 1982. The information on mathematics, statistics, and computer science was presented in digest form in the April 1983 issue of the Notices, pages 257–67, and an analysis of the classifications was given in the June 1983 Notices, pages 392–3.

M increased by 508 to 3,585, an increase of 16.5%. Full-time female graduate students in Groups I, II, III, and M increased from 3,223 to 3,952, a 22.6% increase. U.S. citizen full-time graduate students in these groups increased 14.5%. Part-time graduate students in these same groups increased 17.5% to 3,592.

Table 6B gives for Groups I, II, and III the total number of full-time, full-time first-year, full-time female, full-time male, full-time U.S. citizen, and full-time non-U.S. citizen graduate students for fall 1992 to fall 2000. For most of these categories there has been a downward or stable trend for the years 1992 through 1999. All of them had a substantial increase in 2000. The percentage increases from 1999 for Groups I, II, and III graduate students are:

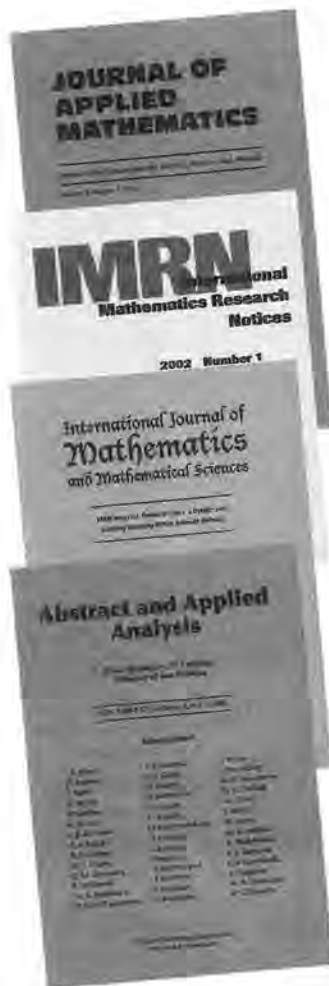
Full-time	11.1%
First-year full-time	5.1%
Female full-time	12.0%
Male full-time	10.6%
U.S. citizen full-time	10.7%
Non-U.S. citizen full-time	11.5%

For the second year the number of part-time graduate students is reported for the various groups. Part-time graduate students in Groups I, II, and III increased from 1,255 to 1,501, a 19.6% increase. Group III has 686 (45.7%) of the part-time graduate students. For Groups I, II, and III, 75.3% of the part-time graduate students are U.S. citizens and 40.4% are females. Group M departments have 2,091 part-time graduate students compared to 2,486 full-time graduate students. For Group M, 81.4% of the part-time graduate students are U.S. citizens and 46.6% are females.

Acknowledgments

The Annual Survey of the Mathematical Sciences attempts to provide an accurate appraisal and analysis of various aspects of the academic mathematical sciences scene for the use and benefit of the community and for filling the information needs of the professional organizations. Every year, college and university departments in the United States are invited to respond. The Annual Survey relies heavily on the conscientious efforts of the dedicated staff members of these departments for the quality of its information. On behalf of the Annual Survey Data Committee and the Annual Survey staff, we thank the many secretarial and administrative staff members in the mathematical sciences departments for their cooperation and assistance in responding to the survey questionnaires.

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Mathematics People

Zagier Receives Von Staudt Prize

This is the fourth time that the Otto and Edith Haupt Foundation has awarded the Karl-Georg Christian von Staudt Prize for outstanding achievements in the field of theoretical mathematics. The prizewinner is DON B. ZAGIER of the Max-Planck-Institut für Mathematik in Bonn. Zagier received this distinguished award for his pioneering work in the field of number theory. Through his work he has facilitated the solving of old and new problems using methods from many mathematical disciplines, and thus he has had considerable impact on the development of number theory over the last few decades. The award, endowed with DM 120,000 (about US\$52,000), was presented on May 11, 2001, during a ceremony held in the auditorium of the Erlangen Palace.

The Otto and Edith Haupt Foundation, which was founded in 1986 at the Friedrich-Alexander-Universität Erlangen-Nürnberg, has the awarding of the Karl-Georg Christian von Staudt Prize as its main objective.

Otto Haupt was a full professor of mathematics at the university in Erlangen from 1921 until his retirement in 1953. When he died at the age of 101 in November 1988, he left a considerable amount of money to the foundation, which is named after his wife and him and from which the von Staudt Prize is financed.

In 1991 Hans Grauert of Universität Göttingen was the first recipient of the von Staudt Prize. In the following years the prize went to Stefan Hildebrandt, Universität Bonn (1994), and Martin Kneser, Universität Göttingen (1997). According to the statutes of the foundation, the prize is awarded approximately every three years to a scientist who is working at a university or research facility in the Federal Republic of Germany on a permanent basis. The prize is awarded for specific results with special appeal, as well as for the overall work of accomplished researchers in the field of theoretical mathematics.

The award is named after the mathematician Karl-Georg Christian von Staudt (1798–1867), who held what was at the time the only chair of mathematics in Erlangen. Von Staudt came from an old patrician family in Rothenburg. During his studies in Göttingen he was greatly influenced by Karl Friedrich Gauss. He received his doctorate in 1822 in Erlangen and subsequently taught at high schools in Würzburg and Nürnberg. In 1835 he was appointed to the Erlangen chair of mathematics, where he worked until his death. Von Staudt is one of the creators of projective geometry. His most important research results in this field of mathematics were published in 1847 in Nürnberg in his book titled *Geometrie der Lage*. Von Staudt's pioneering ideas continue to influence the development of geometry to this day. He is considered to be the first modern mathematician at a Bavarian university.

Don Zagier, an American citizen, was born in 1951 in Heidelberg and grew up in the United States. He finished high school at the age of 13, and three years later he received his master's degree in physics and mathematics from the Massachusetts Institute of Technology. At the age of 20 he received his doctorate from Oxford. One year earlier he had come to Bonn, where he is still working today. Zagier started his career at the university in Bonn in the "Sonderforschungsbereich Theoretische Mathematik", sponsored by the Deutsche Forschungsgemeinschaft (the German equivalent of the U.S. National Science Foundation). In 1982 the Max-Planck-Institut für Mathematik evolved from this research project. Since its founding, Zagier has been a scientific member, and since 1995 he has acted as one of the four directors of the institute.

In addition to his work in Bonn, Zagier was also a professor at the University of Maryland (1979–1990). Since 1990 he has been a professor at the University of Utrecht (The Netherlands), and recently he was appointed professor at the renowned Collège de France in Paris.

Zagier's main area of work and expertise is in number theory, one of the oldest fields of mathematics. In 1984, together with B. H. Gross from Harvard University,

he succeeded in effectively solving the so-called "Class Number Problem" of Gauss.

The presentation ceremony of the von Staudt Prize included the four movements of Brahms's Sonata in E-minor for violoncello and piano. After addresses by the university rector and the vice president of the Max Planck Society, the laudatio for Zagier was given by Hendrik Lenstra of the University of California, Berkeley. The certificate of the von Staudt prize was presented to Zagier with the following text: "In 2001 the Otto and Edith Haupt Foundation awarded the Karl-Georg Christian von Staudt Prize to Prof. Dr. Don B. Zagier in appreciation of his pioneering works on number theory and its applications, such as the theory of modular forms, elliptic curves, hyperbolic spaces, zeta functions and polylogarithms, which he brought forward substantially in the last decades via the application of deep methods from algebraic geometry, analysis and combinatorics."

Zagier thanked the rector and the audience and gave a lecture with the title "Number theory: Old questions, modern answers".

—*W.-D. Geyer, Universität Erlangen*

Packard Fellowships

The David and Lucile Packard Foundation awarded 24 Fellowships for Science and Engineering for the year 2000. Among the awardees were two mathematical scientists.

RAHUL V. PANDHARIPANDE of the California Institute of Technology and ADAM SOBEL of Columbia University will each receive a fellowship of \$625,000 over five years.

The fellowships are awarded to researchers in mathematics, natural sciences, computer science, and engineering who are in the first three years of a faculty appointment.

—*From a Packard Foundation announcement*

Schramm and Smirnov Awarded 2001 Salem Prize

The Salem Prize for 2001 has been awarded jointly to ODED SCHRAMM of Microsoft Corporation and the Weizmann Institute and STANISLAV SMIRNOV of the Royal Institute of Technology, Stockholm.

Schramm was recognized for his development of stochastic Loewner equations and for his contributions to the geometry of Brownian curves in the plane. Smirnov was recognized for his work on existence of scaling limits and conformal invariance for critical percolation in the hexagonal grid.

The prize, in memory of Raphaël Salem, is awarded yearly to young researchers for outstanding contributions in the field of analysis.

Previous winners of the Salem Prize include the following: N. Varopoulos, R. Hunt, Y. Meyer, C. Fefferman, T. Körner, E. M. Nikishin, H. Montgomery, W. Beckner, M. R. Herman, S. B. Bochkarev, B. E. Dahlberg, G. Pisier, S. Pichorides, P. Jones, A. B. Aleksandrov, J. Bourgain, C. Kenig, T. Wolff, N. G. Makarov, G. David, J. L. Journé, A. L. Vol'berg, J.-C. Yoccoz, S. V. Konyagin, C. McMullen, M. Shishikura, S. Treil, K. Astala, H. Eliasson, M. Lacey, C. Thiele, T. Wooley, F. Nazarov, T. Tao.

The 2001 Salem Prize committee consisted of J. Bourgain, C. Fefferman, P. Jones, N. Nikolski, P. Sarnak, and J.-C. Yoccoz.

—*Elaine Kehoe*

CMI Long-Term Prize Fellows

The Clay Mathematics Institute (CMI) has announced its selection of four long-term prize fellows for 2001. Their names and most recent affiliations follow: ROMAN BEZRUKAVNIKOV, University of Chicago; ALEXEI BORODIN, Institute for Advanced Study, Princeton University; SERGEI GUKOV, Harvard University; and MIRCEA MUSTATA, University of Nice. They join the following long-term prize fellows for 2000, the first year in which the fellowships were awarded: MANJUL BHARGAVA, Princeton University; DENNIS GAITSGORY, University of Chicago; DANIEL GOTTESMAN, University of California, Berkeley; and TERENCE TAO, University of California, Los Angeles.

The prize fellowships are awarded to mathematicians who are thirty years old or younger and who have contributed profound ideas and major achievements to the discipline of mathematics. The long-term prize fellows are employed by CMI for terms ranging from one to five years and are paid a salary to conduct research at institutions of their choice. Additional research funding can be requested. Areas of research in which current fellows are involved range from the theory of numbers to error correction in quantum computation.

The Clay Mathematics Institute is a private, nonprofit foundation dedicated to increasing and disseminating mathematical knowledge. It sponsors a series of programs that include creating new mathematical knowledge, disseminating mathematical insights, inspiring talented students, and recognizing extraordinary mathematical achievement and solutions of specific mathematical problems.

—*From a CMI announcement*

Trjitzinsky Memorial Awards Presented

The AMS has made awards to nine undergraduate students through the Waldemar J. Trjitzinsky Memorial Fund. The fund is made possible by a bequest from the estate of Waldemar J., Barbara G., and Juliette Trjitzinsky. The will

of Barbara Trjitzinsky stipulates that the income from the bequest should be used to establish a fund in honor of the memory of her husband to assist needy students in mathematics.

For the 2001 awards the AMS chose eight geographically distributed schools to receive one-time awards of \$4,000 each. The mathematics departments at those schools then chose students to receive the funds to assist them in pursuit of careers in mathematics. The schools are selected in a random drawing from the pool of AMS institutional members.

Waldemar J. Trjitzinsky was born in Russia in 1901 and received his doctorate from the University of California, Berkeley, in 1926. He taught at a number of institutions before taking a position at the University of Illinois, Urbana-Champaign, where he remained for the rest of his professional life. He showed particular concern for students of mathematics and in some cases made personal efforts to insure that financial considerations would not hinder their studies. Trjitzinsky was the author of about sixty mathematics papers, primarily on quasi-analytic functions and partial differential equations. A member of the AMS for forty-six years, he died in 1973.

What follows are the names of the selected schools for 2001, the names of the students receiving Trjitzinsky awards, and brief biographical sketches of the students.

Columbia University: ALEXANDER IVANOV SOTIROV. Born in Sofia, Bulgaria, Sotirov attended high school there before becoming a student at Columbia University in September 1998. He has taken a variety of undergraduate and graduate mathematics courses and has an A average. He received Columbia's Van Amringe and I. I. Rabi/Kann-Rasmussen Prizes. A recipient of a Global Scholarship for international students, Sotirov also works and relies on loans to support his education. After finishing his bachelor's degree he intends to go to graduate school in mathematics. Henry Pinkham of Columbia University called Sotirov "one of our most talented students."

Florida Atlantic University: GREGORY NEVIL LEUCHIALI MAXWELL. Maxwell is a mathematics major and a participant in a program whereby students earn a bachelor's degree in an area of specialization and then go on to receive an M.Ed. degree. Maxwell was born and raised in Jamaica, where he was one of three children in a single-parent, low-income family. He came to the U.S. in 1997, originally intending to study medicine. His experiences teaching mathematics have drawn him to a career in mathematics education. In addition to working as a student assistant in the mathematics department, he has volunteered his time to be a tutor at the university and also to help high school students prepare for the Scholastic Aptitude Test. "He is an excellent student struggling to make ends meet," the mathematics department said.

Henderson State University: ANN SMITH. Smith is "an outstanding math student with potential to be a very good graduate student," said William M. Durand, chair of the department of mathematics and computer science. Smith graduated first in her class from high school and now has a 3.97 grade point average. She has served as a tutor for the past two years and "has done an outstanding job,"

Durand reported. A recipient of one of the departmental scholarships, she is a member of three honor societies and secretary of the math club. She was selected by the dean to serve as the student representative on the General Education Committee. "Ann is an outstanding student and a worthy recipient of this award," Durand concluded.

John Carroll University: ANDREA C. FORNEY. Forney is a mathematics major in her junior year. In addition to a love of and talent for mathematics, Forney plays the piano and cello and also enjoys field hockey, and track and field sports. She finances her education through summer jobs, scholarships, and a federal work/study award. She also grades calculus homework for the mathematics department. She is an inductee of Pi Mu Epsilon and will serve as chapter secretary next year. She would like to have a career in an analysis-based field and perhaps to teach. Her favorite mathematics class so far has been abstract algebra. "It was the hardest math class I ever took," she said, "but I grew to love it because I realized that a compartment of my brain was opening up that I never knew I had."

Seattle University: SINÉAD POLLOM. Born in Seattle, Pollom is one of four children and the first in her family to attend college. She got interested in mathematics "rather by accident," she said. At first she took mathematics courses because she had to; then as she started to like them, she decided to minor in the subject. Eventually mathematics became her major. She has two other majors, in ecology and German, and a minor in economics. She hopes to pursue a career that involves mathematics, such as being a teacher or an actuary.

University of Texas at Austin: VIRGINIA ROBERTS. Roberts receives no financial assistance from the university and supports her studies by working as a grader and a consultant in the computer laboratory of the mathematics department. A faculty member nominating her for the award said Roberts "possesses both an incisive intelligence and broad interests across the spectrum of math, science, and arts." In the summer of 1999 she learned about wavelets in order to apply them to remastering music. She was able to remove audience noise from a short recording of a 1961 Miles Davis concert. With support from University of Texas mathematician Karen Uhlenbeck, Roberts presented her results last year at a conference for women in mathematics in Lincoln, Nebraska. In naming Roberts as the recipient of the Trjitzinsky award, mathematics department chair Efraim Armendariz wrote, "She is richly deserving of this honor."

University of Utah: PAUL T. WATKINS. Originally a German major (he has completed a baccalaureate in that subject), Watkins is now a double major in mathematics and electrical engineering, with a 3.96 grade point average. This year he earned the best score in the mathematics department on the Putnam Examination and tied for third in the local Calculus Challenge. One professor in the mathematics department, who had Watkins in a course, said that Watkins was the best student in the class, "better than the grad students." Watkins' wife is also a mathematics major, and the newly married couple have struggled to support their studies, with Watkins working 30-40 hours a week. "This scholarship will mean a very great deal to this talented young

man," noted the departmental committee choosing Watkins for the award.

Worcester Polytechnic Institute: YAKOV KRONROD and MEGAN LALLY. Worcester Polytechnic Institute chose to split the Trjitzinsky award evenly between two students. Yakov Kronrod was born in Russia and moved to the U.S. in 1989. He is currently a junior, majoring in mathematics and computer science. His interests include random number generation and reaction-diffusion equations associated with biological systems. After graduation he plans to earn a master's degree in computer science and a Ph.D. in mathematics, in preparation for a career in research and teaching. Megan Lally is also a junior and is also majoring in mathematics and computer science. She is interested in cryptography, especially cryptographic algorithms derived from classical mathematics. Her undergraduate major project in mathematics involves studying and simulating patterns in nature using numerical analysis and modeling. A planned future project is studying the Advanced Encryption Standard. After graduation she plans to obtain a master's degree in computer science.

For further information about the Trjitzinsky Memorial Fund, contact the AMS Development Office, P.O. Box 6248, Providence, RI 02940-6248; e-mail: development@ams.org; telephone: 401-455-4111.

—Alyn Jackson

AMS Menger Awards Made

The 2001 Intel-International Science and Engineering Fair (ISEF) was held May 6–12, 2001, in the San Jose Convention Center in San Jose, California. This year marked the 52nd anniversary of the ISEF. Nearly 1,200 ninth-through twelfth-graders qualified to compete by winning top prizes in local, regional, and state fairs in the United States or national science fairs abroad. ISEF Special Award prizes were given by over fifty organizations, including the AMS. These prizes included scholarships, cash awards, T-shirts, magazines, and books.

This was the fourteenth year of participation in ISEF by the AMS, and the twelfth year of presentation of the Karl Menger Memorial Awards. The AMS Special Awards Panel of Judges included Gisele Goldstein (University of Memphis), Marius Nkashama (University of Alabama, Birmingham), and Julian Palmore, chair (University of Illinois at Urbana-Champaign). The judges also comprise the AMS Menger Prize Committee. The panel of judges reviewed forty-eight projects, all in mathematics. Each project was inspected by a panel member, and each student was interviewed. To select the winning projects, the panel conducted additional interviews with the student finalists. There was one first-place award, two second-place awards, and four third-place awards. The winners were given cash prizes, and they and the seven honorable mention winners were given copies of *What's Happening in the Mathematical Sciences*, Volume 4, by Barry Cipra (published by the AMS); and a short biography of Karl Menger, in whose honor the awards are named.



2001 AMS Menger Awardees, shown holding the AMS soft "briefcases" each received. Back row, left to right: Matthew Stemm, Christopher Bruner, Jesse Trana (all Honorable Mention). Third row, left to right: Michael Kaleta, Heon Choe, Jennifer Balakrishnan, Lindsey Cable (all Honorable Mention). Second row, left to right: Craig Schroeder, Jason Chiu, Hasuk Song, Daniel Wicks (all Third Place). Front row, left to right: Julian Palmore (Judge), Abdur Sabar (First Place), Serge Tishchenko (Second Place), Yuri Kudryashov (Second Place).

The Karl Menger Memorial prize winners were as follows:

First Place (\$1,000): ABDUR RASHEED SABAR, "Integral Products of Laguerre Polynomials and Their Discrete Analogues", Senior, Parkway West High School, Ballwin, Missouri.

Second Place (\$500): YURI GEORGIEVICH KUDRYASHOV, "Realization of Graphs and Surfaces in the Book with Three Pages", Sophomore, Kolmogorov College, Moscow, Russia; SERGE A. TISHCHENKO, "Separators in Planar Graphs as a New Characterization Tool", Junior, Vtoraia Shkola, Moscow, Russia.

Third Place (\$250): JASON WAH LONE CHIU, "On the Hamiltonian Decompositions of $Z_m \times Z_n$ ", Senior, Laramie Senior High School, Laramie, Wyoming; CRAIG ALLEN SCHROEDER, "Soap Hyperfilms", Senior, Wessington Springs High School, Wessington Springs, South Dakota; HASUK FRANCIS SONG, "Application of Differential Evolution to the Solution of Differential Equations", Junior, La Jolla High School, La Jolla, California; DANIEL WICKS, "Algebraic and Number Theoretic Properties of the Perrin Sequence", Senior, Yeshivah of Flatbush, Brooklyn, New York.

Honorable Mention: JENNIFER SHYAMALA SAYAKA BALAKRISHNAN, "An Analysis of Elliptical Coordinate Systems", Junior, Harvest Christian Academy, Guam; CHRISTOPHER RYAN BRUNER, "An Improved Mathematical Model of Populations", Freshman, Wewoka High School, Wewoka, Oklahoma; LINDSEY JO CABLE, "Proving POTS", Junior, De Soto High School, De Soto, Missouri; MICHAEL HARRY KALETA, MATTHEW HOWARD STEMM, HEON JOON CHOE, "Daedalus' Box: A Three-Dimensional Parabola", Seniors, Marquette University High School, Milwaukee, Wisconsin; JESSE SCOTT TRANA, "On the Forming of Pascal's N -Simplex Using Multinomial Expansion",

Sophomore, Johnson Corners Christian Academy, Watford City, North Dakota.

The entry titles of the winners indicate the breadth and scope of the projects and the wide interests of the participants. The judges were impressed particularly by the enthusiasm of the participants and their interest in mathematics.

The Society's participation in the Intel-ISEF is supported in part by income from the Karl Menger Fund, which was established by the family of the late Karl Menger. For more information about this program or to make contributions to the fund, contact the AMS Development Office, P.O. Box 6248, Providence, RI 02940-6248.

—Julian Palmore, University of Illinois at Urbana-Champaign

Mikaelian Awarded Emil Artin Junior Prize

The first Emil Artin Junior Prize in Mathematics has been awarded to VAHAGN MIKAEKIAN of Yerevan State University, Armenia. Mikaelian was chosen for his paper "Subnormal embedding theorems for groups", published in the *Journal of the London Mathematical Society* (2) 62 (2000), 398-406.

The prize carries a cash award of US\$500 and will be awarded annually to a student or a former student at an Armenian university who is under the age of 35 for outstanding contributions to algebra, geometry, topology, and number theory, the fields in which Emil Artin made major contributions.

The prize committee consisted of A. Basmajian, Y. Movsisyan, and V. Pambuccian.

—Artin Prize Committee announcement

Royal Society of London Elections

Four mathematical scientists are among those elected as new fellows of the Royal Society of London for 2001: FRANCES KIRWAN, University of Oxford; ADRIAN F. M. SMITH, University of London; IAN STEWART, University of Warwick; and ALEX WILKIE, University of Oxford.

—From a Royal Society announcement

Royal Society of Edinburgh Elections

Five mathematicians are among those elected to the Fellowship of the Royal Society of Edinburgh (RSE) in 2001. MARTIN D. KRUSKAL of Rutgers University was elected as an honorary fellow. Chosen as corresponding fellows

were OLE E. BARNDORFF-NIELSEN, Aarhus University, and VLADIMIR MAZ'YA, Linköping University. ANTHONY CARBERY, University of Edinburgh, and JONATHAN A. SHERRATT, Heriot-Watt University, were elected as ordinary fellows.

—From an RSE announcement

USA Mathematical Olympiad

The thirtieth annual USA Mathematical Olympiad (USAMO) was held on May 1, 2001. The students participating in the Olympiad were selected on the basis of their performances on the American High School and American Invitational Mathematics Examinations, which involved hundreds of thousands of students.

The twelve highest scorers in the USAMO were: REID W. BARTON of Arlington, Massachusetts; GABRIEL D. CARROLL of Oakland, California; STEPHEN GUO of San Francisco, California; LUKE GUSTAFSON of Breckenridge, Minnesota; DANIEL KANE of Madison, Wisconsin; IAN LEE of Princeton Junction, New Jersey; RICKY I. LIU of Newton Center, Massachusetts; TIANKAI LIU of San Jose, California; PO-RU LOH of Madison, Wisconsin; OAZ NIR of Cupertino, California; GREGORY PRICE of Alexandria, Virginia; and DONG SHIN of West Orange, New Jersey.

The Clay Mathematics Institute (CMI) selected MICHAEL HAMBURG of South Bend, Indiana, as the CMI Olympiad Scholar for 2001, an award given for the solution judged most elegant. Ricky Liu received that distinction in last year's competition.

These thirteen students and seventeen others who scored highly on the USAMO were invited to attend the four-week Mathematical Olympiad Summer Program (MOSP) at Georgetown University in Washington, DC, from June 5 to July 3, 2001. This program helps to broaden students' view of mathematics and prepares them for possible participation on the United States team for the International Mathematical Olympiad, to be held in Washington, DC, July 4 through July 14, 2001. The USA Team will be selected on the basis of further testing during the MOSP.

—Elaine Kehoe

Mathematics Opportunities

American Mathematical Society Centennial Fellowships

Invitation for Applications for Awards for 2002-2003

Deadline December 1, 2001

The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. From 1997-2001, the fellowship program was aimed at recent Ph.D.'s. Recently the AMS Council approved changes in the rules for the fellowships. The eligibility rules are as follows.

The primary selection criterion for the Centennial Fellowship is the excellence of the candidate's research. Preference will be given to candidates who have not had extensive fellowship support in the past. Recipients may not hold the Centennial Fellowship concurrently with another research fellowship such as a Sloan or NSF Postdoctoral Fellowship. Under normal circumstances, the fellowship cannot be deferred. A recipient of the fellowship shall have held his or her doctoral degree for at least three years and not more than twelve years at the inception of the award. Applications will be accepted from those currently holding a tenured, tenure-track, postdoctoral, or comparable (at the discretion of the selection committee) position at an institution in North America.

The stipend for fellowships awarded for 2002-2003 is expected to be approximately \$55,000, with an additional expense allowance of about \$1,650. Acceptance of the fellowship cannot be postponed.

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. Due to a change in eligibility criteria and an increase in the stipend beginning in 2002-2003, it is expected that three fellowships will be awarded. A list of previous fellowship winners can be found at <http://www.ams.org/secretary/prizes.html>.

Applications should include a cogent plan indicating how the fellowship will be used. The plan should include travel to at least one other institution and should demonstrate that the fellowship will be used for more than reduction of teaching at the candidate's home institution. The selection committee will consider the plan in addition to the quality of the candidate's research and will try to award the fellowship to those for whom the award would make a real difference in the development of their research careers. Work in all areas of mathematics, including interdisciplinary work, is eligible.

The deadline for receipt of applications is **December 1, 2001**. Awards will be announced in February 2002 or earlier if possible.

For application forms write to the Executive Director, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; or send electronic mail to ams@ams.org; or call 401-455-4106. Application forms are also available via the Internet at <http://www.ams.org/employment/centflyer.html>.

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

NSA Grant and Sabbatical Programs

The Mathematical Sciences Program of the National Security Agency (NSA) provides grants and sabbatical opportunities to support research by academic mathematical scientists.

The NSA makes grants to universities and nonprofit institutions to support self-directed research in the following areas of mathematics (including possible computational aspects): algebra, number theory, discrete mathematics, probability, and statistics. The NSA also accepts proposals for small grants for conferences, workshops, and special academic endeavors. Research grants are designed principally to provide summer salary for professors and limited support for their graduate students. The deadline for submission of proposals is **October 15** each year. Grants begin in the fall of the following year.

The NSA also accepts proposals for small grants for conferences, workshops, and special academic endeavors. Proposals for these may be submitted at any time and will be reviewed as they are received at NSA. Allow at least eight months for review, negotiation, and processing.

The sabbatical opportunities offered by the NSA provide support for academic mathematical scientists to visit the NSA for periods ranging from 9 to 24 months. Visitors' sabbatical stipends will be supplemented with funds to equal their regular monthly salaries. A choice is offered between an allowance for moving expenses or a housing supplement. Applicants and their immediate family members must be U.S. citizens. Because a complete background investigation is required, applications should be submitted well in advance of the requested starting date.

Further information may be obtained from the NSA's Web site: <http://www.nsa.gov/programs/msp/grants.html>. The telephone number is 301-688-0400, the e-mail address is msp@math.umbc.edu, and the postal address is: Mathematical Sciences Program, National Security Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557.

—From an NSA announcement

AWM Travel Grants for Women

With funding from the National Science Foundation, the Association for Women in Mathematics (AWM) sponsors two travel grant programs for women mathematicians.

AWM Travel Grants enable women to attend research conferences in their fields, thereby providing scholars valuable opportunities to advance their research activities and their visibility in the research community. A travel grant provides full or partial support for travel and subsistence for a meeting or conference in the grantee's field of specialization.

AWM Mentoring Travel Grants are designed to help junior women develop long-term working and mentoring relationships with senior mathematicians. A Mentoring

Travel Grant funds travel, subsistence, and other expenses for an untenured woman mathematician to travel to an institute or a department to do research with a specified individual for one month.

The final deadline for the Travel Grants program for 2001 is **October 1, 2001**; the deadlines for 2002 are **February 1, 2002**; **May 1, 2002**; and **October 1, 2002**. For the Mentoring Travel Grants program the deadline is **February 1, 2002**. For further information and details on applying, see the AWM Web site, <http://www.awm-math.org/travelgrants.html>; or telephone 301-405-7892; or send e-mail to awm@math.umd.edu. The postal address is: Association for Women in Mathematics, 4114 Computer and Space Sciences Building, University of Maryland, College Park, MD 20742-2461.

—From an AWM announcement

NSF Mathematical Sciences Postdoctoral Research Fellowships

The Mathematical Sciences Postdoctoral Research Fellowship program of the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) awards fellowships each year for research in pure mathematics, applied mathematics and operations research, and statistics. The deadline for this year's applications is **October 17, 2001**. Applications must be submitted via FastLane on the World Wide Web. Go to <http://www.fastlane.nsf.gov/> and click on "Postdoctoral Fellowships". Information can be found there for the Mathematical Sciences Postdoctoral Research Fellowships, as well as other NSF fellowship opportunities. For more information, telephone the DMS at 703-306-1870 or e-mail: msprf@nsf.gov.

—From an NSF announcement

NSF Graduate Fellowships

The National Science Foundation (NSF) awards Graduate Research Fellowships to graduating seniors and first-year graduate students. These are three-year fellowships awarded to U.S. students for full-time graduate study at the institutions of their choice. The fellowships include a stipend, tuition coverage, and possible international travel allowances. Awards are made based on the candidates' intellectual merit and potential for research achievement. More information and applications will be available early in August 2001 at <http://www.orau.org/nsf/nsffe1.htm>.

—From an NSF announcement

Call for Submissions for Sunyer i Balaguer Prize

Ferran Sunyer i Balaguer (1912–1967) was a self-taught Catalan mathematician who, despite a serious physical disability, was very active in research in classical analysis, an area in which he acquired international recognition. Each year, in honor of the memory of Ferran Sunyer i Balaguer, the Institut d'Estudis Catalans awards an international research prize bearing his name.

The prize is awarded for a mathematical monograph of an expository nature presenting the latest developments in an active area of research in mathematics in which the author has made important contributions. The monograph should be written in English and should be at least 150 pages.

The prize, amounting to 10,000 euros (about US\$8,600), is provided by the Ferran Sunyer i Balaguer Foundation. The winning monograph will be published in Birkhäuser-Verlag's series Progress in Mathematics, subject to the usual regulations concerning copyright and author's rights.

Submissions should be sent before **December 1, 2001**, to: Centre de Recerca Matemàtica, Fundació Ferran Sunyer i Balaguer, Apartat 50, E-08193 Bellaterra, Spain. For further information, visit the Web site <http://www.crm.es/info/ffsb.htm>, or send e-mail to crm@crm.es.

—From an Institut d'Estudis Catalans announcement

COBASE Collaborative Grants

With funding from the National Science Foundation (NSF), the Office for Central Europe and Eurasia of the National Research Council, the operating arm of the National Academies, 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). This program is designed primarily to prepare these new partnerships for competition in NSF programs. Although proposals are accepted for collaborative research in all fields of basic science supported by NSF, this year the Collaboration in Basic Science and Engineering (COBASE) program has added three topical focus areas in which applications will be given special priority. One of these areas is mathematics.

Project Development and Initiation Grants support American specialists who wish to host and/or visit their CEE or NIS colleagues in order to initiate research projects and prepare collaborative research proposals for submission to NSF. U.S. applicants may request support for up to two visits in either or both directions (i.e., either traveling to CEE/NIS or hosting a colleague from the region here in the U.S.), with the total combined duration of the visit(s) not to exceed eight weeks. Each individual visit proposed must be at least two weeks (10–14 days) in length. Grants will be in the range of \$2,500 to \$10,000.

Participating countries: Armenia, Azerbaijan (traveling only), Bosnia (hosting in U.S. only), Bulgaria, Croatia, Czech

Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, (Former Yugoslav Republic of) Macedonia, Moldova, Poland, Romania, Russia (see website for updated list of ineligible partner institutions), Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

Eligibility: All applicants must: (1) be U.S. citizens or permanent residents, (2) be affiliated with U.S. universities or other nonprofit research institutions, and (3) possess Ph.D. degrees or equivalent research experience. Foreign counterparts involved must possess CEE/NIS citizenship, be permanently employed at CEE/NIS institutions, and hold Ph.D. (kandidat) degrees or research training and experience equivalent to a doctoral degree. Employees of private companies and the U.S. government generally are not supported under the COBASE program. Each set of partners may receive no more than one COBASE grant, and each individual may be involved in no more than two grants in a four-year period. Generally, those who hold a current NSF grant and are eligible for an NSF international supplement should not apply to this program. NSF's Central and Eastern Europe Program staff (telephone 703-292-8703) can advise regarding applications for NSF international supplements. *However, for projects in the three special topical areas (including mathematics), applicants with current NSF support are eligible to apply.*

Special Opportunities for Junior Investigators: American applicants who have received their doctoral degrees within the past ten years will receive special consideration. The COBASE program allocates at least 25 percent of its grants to researchers in this category in order to encourage beginning investigators to become involved in international collaboration.

Collaborative proposals involving any field of mathematics are welcome, including but not limited to algebra and number theory, analysis, computational mathematics, geometric analysis, statistics and probability, and topology and foundations. Projects in applied mathematics involving collaborations with specialists from other fields such as the biological, computer, and environmental sciences are also encouraged. Collaborative research proposals involving the modeling of complexity are particularly welcome.

The postmarking deadlines for proposals are **August 27, 2001; January 4, 2002; and April 15, 2002**. For application forms and instructions, visit the website <http://www.nationalacademies.org/oia/>. For more information telephone 202-334-2644, send a fax to 202-334-2614, or send e-mail to occe@nas.edu.

—From an NAS announcement

For Your Information

News from IPAM

The Institute for Pure and Applied Mathematics (IPAM) at the University of California, Los Angeles, announces the following schedule of programs.

Semester-Long Programs, 2001–2002

Conformal Field Theory, September 2001–December 2001: Organizing Committee: Eric D'Hoker (UCLA), David Gieseker (UCLA), Victor Kac (MIT), Tetsuji Miwa (RIMS, Kyoto University), David Olive (University of Wales, Swansea), Duong H. Phong (Columbia), and Edward Witten (IAS). Workshops: Applications of Conformal Field Theory, October 15–19, 2001; Representation Theory of Loop Groups, November 12–16, 2001.

Large-Scale Communication Networks, March 2002–June 2002: Organizing Committee: Tony Chan (UCLA and IPAM), David Donoho (Stanford), John Doyle (Caltech), Deborah Estrin (UCLA), Kristina Lerman (USC/ISI), and Walter Willinger (AT&T Labs-Research). Tutorials will be held March 12–15, 2002. Workshops: Large-Scale Communication Networks: Topology and Routing, March 18–22, 2002; Spatio-Temporal Aspects of Large-Scale Network Dynamics, April 15–19, 2002; and On Massively Distributed Self-Organizing Systems (Sensor Networks), May 13–17, 2002.

Short Programs, 2001–2002

Contemporary Methods in Cryptography, January 9–13, 2002: Organizing Committee: Don Blasius (UCLA), William Duke (UCLA), Jonathan Rogawski (UCLA), Daniel Boneh (Stanford), Cynthia Dwork (Compaq Systems Research Center), and Joseph Silverman (NTRU Cryptosystems/Brown University).

Mathematical Challenges in Scientific Data Mining, January 14–18, 2002: Organizing Committee: Chandrika Kamath (CASC, LLNL), Padhraic Smyth (CS, UC Irvine), B. S. Manjunath (ECE, UC Santa Barbara), and Ananth Grama (CS, Purdue).

Mathematics of Subgrid-Scale Phenomena in Atmospheric and Oceanic Flows, January 28–February 5, 2002: Organizing Committee: Kerry Emanuel (Atmospheric Sciences, MIT), Markos A. Katsoulakis (Mathematics, U. Mass), Andrew Majda (Mathematics, NYU), and Bjorn Stevens (Atmospheric Sciences, UCLA).

Human Evolution and Genetics, February 11–15, 2002: Organizing Committee: Simon Tavaré (USC), Mark Green (UCLA), and Magnus Nordborg (USC).

Linear Scaling Electronic Structure Methods, April 1–4, 2002: Organizing Committee: Emilio Artacho (UAM), Roi Baer (Chemistry, Hebrew U., Israel), Gregory Beylkin (U. Colorado, Boulder), Achi Brandt (Math. Sci., Weizmann Inst., Israel), Emily Carter (Chemistry, UCLA), and Yousef Saad (CS, Minnesota).

Undergraduate Program, Summer 2002

Research in Industrial Projects for Students (RIPS): RIPS is a summer program based on the National Science Foundation's Research Experiences for Undergraduates program with industry-sponsored projects. It will run from July 1, 2002, to August 31, 2002. The application period for 2002 will open September 1, 2001. Please see <http://www.ipam.ucla.edu/programs/rips2002/> for details.

Registration for individual workshops is available. Please visit the IPAM Web site for more detailed information: <http://www.ipam.ucla.edu/programs/>.

—IPAM announcement

Board on Mathematical Sciences Chairs' Colloquium

The Sixteenth Annual Chairs' Colloquium of the Board on Mathematical Sciences (BMS) will be held November 9–10, 2001. Brochures and registration forms are mailed in August to each four-year U.S. mathematics and statistics department. For further information, see the BMS Web site at <http://www.nas.edu/bms/>, or contact the Board on Mathematical Sciences by telephone at 202-334-2421 or by e-mail at bms@nas.edu. The postal address is: Board on Mathematical Sciences, National Research Council, Room HA476U, 2101 Constitution Avenue, NW, Washington, DC 20418.

—BMS announcement

Proof Wins Best Play Tony Award

The play *Proof* by David Auburn has received the 2001 Tony Award for Best Play. The play concerns the daughter of a late mathematician who became famous for his complicated proofs and who suffered from dementia. The daughter, who has fears for her own mental health, claims to be the author of an important theorem about prime numbers that could change mathematics forever, but one of her father's former students has doubts about her authorship. The play also received the 2001 Pulitzer Prize for Drama. Reviews of the play previously appeared in the *Notices*, October 2000, pages 1082–4, and June/July 2000, pages 596–7.

—Elaine Kehoe

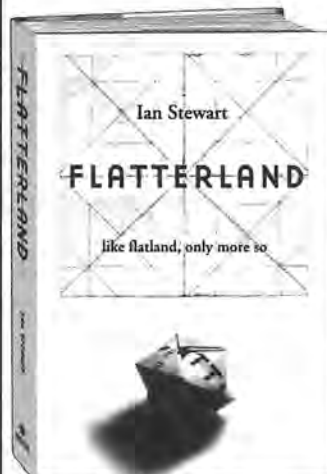
Questionnaire for Mathematicians

A research project has been launched to investigate what fascinates mathematicians about their subject, how they came into the field, and what they think about it now. Conducting the research are Patrick Bangert of the Department of Mathematics at University College London and Nicky Graves Gregory, a cranio-sacral therapist and director of the Web site ecobiz.co.uk. They intend to interview about ten prominent mathematicians and are also circulating a questionnaire. The ultimate aim is to write a book based on this research.

Mathematicians may participate in the project by filling out the questionnaire, which is on the Web at <http://www.knot-theory.org/questionnaire/>.

—Allyn Jackson

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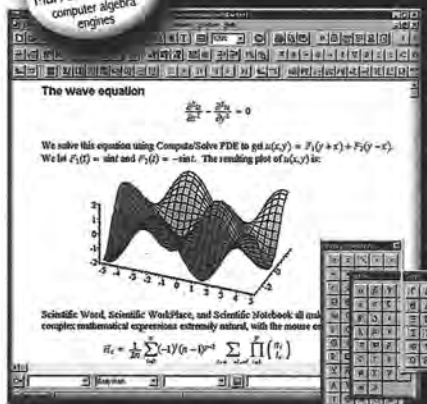
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Inside the AMS

A Summer at *Popular Science* Magazine

Each summer the American Association for the Advancement of Science (AAAS) runs a fellowship program that places science graduate students in ten-week internships at media outlets. In sponsoring the AMS-AAAS Mass Media Fellowship, the AMS provides funds for one or two mathematics graduate students to participate each year. What follows are reflections by Kathryn Leonard, a mathematics graduate student at Brown University, about her fellowship at Popular Science magazine in New York City during the summer of 2000.

The deadline to apply for the AMS-AAAS Mass Media Fellowship is traditionally January 15 each year. Information about applying will appear in the "Stipends" section of the October issue of the Notices.

I sit on the other side of a massive desk from Glennys Farrar, chair of New York University's physics department. In my lap I hold a white notepad, upon which I am scribbling notes while Professor Farrar describes her research. Nothing is remarkable about this; I have been taking notes on white notepads in professors' offices for over a decade. But today, for the first time, I am a reporter instead of a student.

Farrar's gray curls dance as she describes the surprises awaiting us when scientists better understand the behavior and composition of high-energy cosmic rays. Nothing less than our fundamental understanding of the universe will change as their mysteries unravel. When she mentions theories that these streams of charged particles may be manifestations of high-energy events in a fourth dimen-

sion, chills scurry down my spine. I wonder how she maintains her composure while probing the secrets of the universe on a daily basis.

Not until I'm passing the bustling shoe stores on 8th Street, reveling in the stimulation of our interview, do I realize I have never before left a professor's office so excited and curious and motivated to learn more. In my quest to find an interesting, accessible story in Farrar's research, I asked all the right questions—questions I would never have asked as a student. Surprisingly, my short-lived role as reporter made me a better student than years of academic training.

A few months earlier, science writing boot camp for the twenty-odd science graduate students in the AAAS Mass Media Science and Engineering Fellows Program had introduced me to the unfamiliar world of journalism. An intensive three days in Washington, DC, the training involved lectures on topics from interviewing techniques (consider "Have you ever done time?" as an opening question) to finding sources (ask interviewees for names of people who hate them). We practiced our craft in workshops, then toured National Public Radio and *WashingtonPost.com* to observe the professionals. At every opportunity our drill sergeants reminded us of the differences between the worlds of academia and of popular media. They were right of course. Academia's conservative thoroughness is inherently at odds with the edgy, fast-paced media. Imagining my summer as a writer for *Popular Science* magazine, I expected to learn anything but how to be a better student.

I did learn other things. *Popular Science* was ideal for my media initiation because its small, overworked staff eagerly involved me in a wide variety of projects. Writing articles on subjects ranging from evolution to space tourism

to bioengineered corneas gave me crash courses in subjects I hadn't studied in years. The short length of most of the pieces—around 300 words—taught me sharpness and efficiency in writing, as well as creative ways of communicating sophisticated ideas simply and colorfully. Clever editing showed me how adding a single word can focus a whole paragraph. Careless editing demonstrated how easily misinformation prevails. I learned about general magazine operations, the delicate dance between editorial and advertising content, and the agony behind every cover design.

I also learned of similarities between academic and mass media career paths. Advertising and marketing staff are as overpaid as university administrators, while editors and writers earn far smaller salaries than professors. While postdoctoral positions require relocation every two years, newly graduated journalists often move every three months for internships paying as little as \$300 per month. Freelance writers' earnings are comparable to adjunct professors', without benefits or access to university health services. Sadly, those in power seem reluctant to change the system, echoing arguments I've heard on the lips of numerous professors: they made the sacrifices when they were starting out, so why should the new generation have it any easier? If I hope to escape the hardships of launching an academic career, I shouldn't look to journalism.

Yet here I am at NYU, bridging these two imperfect worlds. The end of the exhilarating and exhausting day that began with a lesson in cosmic rays and continued through DNA robots, insect flight simulation, and bioengineered neural networks finds me lounging in an easy chair facing neuroscientist Paul Glimcher as he describes his work on the mechanisms of decision making in primates. I've applied my newly empowered student skills to understand how the level of brain activity in monkeys reflects the amount of benefit the monkeys expect from a particular decision. Glimcher stops short of the really good stuff, he explains, because it involves math—game theory, in fact—and he doesn't know how to explain it to me without technical constructions. With a smile, I expose my secret life as a mathematician. His jaw drops for just a second before he enthusiastically launches into a description of his latest experiment and how he's certain his results will be consistent with game-theoretic predictions.

As I walk to the subway in a gentle drizzle, I can't help chuckling at all the warnings I received about how journalists and academics think differently. Today I have discovered the synergy between these two mindsets. And now that the reporter and the mathematician in me have been introduced, their differences will make each indispensable to the other. I thought my summer would be about choosing a future career. Instead, it's been about enlightenment.

—Kathryn Leonard, Brown University

Deaths of AMS Members

DOUGLAS DERRY, of the University of British Columbia, died on April 24, 2001. He was a member of the Society for 63 years.

CAROLYN EISELE, of New York, NY, died on January 15, 2000. Born on June 13, 1902, she was a member of the Society for 66 years.

ROBERT FAURE, of Paris, France, died on July 24, 2000. Born on November 20, 1919, he was a member of the Society for 48 years.

MAY H. MARIA, of Austin, TX, died on June 8, 2001. Born on December 16, 1904, she was a member of the Society for 73 years.

C. W. MCARTHUR, of Tallahassee, FL, died on May 26, 2001. Born on November 4, 1921, he was a member of the Society for 51 years.

JAMES HENRY MICHAEL, of the University of Adelaide, Australia, died on April 17, 2001. Born on April 3, 1920, he was a member of the Society for 40 years.

STANLEY W. NASH, professor emeritus, University of British Columbia, died on March 28, 2001. Born on October 8, 1915, he was a member of the Society for 49 years.

WALTER PRENOWITZ, professor emeritus, Brooklyn College, CUNY, died on August 7, 2000. Born on October 19, 1906, he was a member of the Society for 68 years.

J. J. SEIDEL, professor emeritus, Eindhoven University of Technology, The Netherlands, died on May 8, 2001. Born on August 19, 1919, he was a member of the Society for 36 years.

Reference and Book List

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.

Contacting the Notices

The preferred method for contacting the Notices is electronic mail. The editor is the person to whom to send articles and letters for consideration. Articles include feature articles, memorial articles, communications, opinion pieces, and book reviews. The editor is also the person to whom to send news of unusual interest about other people's mathematics research.

The managing editor is the person to whom to send items for "Mathematics People", "Mathematics Opportunities", "For Your Information", "Reference and Book List", and "Mathematics Calendar". Requests for permissions, as well as all other inquiries, go to the managing editor.

The electronic-mail addresses are `notices@math.tamu.edu` in the case of the editor and `notices@ams.org` in the case of the managing editor. The fax numbers are 979-845-6028 for the editor and 401-331-3842 for the managing editor. Postal addresses may be found in the masthead.

Upcoming Deadlines

September 1, 2001: Applications for AWM Workshops for Women Graduate Students and Postdocs. See <http://www.awm-math.org/>, or contact Workshop Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; telephone 301-405-7892; e-mail: `awm@math.umd.edu`.

September 15, 2001: Nominations for Alfred P. Sloan Research Fellowships. Contact Sloan Research

Fellowships, Alfred P. Sloan Foundation, 630 Fifth Avenue, Suite 2550, New York, NY 10111, or see <http://www.sloan.org/>.

October 1, 2001: Nominations for the Louise Hay and Alice T. Schafer awards of the AWM. Contact Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; telephone 301-405-7892; e-mail: `awm@math.umd.edu`; World Wide Web: <http://www.awm-math.org/>.

October 1, 2001: Nominations for the Emanuel and Carol Parzen Prize. Submit nominations to J. H. Matis, Department of Statistics, Texas A&M University, College Station, TX 77873-3143.

October 1, 2001, and May 1, February 1, October 1, 2002: Applications for NSF/AWM Travel Grants for Women. See "Mathematics Opportunities" in this issue.

October 15, 2001: Applications for NSA Grant and Sabbatical Programs. See "Mathematics Opportunities" in this issue.

October 17, 2001: Applications for NSF Postdoctoral Research Fellowships. See "Mathematics Opportunities" in this issue.

October 31, 2001: Applications for AMS Travel Grants for ICM 2002. Contact `ICM02@ams.org`; telephone 800-321-4267, ext. 4105, or 401-455-4105; World Wide Web: <http://www.ams.org/careers-edu/icmapp.html>.

November 1, 2001: Applications for Fulbright scholar international education and academic administrator seminars. Contact the Council for International Exchange of Scholars (CIES), 3007 Tilden Street, NW, Suite 5L, Washington, DC 20008-3009; telephone 202-686-7877; World Wide Web: http://www.cies.org/cies/pr_competit_02.htm.

December 31, 2001: Submissions for undergraduate paper contest in *Cryptologia*. See <http://www.dean.usma.edu/math/pubs/cryptologia/default.htm>.

January 31, 2002: Applications for IMU travel grants for ICM 2002. See <http://elib.zib.de/IMU/>.

Where to Find It

A brief index to information that appears in this and previous issues of the Notices.

AMS Bylaws—November 1999, p. 1252

AMS e-Mail Addresses—November 2000, p. 1288

AMS Ethical Guidelines—June 1995, p. 694

AMS Officers 2000 and 2001 (Council, Executive Committee, Publications Committees, Board of Trustees)—May 2001, p. 520

AMS Officers and Committee Members—October 2000, p. 1127

Conference Board of the Mathematical Sciences—September 2001, p. 843

Information for Notices Authors—June/July 2001, p. 611

Mathematics Research Institutes Contact Information—August 2001, p. 731

National Science Board—February 2001, p. 216

New Journals for 2000—June/July 2001, p. 612

NRC Board on Mathematical Sciences and Staff—April 2001, p. 427

NRC Mathematical Sciences Education Board and Staff—May 2001, p. 517

NSF Mathematical and Physical Sciences Advisory Committee—March 2001, p. 328

Program Officers for Federal Funding Agencies—October 2000, p. 1100 (DoD, DoE); November 2000, p. 1291 (NSF)

February 1, 2002: Applications for NSF/AWM Mentoring Travel Grants. See "Mathematics Opportunities" in this issue.

Conference Board of the Mathematical Sciences

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National Council of Supervisors of
Mathematics (NCSM)
National Council of Teachers of
Mathematics (NCTM)
Society for Industrial and Applied
Mathematics (SIAM)
Society of Actuaries (SOA)

Book List

The Book List highlights books that have mathematical themes and hold appeal for a wide audience, including mathematicians, students, and a significant portion of the general public.

When a book has been reviewed in the Notices, a reference is given to the review. Generally the list will contain only books published within the last two years, though exceptions may be made in cases where current events (e.g., the death of a prominent mathematician, coverage of a certain piece of mathematics in the news) warrant drawing readers' attention to older books. Suggestions for books to include on the list may be sent to the managing editor, e-mail: notices@ams.org.

Angles of Reflection: Logic and a Mother's Love, by Joan L. Richards. W. H. Freeman, May 2000. ISBN 0-716-73831-7.

Battle of Wits: The Complete Story of Codebreaking in World War II, by Stephen Budiansky. Free Press, October 2000. ISBN 0-684-85932-7.

The Bit and the Pendulum: How the New Physics of Information Is Revolutionizing Science, by Tom Siegfried. John Wiley & Sons, February 2000. ISBN 0-47132-174-5.

* *The Book of Nothing: Vacuums, Voids, and the Latest Ideas about the Origins of the Universe*, by John D. Barrow. Pantheon Books, April 2001. ISBN 0-375-42099-1.

The Brain: Unraveling the Mystery of How It Works (The Neural Network Process), by Thomas L. Saaty. RWS Publications, 2000. ISBN 1-888603-02-X.

Chaotic Elections! A Mathematician Looks at Voting, by Donald G. Saari. AMS, April 2001. ISBN 0-8218-2847-9.

Computers Ltd.: What They Really Can't Do, by David Harel. Oxford University Press, November 2000. ISBN 0-198-50555-8.

A Concise History of Mathematics, by Dirk J. Struik. Dover Publications, 1987. ISBN 0-486-60255-9. (Reviewed June/July 2001.)

Conned Again, Watson! Cautionary Tales of Logic, Math, and Probability, by Colin Bruce. Perseus Publishing, January 2001. ISBN 0-7382-0345-9.

Creators of Mathematics: The Irish Connection, by Ken Houston. University College Dublin Press, September 2000. ISBN 1-900-62149-5.

The Crest of the Peacock: The Non-European Roots of Mathematics, by George Gheverghese Joseph. Princeton University Press, October 2000 (new edition). ISBN 0-691-00659-8.

Crypto: How the Code Rebels Beat the Government—Saving Privacy in the Digital Age, by Steven Levy. Viking Press, January 2001. ISBN 0-67085-950-8.

Divine Harmony: The Life and Teachings of Pythagoras, by John Strohmeier and Peter Westbrook. Berkeley Hills Books, November 1999. ISBN 0-965-37745-8.

The Dots and Boxes Game, by Elwyn Berlekamp. A K Peters, July 2000. ISBN 1-568-81129-2.

Duelling Idiots and Other Probability Puzzlers, by Paul J. Nahin. Princeton University Press, October 2000. ISBN 0-691-00979-1.

Education of a Mathematician, by Philip J. Davis. A K Peters, August 2000. ISBN 1-568-81116-0. (Reviewed January 2001.)

Einstein in Love: A Scientific Romance, by Dennis Overbye. Viking Press, October 2000. ISBN 0-670-89430-3.

Euclid's Window: The Story of Geometry from Parallel Lines to Hyperspace, by Leonard Mlodinow. Free Press, April 2001. ISBN 0-684-86523-8.

Exploring Randomness, by Gregory J. Chaitin. Springer, December 2000. ISBN 1-852-33-417-7.

Finite vs. Infinite, Contributions to an Eternal Dilemma, Cristian S. Calude and Gheorghe Paun, editors. Springer, 2000. ISBN 1-852-33251-4.

Flatterland: Like Flatland, Only More So, by Ian Stewart. Perseus Publishing, May 2001. ISBN 0-7382-0442-0.

The Fractal Murders, by Mark Cohen. E-book published by Southern Cross Review, 2001. World Wide Web: www.southerncrossreview.org/.

Geometry from Africa: Mathematical and Educational Explorations, by Paulus Gerdes. Mathematical Association of America, April 1999. ISBN 0-88385-715-4.

Gödel: A Life of Logic, by John L. Casti and Werner DePauli. Perseus, August 2000. ISBN 0-7382-0274-6. (Reviewed in this issue.)

Gödel Meets Einstein: Time Travel in the Gödel Universe, by Palle Yourgrau. Open Court, November 1999. ISBN 0-812-69408-2.

Hex Strategy: Making the Right Connections, by Cameron Browne. A K Peters, May 2000. ISBN 1-568-81117-9.

* *The Hole in the Universe: How Scientists Peered over the Edge of Emptiness and Found Everything*, by K. C. Cole. Harcourt Brace, January 2001. ISBN 0-151-00398-X.

* *How the Other Half Thinks: Adventures in Mathematical Reasoning*, by Sherman Stein. McGraw-Hill, July 2001. ISBN 0-071-37339-X.

How to Solve It: Modern Heuristics, by Zbigniew Michalewicz and David B. Fogel. Springer, 2000. ISBN 3-540-66061-5.

The Kingdom of Infinite Number: A Field Guide, by Bryan Bunch. W. H. Freeman, January 2000. ISBN 0-716-73388-9.

Logical Dilemmas: The Life and Work of Kurt Gödel, by John Dawson. A K Peters, December 1997. ISBN 1-56881-025-3. (Reviewed in this issue.)

The Math Gene: How Mathematical Thinking Evolved and Why Numbers Are Like Gossip, by Keith Devlin. Basic Books, August 2000. ISBN 0-465-01618-9. (Reviewed February 2001.)

Mathematics As Sign: Writing, Imagining, Counting, by Brian Rotman. Stanford University Press, September 2000. ISBN 0-804-73684-7.

Mathematics: Frontiers and Perspectives, V. Arnold, M. Atiyah, P. Lax, and B. Mazur, editors. AMS, December 1999. ISBN 0-8218-2697-2.

My Numbers, My Friends: Popular Lectures on Number Theory, by Paulo Ribenboim. Springer, February 2000. ISBN 0-387-98911-0.

The Mystery of the Aleph: Mathematics, the Kabbalah, and the Search for Infinity, by Amir D. Aczel. Four Walls Eight Windows, November 2000. ISBN 1-568-58105-X.

Newton's Gift: How Sir Isaac Newton Unlocked the System of the World, by David Berlinski. Free Press, October 2000. ISBN 0-684-84392-7.

* *Newton's Tyranny: The Suppressed Scientific Discoveries of John Flamsteed and Stephen Gray*, by David H. Clark and Stephen P. H. Clark. W. H. Freeman, October 2000. ISBN 0-716-74215-2.

Niels Hendrik Abel and His Times: Called Too Soon by Flames Afar, by Arild Stubhaug, translated by

R. Daly. Springer, May 2000. ISBN 3-540-66834-9.

Number: From Ahmes to Cantor, by Midhat Gazalé. Princeton University Press, March 2000. ISBN 0-691-00515-X. (Reviewed August 2001.)

The Parrot's Theorem, by Denis Guedj. Weidenfeld & Nicolson, June 2000. ISBN 0-297-64578-1. (To be published in the U.S. by St. Martin's Press, September 2001, ISBN 0-312-28055-6.) (Reviewed March 2001.)

Proofs from the Book, by M. Aigner and G. M. Ziegler. Revised and expanded second edition, Springer, January 2001. ISBN 3-540-67865-4. (First edition reviewed August 1999.)

Ptolemy's Geography, translated by J. Lennart Berggren and Alexander Jones. Princeton University Press, November 2000. ISBN 0-691-01042-0.

The Pursuit of Perfect Packing, by Tomaso Aste and Denis Weaire. Institute of Physics Publishing, July 2000. ISBN 0-750-30648-3.

Radical Equations: Math Literacy and Civil Rights, by Robert P. Moses and Charles E. Cobb Jr. Beacon Press, February 2001. ISBN 0-807-03126-7.

* *Sacred Geometry*, by Miranda Lundy. Walker & Company, April 2001. ISBN 0-802-71382-3.

The Search for Mathematical Roots, 1870-1940: Logics, Set Theories, and the Foundations of Mathematics from Cantor through Russell to Gödel, by I. Grattan-Guinness. Princeton University Press, February 2001. ISBN 0-691-0587-1.

The Story of Mathematics, by Richard Mankiewicz. Princeton University Press, February 2001. ISBN 0-691-08808-X.

Surfing through Hyperspace: Understanding Higher Universes in Six Easy Lessons, by Clifford A. Pickover. Oxford University Press, September 1999. ISBN 0-195-13006-5.

The Symbolic Universe: Geometry and Physics 1890-1930, edited by Jeremy Gray. Oxford University Press, September 1999. ISBN 0-198-50088-2.

Triangle of Thoughts, by Alain Connes, André Lichnerowicz, and Marcel Paul Schützenberger. AMS, July 2001. ISBN 0-8218-2614-X.

Two Millennia of Mathematics: From Archimedes to Gauss, by George M. Phillips. Springer, July 2000. ISBN 0-387-95022-2.

The Universal Computer: The Road from Leibniz to Turing, by Martin Davis. W.W. Norton & Company, October 2000. ISBN 0-393-04785-7. (Reviewed May 2001.)

The Universal History of Computing: From the Abacus to the Quantum Computer, by Georges Ifrah; translated from the French and with notes by E. F. Harding, assisted by Sophie Wood, Ian Monk, Elizabeth Clegg, and Guido Waldman. John Wiley & Sons, November 2000. ISBN 0-471-39671-0.

The Universal History of Numbers: From Prehistory to the Invention of the Computer, by Georges Ifrah; translated from the French by David Bellos, E. F. Harding, Sophie Wood, and Ian Monk. John Wiley & Sons, December 1999. ISBN 0-471-37568-3.

The Unknowable, by Gregory J. Chaitin. Springer, August 1999. ISBN 9-814-02172-5.

What Is Mathematics? An Elementary Approach to Ideas and Methods, by Richard Courant and Herbert Robbins; second edition, revised by Ian Stewart. Oxford University Press, August 1996. ISBN 0-195-10519-2.

Where Mathematics Comes From: How the Embodied Mind Brings Mathematics into Being, by George Lakoff and Rafael Núñez. Basic Books, October 2000. ISBN 0-465-03770-4.

White Light, by Rudy Rucker. Four Walls Eight Windows, April 2001. ISBN 1-56858-198-X.

Women Becoming Mathematicians: Creating a Professional Identity in Post-World War II America, by Margaret A. M. Murray. MIT Press, September 2000. ISBN 0-262-13369-5. (Reviewed August 2001.)

Wonders of Numbers: Adventures in Math, Mind, and Meaning, by Clifford A. Pickover. Oxford University Press, September 2000. ISBN 0-195-13342-0.

*Added to "Book List" since the list's last appearance.

*American
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Election of Officers for 2002

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2001 AMS Elections Special Section

Dear Colleagues:

Once again members of the Society are invited to vote for candidates for several of the Society's governing bodies. The candidates for election are presented in the material that follows. This information and the official ballot will be sent to you in early September. Also this year you will be asked to ratify several changes to the bylaws of the Society. The choices you make in these elections directly affect the direction that the Society takes. This may not be obvious to the casual member, so let me take a few lines to explain.

The president of the society (whom you elect every other year) is the most important officer. The president determines, either directly or indirectly, most of the scientific policies of the Society. The direct effect comes through the president's personal interactions both with members of the Society and outside the organization, for example, in testimony before Congressional committees. Indirect influence occurs as the president appoints chairs and members of almost all committees of the Society, including the policy committees. The president sits as member of all five policy committees, is the chair of the Council's Executive Committee, and serves ex-officio as a trustee. The president works closely with all officers and administrators of the Society, especially the executive director and the secretary, to insure the orderly transaction of Society business. Finally the president nominates candidates for the Nominating Committee and the Editorial Boards Committee. Consequently, the president also has a long-term effect on affairs of the Society.

The vice president and the members at large of the Council you select will serve for three years on the AMS Council. That body determines membership on the editorial boards of the Society, appoints the treasurers and members of the Secretariat, makes nominations of candidates for future elections, creates committees, and determines all scientific policy of the Society. Typically each of these new members of the Council will serve one of the Society's policy committees.

The trustees, of whom you will be selecting one for a five-year term, have complete fiduciary responsibility for the Society. The person you select will serve as chair of the Board of Trustees during the fourth year of the term and as secretary of the board during the second year. Among other activities the trustees determine the annual budget of the Society, prices of journals, salaries of employees, dues (in cooperation with the Council), registration fees for meetings, and investment policy for the Society's reserves.

The candidates presented to you were suggested to the Council by the Nominating Committee or by petition from

members. While the Council has the final nominating responsibility, the groundwork is done by the Nominating Committee. New members of this committee will be elected by you in this coming election. The candidates were nominated by the current president, Hyman Bass. The three elected will serve three-year terms. The main work of the Nominating Committee takes place during the annual meeting of the Society, during which it has four sessions of face-to-face meetings, each lasting about three hours. The Committee then reports its suggestions to the Council, which makes the final nominations.

The Editorial Boards Committee is responsible for the operation of the editorial boards of the Society. Members are elected for three-year terms from a list of candidates named by the president. The Editorial Boards Committee makes recommendations for almost all editorial boards of the Society. Chief or managing editors of those journals named in the bylaws are appointed by the Council, upon recommendation of the Editorial Boards Committee; in virtually all cases, other editors are appointed by the President, upon recommendation by the Editorial Boards Committee.

According to the Society's bylaws, amendments to them are recommended by the Council and approved by its members. To gain approval an amendment must have an affirmative vote of two-thirds of those voting in this mail ballot. The items here, endorsed by both the AMS Committee on the Profession and the Council, concern voting mechanics. Late last year the District of Columbia, where the AMS is incorporated, passed legislation enabling electronic voting, and the AMS would like to take advantage of this rule change, for member convenience and possible cost savings. To do so requires changing the AMS Bylaws, specifically Article VII, Section 2 about its elections. When considering changes for that section, it seemed prudent to simultaneously insure that alternate voting procedures be tolerated in the conduct of other AMS business, such as when the Council, the Executive Committee and/or the Board of Trustees must act between regularly scheduled meetings. The Council urges you to vote on the matter and recommends an affirmative vote. If you return a ballot and do not vote on the amendments, the effect is to vote "NO" on them.

If past elections are a reliable measure, about 12 percent of you will vote in this election, which is in line with voting participation in other professional organizations. This is not offered as an excuse for you to throw the ballot in the trash, however; the other officers and

members of the Council join me in urging you to take a few minutes to review the election material, fill out your ballot, and mail it. The Society belongs to its members. You can influence the policy and direction it takes by voting.

Let me urge anyone still reading to consider other ways of participating in Society activities. The Nominating Committee, the Editorial Boards Committee, and the Committee on Committees are always interested in learning of members who are willing to serve the Society in various capacities. Names are always welcome, particularly when accompanied by a few words detailing the

person's background and interests. Self-nominations are probably the most useful. Recommendations can be transmitted from the web (<http://www.ams.org/committee-nominate>), also linked from the AMS home page via the Secretary's page) or sent directly to the secretary (secretary@ams.org), who will forward them to the cognizant body.

PLEASE VOTE.

—Robert J. Daverman
Secretary

List of Candidates-2001 Election

President

(one to be elected)

David Eisenbud
David A. Vogan Jr.

Vice President

(one to be elected)

Raymond L. Johnson
Hugo Rossi

Board of Trustees

(one to be elected)

Andy R. Magid
Carol S. Wood

Member at Large of the Council

(five to be elected)

Colin C. Adams
Bruce E. Blackadar
Sylvia T. Bozeman
Percy A. Deift
Irene M. Gamba
Henri A. Gillet
David R. Morrison
Douglas C. Ravenel
Frank Sottile
W. Stephen Wilson

Nominating Committee for 2002

(three to be elected)

Alejandro Adem
Sheldon Axler
Robert M. Fossum
Jane Hawkins
Michael Starbird
Daniel W. Stroock

Editorial Boards Committee for 2002

(two to be elected)

Clifford Earle
Benson S. Farb
Robert Friedman
Svetlana Jitomirskaya

Election Information

The ballot for election of officers, members of the Council, a trustee, and committee members will be mailed on or shortly after September 10, 2001, in order for members to receive their ballots well in advance of the November 10, 2001, deadline. A list of members of the Council and Board of Trustees serving terms during 2001 will appear in the "AMS Officers and Committee Members" section of the October issue of the *Notices* (and will be mailed with the election material sent to all members in September).

Replacement Ballots

There has been a small but recurring and distressing problem concerning members who state that they have not received ballots in the annual election. It occurs for several reasons, including failure of local delivery systems on university or corporate properties, failure of members to give timely notice of changes of address to the Providence office, failures of postal services, and other human errors.

To help alleviate this problem, the following replacement procedure has been devised: A member who has not received a ballot by October 10, 2001, or who has received a ballot but

has accidentally spoiled it may write after that date to the Secretary of the AMS, P. O. Box 6248, Providence, RI 02940, asking for a second ballot. The request should include the individual's member code and the address to which the replacement ballot should be sent. Immediately upon receipt of the request in the Providence office, a second ballot, which will be indistinguishable from the original, will be sent by first class or airmail. It must be returned in an envelope which will be supplied, on the outside of which is the following statement to be signed by the member:

The ballot in this envelope is the only ballot that I am submitting in this election. I understand that if this statement is not correct, then no ballot of mine will be counted.

signature

Although a second ballot will be supplied on request and will be sent by first class or airmail, the deadline for receipt of ballots will not be extended to accommodate these special cases.

Suggestions for 2002 Nominations

Each year the members of the Society are given the opportunity to propose for nomination the names of those individuals they deem both qualified and responsive to their views and needs as part of the mathematical community. Candidates will be nominated by the Council to fill positions on the Council and Board of Trustees to replace those whose terms expire January 31, 2002. See the "AMS Officers and Committee Members" section of the October issue for the list of current members of the Council and Board of Trustees. Members are requested to write their suggestions for such candidates in the appropriate spaces below.

COUNCIL AND BOARD OF TRUSTEES

Vice President (1)

Members at Large of the Council (5)

Member of the Board of Trustees (1)

The completed form should be addressed to AMS Nominating Committee, P. O. Box 6248, Providence, RI 02940, to arrive no later than **November 10, 2001**.

Proposed Amendments to AMS Bylaws

According to the Society's bylaws, amendments to them are recommended by the Council and approved by its members. To gain approval an amendment must have an affirmative vote of two-thirds of those voting in this mail ballot. The items here, endorsed by both the AMS Committee on the Profession and the Council, concern voting mechanics. Late last year the District of Columbia, where the AMS is incorporated, passed legislation enabling electronic voting, and the AMS would like to take advantage of this rule change, for member convenience and possible cost savings. To do so requires changing the AMS Bylaws, specifically Article VII, Section 2 about its elections. When considering changes for that section, it seemed prudent to simultaneously insure that alternate voting procedures be tolerated in the conduct of other AMS business, such as when the Council, the Executive Committee and/or the Board of Trustees must act between regularly scheduled meetings. The Council urges you to vote on the matter and recommends an affirmative vote. If you return a ballot and do not vote on the amendments, the effect is to vote "NO" on them.

Subsections with recommended changes are reproduced in their entirety. They are taken only from Articles IV, VII, and X. Words to be deleted are surrounded in brackets, as in "[by a mail vote]". In the few instances where there are recommended replacements - a full sentence in Article VII, Section 2, and the word "sent" on two occasions in Article X - replacements are reproduced in bold face italics, as in "*sent*".

The complete Bylaws can be viewed on the Web - there is a direct link from the Secretary's page on the AMS website (see <http://www.ams.org/secretary/bylaws.html>). The Bylaws were published in the November 1999 issue of the *Notices*, pp. 1252-1256.

Article IV

Council

Section 6. Between meetings of the Council, business may be transacted [by a 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 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 members. 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 VII

Election of Officers and Terms of Office

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.] *The secretary shall send notification to each member of the Society about the slate of candidates and the voting procedure on or before October 10, and legitimate ballots received by an established deadline at least 30 days later will 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 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.

Article X

Meetings

Section 1. The annual meeting of the Society shall be held between the fifteenth of December and the tenth of February next following. Notice of the time and place of this meeting shall be [mailed] *sent* by the secretary or an associate secretary to [the last known post office address of] each member of the Society. The times and places of the annual and other meetings of the Society shall be designated by the Council.

Section 5. The Board of Trustees shall hold at least one meeting in each calendar year. Meetings of the Board of Trustees may be called by the president, the treasurer, or the secretary of the Society upon three days' notice of such meetings [mailed] *sent* to [the last known post office address of] each trustee. The secretary of the Society shall call a meeting upon the receipt of a written request of two of the trustees. Meetings may also be held by common consent of all the trustees.

Nominations for President Elect

Nomination for David Eisenbud

Barry Mazur and Margaret H. Wright



It is a challenging exercise to convey David Eisenbud's deeply impressive combination of mathematical contributions, commitment to research in the mathematical sciences, creative and inspiring leadership, and ability to get things done—all of which make him an outstanding candidate for president of the American Mathematical Society.

This article has two parts: Barry Mazur describes David's accomplishments in mathematics, and Margaret Wright discusses his service to the mathematical sciences community.

Barry Mazur

It is a pleasure to have the opportunity to write some lines about David Eisenbud's mathematical work, in connection with his nomination for the presidency of the American Mathematical Society. David Eisenbud's research accomplishments extend broadly through algebra and its applications. His publications (over a hundred of them!) have made significant contributions to fundamental issues in the subject. David also has a marvelous gift for mathematical collaboration. The sweep of his interests and the intensity of his mathematical interactions have brought him into fruitful co-authorship with many mathematicians of different backgrounds and different viewpoints.

Barry Mazur is professor of mathematics at Harvard University. His e-mail address is mazur@math.harvard.edu.

Margaret H. Wright is at Bell Labs, Lucent Technologies, Murray Hill, NJ. Her e-mail address is mhw@research.bell-labs.com.

Shortly after his graduate days, David began a joint project with Buchsbaum (cf. [1]–[4]). Among other things, they established an elegant geometric criterion for exactness of a finite free complex that has many applications in the homological study of commutative rings. For example, let $S = \mathbb{C}[x_1, \dots, x_n]$ be the ring of polynomial functions on \mathbb{C}^n , and let

$$0 \rightarrow S^{r_i} \rightarrow \dots \rightarrow S^{r_0}$$

be a complex of free S -modules S^{r_i} and maps $\phi_i(x) : S^{r_i} \rightarrow S^{r_{i-1}}$ that are matrices of polynomial functions on \mathbb{C}^n . If the ϕ_i were constant matrices, then this complex would be exact if and only if $\text{rank } \phi_i + \text{rank } \phi_{i-1} = r_i$ for all i . Buchsbaum and Eisenbud showed that, in general, the complex is exact if and only if, for all i , the set of points $x \in \mathbb{C}^n$ where $\text{rank } \phi_i(x) + \text{rank } \phi_{i-1}(x) \neq r_i$ is either empty or of codimension at least i in \mathbb{C}^n .

Eisenbud and Buchsbaum [4] also established a structure theorem for Gorenstein rings of codimension 3, which parallels a structure theorem for Cohen-Macaulay rings of codimension 2 found by Hilbert in the 1880s and generalized by Burch and others. Here is what they do, formulated in a geometric setting. If $V \subset \mathbb{C}^d$ is a subvariety of codimension e which can be cut out, locally, by precisely e equations, then its local rings satisfy certain dualities; let us refer to these dualities as the *Gorenstein condition*. Sometimes one encounters varieties of codimension e whose local rings satisfy this Gorenstein condition but require strictly more than e equations. Eisenbud and Buchsbaum show that, in codimension 3, such a variety V is defined locally by a set of polynomials \mathcal{E} obtained from an $n \times n$ alternating matrix M of rank $n - 1$ with entries in $\mathbb{C}[x_1, \dots, x_d]$, for some n , as follows. The elements of \mathcal{E} are the Pfaffians of the $(n - 1) \times (n - 1)$ submatrices obtained by deleting a row and the corresponding column of M . (A Pfaffian of an alternating matrix is, in effect, the square root of its determinant.) This result has continued to play an important role in the local theory because of the access that it gives to interesting examples. It recently received attention also in the global case and has been

extended by work on vector bundles and projective varieties in which Eisenbud continues to play a significant role [12].

In the middle 1970s David worked with Harold Levine on the topology of *finite* C^∞ map germs $f : (\mathbb{R}^n, 0) \rightarrow (\mathbb{R}^n, 0)$ (cf. [5]). The requirement of "finiteness" is an algebraic property of the map germ which, among other things, guarantees that the restriction of f to a small sphere around the origin maps that sphere to a set which misses the origin. Such a finite map germ f therefore induces a map between $n - 1$ -spheres. The degree of this map of spheres is called the *topological degree* of f ; it may also be regarded as the Poincaré index of the associated vector field. One can associate a finite dimensional vector space to such a map germ; its dimension is the multiplicity of the complexified germ. Eisenbud and Levine describe a quadratic form on this vector space and show that the signature of this quadratic form is equal to the topological degree [5].

V. I. Arnol'd once referred to this celebrated formula of Eisenbud-Levine, which links calculus, algebra and geometry, as a "paradigm" more than a theorem that provides a local manifestation of interesting global invariants and that "would please Poincaré and Hilbert (also Euler, Cauchy and Kronecker, to name just those classical mathematicians, whose works went in the same direction)."

Given this early work, it was natural for David's attention to turn to the study of singularities and their topology. In this period, David wrote a book with the topologist Walter Neumann [6] on the topology of the complements of the sort of knots that appear in the theory of plane-curve singularities.

David next became interested in algebraic geometry, beginning a long and important collaboration with Joe Harris (cf. [7], [8]). Together, they developed the theory of Limit Linear Series and used it to solve a number of classical problems about the moduli spaces of complex algebraic curves. This theory was published in a series of eight papers in *Inventiones*. One of the well-known applications of their theory is that it gives a nice proof of the following fact. For most algebraic curves C of genus $g \geq 23$, if we write down polynomial equations which define C and let the coefficients of the polynomials vary as rational functions of a complex parameter in such a way that for each value of the parameter the system of equations continues to define a curve, then all the curves obtained are isomorphic. In particular, this shows that the moduli space of curves of genus $g \geq 23$ is not rational, or even unirational, as had been conjectured by Severi. This result of Eisenbud and Harris sharpens what was priorly known and is part of a long classical development of the subject in which many open problems remain today. For example, it is still unknown if the same assertion is true for genus 22. The behavior described is in sharp contrast with what happens for low genus (all curves of genus 1, of course, fit into a single rationally parametrized family; for any genus $g \leq 13$ most curves of genus g are members of a single family of curves cut out by polynomial equations where the coefficients are rational functions of the appropriate number of complex parameters).

In the late '80s and '90s David published papers on many aspects of algebraic geometry and commutative algebra and became interested in combinatorics (collaborating with Dave Bayer on "graph curves" [8a]) and statistics (collaborating with Persi Diaconis and Bernd Sturmfels on random walks on lattices (cf. [9])).

David's most recent research represents projects with a number of mathematicians, mixing commutative algebra, algebraic geometry, and topology. Among other things this work includes significant applications of the theory of free resolutions over exterior algebras to:

Hyperplane arrangements,
Bernstein-Gel'fand-Gel'fand correspondence and Beilinson Monads,
Chow forms and elimination theory (including, among other things, new formulas for the resultant of three homogeneous forms in three variables),
Linearity of free resolutions and the existence of linear Cohen-Macaulay modules.

David has had twenty-one successful Ph.D. students, has organized many conferences here and abroad, and has written two textbooks (cf. [10], with Joe Harris; and [11]) which are among the best-selling texts in Springer's series of Graduate Texts in Mathematics. He is currently engaged with Harris in a new book project, a book for a second course in algebraic geometry.

Margaret Wright

David and I met in 1997 when we traveled to England with Don Lewis (then director of the Division of Mathematical Sciences at NSF) and Jim Crowley of SIAM to visit the Newton Institute and Hewlett-Packard Labs. David was just starting as director of the Mathematical Sciences Research Institute (MSRI) in Berkeley, and I was a member of the MSRI Scientific Advisory Committee. We've worked together closely during the past four years on a wide range of activities related to MSRI, as well as on broader efforts to increase support for mathematics research. Since my 1995-96 term as president of SIAM, I've continued an involvement in science policy—an interest that David and I share.

David has served the mathematical community as chair of the mathematics department at Brandeis, on advisory and evaluation committees for the National Science Foundation, as a member of the Board on Mathematical Sciences, and as vice president of the AMS. But his service that is most visible nationally and internationally has been as director of MSRI, where he moved in 1997 after twenty-seven years at Brandeis.

A fundamental strength of mathematicians is their ability to generalize, and I believe that David's performance as AMS president can be predicted with high accuracy by generalizing from his success at MSRI. In fact, his leadership at MSRI exemplifies the qualities needed by the AMS president.

With David as its director, MSRI has continued its tradition of superlative programs in fundamental mathematics while simultaneously expanding into a broader and more diverse selection of fields. David has furthered

a deliberate policy of outreach into new areas, and MSRI's influence and reputation increasingly extend beyond core mathematics into areas on the boundaries between mathematics and science as well as into applications ranging from imaging to cryptography to finance. In addition to strengthening the intellectual heart of MSRI's mission, David has encouraged MSRI to present events that bring the public closer to the richness of mathematics. He has accomplished this through a multitude of thoughtful innovations—for example, the Journalist-in-Residence program that he began soon after he arrived at MSRI. David clearly understands that MSRI is not a one-person operation; he actively welcomes the ideas of other people, and he has worked to create an environment that encourages staff and volunteers to develop new projects.

Mathematics is, of course, necessarily linked to people—to individual mathematicians and to the mathematical sciences community. David recognizes and likes the human side of mathematics and has an intense interest in engaging and supporting young mathematicians. Within the past few years, MSRI has doubled its programs for graduate students and greatly increased the participation of women and minorities in these programs. The institute has regularly hosted workshops for women and minority mathematicians, as well as workshops conceived and organized by early-career mathematicians.

Some leaders are only “idea people”: strong on concepts, weak on execution, who leave all the hard work to someone else. Others focus on details, their perspective limited by existing practice, feeling threatened by anything different. David is far removed from these extremes; he has many new ideas, but he also takes personal responsibility for transforming the best of them into reality. David follows through and does not shrink from the hard slog when it is necessary to get the job done. For example, to prepare MSRI for its recompetition two years ago, he spent countless hours consulting with others and writing (and rewriting) the NSF proposal. He has recently expended enormous energy raising funds for a building expansion that will greatly improve MSRI's operations.

Skill in communication—an essential quality for any scientific leader today—is one of David's greatest strengths. He is an articulate, original expositor in both writing and speech, able to describe eloquently the nature of mathematics, the links among branches of mathematics, the ties of mathematics with science and engineering, and the role of mathematics in applications. He also has the much rarer ability to communicate the excitement and content of mathematics to a general audience.

David is principled but not unbending; he listens to and respects the views of others, but does not shrink from taking a stand when necessary. He is passionately convinced of the importance of mathematics; his intellectual and personal dedication to mathematics is contagious and energizing to those around him. Even in difficult circumstances, he retains a sense of perspective and (sometimes just as important) a sense of humor. David is a persuasive, hard-working, and effective advocate for mathematics at all levels—precisely what the AMS needs.

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Nomination for David A. Vogan Jr.

Anthony W. Knapp



Photo courtesy Donna Covey/MTI.

In recent years the tradition has been that the AMS president is someone of high stature in mathematics research whose presidential duties include representing American mathematics to the nonmathematical world and guiding the AMS committee system in its formulation and carrying out of policies. For this position, as one says in the sports world, David Vogan is the

complete package. He has done stunning research over a long period of time, he is the Head of one of the very best mathematics departments in the world, he has been a quiet but forceful advocate for women in the profession, he is known for his extraordinary mentoring of graduate students, he is the author of four research-level books, and he has served the AMS long and well in several capacities.

David's field is the representation theory of Lie groups. A group representation is a group action by linear transformations, typically on a complex Hilbert space. Behind a representation is often an action of the group on a manifold, transitive or not, and one studies the manifold in part by studying the complex-valued functions on it. Group representations of nonabelian infinite groups were studied first by I. Schur and H. Weyl in the 1920s, and it was not long before this approach made the subject blend with quantum mechanics, as one examined the effect of symmetry and the breaking of symmetry on systems of differential equations. The decomposition of representations into sums or integrals of other representations and the identification of the ultimate irreducible pieces have remained as fundamental problems in the theory since the 1920s.

David has concentrated his research on reductive Lie groups, which one may view as closed subgroups of real or complex matrices that are stable under conjugate transpose. These are the groups whose normal subgroups offer few clues to their structure. Some early names associated with the representation theory of these groups are Bargmann, I. M. Gelfand, Naimark, Godement, and Mackey. But from the early 1950s until 1976, the year of David's thesis, the direction of the field was set by Harish-Chandra and R. P. Langlands.

Harish-Chandra's approach for such a G was ultimately analytic, using differential equations and asymptotic properties of the functions $g \mapsto (R(g)u, v)$ associated to a representation R to get a handle on R . The fundamental irreducible representations for Harish-Chandra were those in the "discrete series"—the ones that occur as

subrepresentations of $L^2(G)$. Other representations of interest could be constructed by "parabolic induction" from the discrete series. Harish-Chandra classified the discrete series and then, in part using ideas that Langlands had developed for studying $L^2(G/\Gamma)$ for arithmetic subgroups Γ , completed the analysis of $L^2(G)$. Langlands, for his own part, went on to use asymptotic expansions to classify the irreducible representations. He used his classification as substantive evidence for a body of conjectures and questions that have come to be known as the Langlands program; these relate the solutions of Diophantine problems to infinite-dimensional representation theory, and later progress by Langlands on these conjectures was indispensable to the proof of Fermat's Last Theorem.

That much history brings us to David's thesis in 1976, which was written under the direction of B. Kostant and revolutionized the field. David introduced a completely algebraic theory for studying irreducible representations of reductive groups. The fundamental representations were not discrete series but representations behaving quite differently, and the tools were not differential equations and asymptotic expansions but cohomology theories. The final theorem of the thesis was a classification completely different from the one by Langlands. Building on ideas that G. J. Zuckerman introduced in 1978, David developed a construction now called "cohomological induction" that made his classification easier to formulate and to work with. His completed classification was published in 1981 in the first of his four research books. The Vogan-Zuckerman classification, as it is called, does not replace the Langlands classification; it gives a completely new way of looking at the field, and the passage back and forth between the two approaches is a powerful tool.

Left unaddressed by all this work was the question of which irreducible representations are unitary. Parabolic induction carries unitary representations to unitary representations, but cohomological induction does not necessarily. In a 1984 paper David proved, by a remarkably intricate algebraic construction, that cohomological induction does preserve unitarity when a certain positivity condition holds for the parameters. With this theorem he was able to classify the irreducible unitary representations for the general linear groups over the reals, the complexes, and the quaternions.

David's Hermann Weyl Lectures at the Institute for Advanced Study in 1986, published as an *Annals of Mathematics Study* in 1987, showed David's thinking about the classification of irreducible unitary representations for general G . The book gives great insight into the mind of a first-rate mathematician at work.

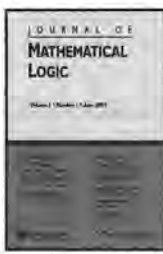
This classification problem for irreducible unitary representations remains unsolved in general, but it is now known that cohomological induction is an indispensable tool for the problem. A 1998 *Annals of Mathematics* paper by David with S. Salamanca-Riba reports on some recent progress.

In the 1980s J. Arthur made some conjectures related to the Langlands program. Like the program in general, Arthur's conjectures are first of all about automorphic forms, but they have consequences and analogs in

Anthony W. Knapp is professor emeritus of mathematics at the State University of New York at Stony Brook. His e-mail address is aknapp@math.sunysb.edu.

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PRICE INFORMATION: ISSN: 0219-0613 Vol. 1/2001 • 4 Issues
(add airmail US\$25 / S\$36) Institutions/Libraries US\$180 / S\$254
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MANAGING EDITORS:

Chitai Chong
National University of Singapore
10, Kent Ridge Crescent
Singapore 119260
Fax: 65-7761956
E-mail: chongcct@math.nus.edu.sg

Theodore A Slaman
Department of Mathematics
University of California, Berkeley
Berkeley, CA 94720, USA
Fax: 1-510-642-8204
E-mail: slaman@math.berkeley.edu

W Hugh Woodin
Department of Mathematics
University of California, Berkeley
Berkeley, CA 94720, USA
Fax: 1-510-642-8204
E-mail: woodin@math.berkeley.edu

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representation theory for real and p-adic reductive groups. A 1992 book by David with two coauthors proves most of Arthur's conjectures for real groups. The results in the book provide evidence for the full Arthur conjectures about automorphic forms, as well as tools to approach those conjectures.

David received his Ph.D. from the Massachusetts Institute of Technology at age twenty-one, spent another year as an instructor at MIT, visited the Institute for Advanced Study for two years, and then returned to the MIT faculty. He rose through the ranks and is now Professor and Head of Mathematics. Over the years he served multiple terms as undergraduate director and graduate director.

He became Head of Mathematics in 1999. The MIT mathematics department has been especially successful at having pure and applied mathematics thrive together in a single department. The department has two subdepartments, one for pure mathematics and one for applied mathematics, and each has a select committee to deal with hiring and some other matters. Before becoming Head, David served on the select committee in pure mathematics. Now, as Head, he is responsible for representing the combined views of the two subdepartments to the dean and others. His appointment as Head indicates a level of trust in his ability to carry out this responsibility.

David takes seriously the status of women in the profession. He is a member of the AWM. As department Head, he has extended to mathematics instructors a good MIT faculty-leave policy for those who assume responsibility to care for a newborn child or a child newly placed for adoption or foster care. This extension of the policy is a serious step, as instructors are more likely to benefit from such a policy than are senior faculty.

David has supervised twenty-one Ph.D. theses. In addition, he has organized a weekly Lie Groups Seminar for twenty years whose speakers have kept the greater Boston mathematical research community abreast of current developments in many areas related to Lie groups.

David is admired as a teacher. At the time of his appointment as Head of Mathematics, the MIT News Office said, "Among these students, he is known for his loyalty and generosity with his time and his ideas."

David is married to his childhood sweetheart, and they have two children. He and his wife are pillars of one of the downtown Boston churches. Also, David is a director of The Giving Back Fund, a public charity that provides expertise to athletes, entertainers, and others to help them get the greatest possible impact from their philanthropy.

For the AMS David has been a member of the Council, has served on the Science Policy Committee, has coorganized three special sections at meetings, has been a member of the editorial staff of the *Bulletin* since 1987, and has served as founding editor of the electronic journal *Representation Theory*.

He has jointly organized three non-AMS conferences: a one-week conference at Oberwolfach, a special year at MSRI in representation theory, and the graduate component of one summer's Park City Mathematics Institute.

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Biographies of Candidates 2001

Biographical information about the candidates has been verified by the candidates, although in a few instances prior travel arrangements of the candidate at the time of assembly of the information made communication difficult or impossible. A candidate had the opportunity to make a statement of not more than 200 words on any subject matter without restriction and to list up to five of her or his research papers.

Abbreviations: American Association for the Advancement of Science (AAAS); American Mathematical Society (AMS); American Statistical Association (ASA); Association for Computing Machinery (ACM); Association for Symbolic Logic (ASL); Association for Women in Mathematics (AWM); Canadian Mathematical Society, Société Mathématique du Canada (CMS); Conference Board of the Mathematical Sciences (CBMS); Institute of Mathematical Statistics (IMS); International Mathematical Union (IMU); London Mathematical Society (LMS); Mathematical Association of America (MAA); National Academy of Sciences (NAS); National Academy of Sciences/National Research Council (NAS/NRC); National Aeronautics and Space Administration (NASA); National Council of Teachers of Mathematics (NCTM); National Science Foundation (NSF); Operations Research Society of America (ORSA); Society for Industrial and Applied Mathematics (SIAM); The Institute of Management Sciences (TIMS).

Each candidate had the opportunity to supply a photograph to accompany her or his biographical information. A candidate with an asterisk (*) beside his or her name was nominated in response to a petition.

President Elect

David Eisenbud



Director, Mathematical Sciences Research Institute; Professor of Mathematics, University of California, Berkeley.

Born: April 8, 1947, New York, New York.

Ph.D.: University of Chicago, 1970.

AMS Offices: Member at Large of the Council, 1983–1985; Vice President, 2000–.

AMS Committees: *Proceedings* Editorial Committee, 1978–1982; Cen-

tennial Fellowships Committee, 1989–1990; *Bulletin* (New Series) Editorial Committee, 1993–1999 (associate editor, Research-Expository Papers, 1993–1996; editor, Research-Expository Surveys, 1996–1998; chair, 1997–1999); Committee on Professional Ethics, 1994–1995; Executive Committee of the Council, 2001–; Science Policy Committee, 2001–.

Selected Addresses: Invited Lecture, International Congress of Mathematicians, Vancouver, 1974; AMS Invited Address, St. Louis, 1977; Plenary Address, 19th Brazilian Mathematical Colloquium, 1993; Distinguished Lecturer Program, University of New Mexico, Las Cruces,

1996; Emmy Noether Lectures, Bar Ilan University, 1999; Owens Lecture, Wayne State University, 2001.

Additional Information: **Non-AMS Editorships:** Wadsworth Advanced Book Series, 1981–1992; *Astérisque* (Société Mathématique de France), 1982–1987; *Journal of Algebraic Geometry*, 1990–1995; Springer-Verlag Series, *Computation in Mathematics*, 1995–; *Mathematische Annalen*, 1997–1998; *Bulletin de la Société Mathématique de France*, 1999–; *Annals of Mathematics*, Associate Editor, 2000–. **Committees:** Board of Mathematical Sciences; U.S. National Committee of the International Mathematical Union. **Other positions held:** Lecturer, Brandeis University, 1970–1972; Assistant Professor, Brandeis University, 1972–1973; Visiting Scholar, Harvard University, 1973–1974; Alfred P. Sloan Foundation Fellow, 1973–1975; Fellow, IHES (Bures-sur-Yvette), 1974–1975; Associate Professor, Brandeis University, 1976–1980; Visiting Professor, University of Bonn (SFB 40), 1979–1980; Professor, Brandeis University, 1980–1998; Research Professor, Mathematical Sciences Research Institute, 1986–1987; Visiting Professor, Harvard University, 1987–1988; Chercheur Associé à l'Institut Henri Poincaré (CNRS), Paris, spring 1995. **Member:** AMS, AWM, MAA, SIAM.

Selected Publications: 1. with H. Levine, An algebraic formula for the degree of a C^∞ map germ, *Ann. of Math.* **106** (1977), 19–44. MR 57:7651; 2. with W. Neumann, *Three-Dimensional Link Theory and Invariants of Plane Curve*

Singularities, Ann. of Math. Stud., vol. 110, Princeton University Press, Princeton, 1985. MR 87g:57007; 3. with J. Harris, The Kodaira dimension of the moduli space of curves of genus ≥ 23 , *Invent. Math.* 90 (1987), 359–387. MR 88g:14027; 4. *Commutative Algebra with a View toward Algebraic Geometry*, Grad. Texts in Math., vol. 150, Springer-Verlag, New York, 1995. MR 97a:13001; 5. with S. Popescu, Gale duality and free resolutions of ideals of points, *Invent. Math.* 136 (1999), 419–449. MR 2000i:13014; 6. with J. Harris, *The Geometry of Schemes*, Grad. Texts in Math., vol. 197, Springer-Verlag, New York, 2000. MR 2001d:14002.

Statement: This is an important time for the AMS to be strong and active in supporting mathematical research and education. There is great opportunity: the director of the NSF, Rita Colwell, is publicly committed to quadrupling the budget of the Division of Mathematical Sciences. The current strength of mathematical research, its importance in applications, and its underfunding since the '70s are the primary reasons for her position. But her awareness of the situation and her readiness to act came about through work of committed people at the AMS, its sister organizations, and the NSF.

In this climate we must be clear about our goals. Mine are: more support for first-class fundamental research; increased contact between mathematics and its applications in other sciences and engineering; more effective encouragement of those with mathematical talents and interests, especially among women and minorities; and improvement of mathematical education to give students the tools they need and to bring the best back into mathematical careers.

In approaching these goals we should take a broad view of mathematics. We should recognize that it takes place at a great range of institutions, from research universities and government centers to colleges and industrial labs. The AMS needs to collaborate with other mathematical and statistical societies and with the societies for women and minority scientists. We should reach out to engineering and to other sciences. The public is increasingly interested in mathematics—witness the books, plays, movies, and TV shows on Fermat and other mathematical themes. We ought to encourage this with vivid, interesting, accurate material.

As director of the Mathematical Sciences Research Institute (MSRI) for the last four years, I have worked toward these goals and raised funds to support them. I have had the opportunity to travel to many departments and to listen to the ideas of mathematicians from all over the world who come to MSRI. I have experienced the difficulty of implementing these ideas—and sometimes had the joy of success.

The AMS is the leading group representing the mathematical sciences in this country, perhaps in the world. I feel deeply honored to have been nominated for the presidency. Should I be elected, I hope that my love of research, my commitment to the breadth of the mathematical sciences, and my experience in nurturing mathematical activity will help me to guide the Society well.

David A. Vogan Jr.



Photo courtesy Donna Coveney/MIT.

Chair, Department of Mathematics, Massachusetts Institute of Technology.

Born: September 8, 1954, Mercer, Pennsylvania.

Ph.D.: Massachusetts Institute of Technology, 1976.

AMS Offices: Member at Large of the Council, 1985–1987.

AMS Committees: Review Committee for JPBM, 1987; Associate Editor for Research-Expository Articles, *Bulletin*,

1987–1992; Science Policy Committee, 1989–1991; Committee to Select the Gibbs Lecturer, 1990–1991; Task Force on Excellence in Mathematics Scholarship, 1993–1998; Associate Editor for Research Reports, *Bulletin*, 1995–2001; Managing Editor, *Journal of Representation Theory*, 1997–; Committee on the Human Rights of Mathematicians, 1999–2001; Associate Editor for Bulletin Articles, *Bulletin*, 2001–.

Selected Addresses: AMS Invited Address, Eugene, August 1984; Hermann Weyl Memorial Lectures, Institute for Advanced Study, January 1986; Invited Address, International Congress of Mathematicians, Berkeley, 1986; Graduate Summer School of the Park City Mathematics Institute, July 1998; Mathematics towards the Third Millennium, Accademia dei Lincei, Rome, May 1999.

Additional Information: **Member:** Board of Directors, The Giving Back Fund (<http://www.givingback.org>); Editorial Board, *International Mathematics Research Notices*, 1990–; American Academy of Arts and Sciences, 1996.

Selected Publications: 1. The algebraic structure of the representation of semisimple Lie groups. I, *Ann. of Math.* 109 (1979), 1–60. MR 81j:22020; 2. The unitary dual of $GL(n)$ over an Archimedean field, *Invent. Math.* 83 (1986), 449–505. MR 87i:22042; 3. with J. Adams and D. Barbasch, *The Langlands Classification and Irreducible Characters for Real Reductive Groups*, Progr. Math., vol. 104, Birkhäuser, Boston, 1992. MR 93j:22001; 4. with A. Knapp, *Cohomological Induction and Unitary Representations*, Princeton Math. Ser., vol. 45, Princeton University Press, Princeton, NJ, 1995. MR 96c:22023; 5. with S. Salamanca-Riba, On the classification of unitary representations of reductive Lie groups, *Ann. of Math.* 148 (1998), 1067–1133. MR 2000d:22017.

Statement: As a young mathematician I had on many occasions an experience that most of us have shared. I was called into the office of a more senior colleague and told, “The proof you showed me yesterday was wrong.” On most of these occasions what I had said was nonsense. In the few instances that I recall most clearly, the proof was correct, and only my explanation was flawed.

These experiences once seemed to me to belong to the distant past. On reflection I realize that they are as abundant as ever, but that my role in them has changed. “The proof you told me yesterday was wrong” is now my own line, and the occasions that are difficult to remember are those in which my judgment was mistaken.

Mathematics is a beautiful and powerful collection of ways of thinking about virtually anything. Almost any change in such a wonderful entity is going to be for the worse, yet it is our business to make changes. It is entirely appropriate that our first reaction to a proposed change is to discredit it, but we must remain open to the possibility of something worthwhile, though it may appear at first to be a familiar misunderstanding. When we deal with mathematics, we balance these conflicting demands fairly well.

If the American Mathematical Society does not rise to the lofty heights of mathematics itself, there are parallels nevertheless. Some of what the Society provides (like MathSciNet) has become a central and indispensable part of doing mathematics anywhere in the world. Almost everything that the AMS does, from the selection of lecturers for meetings to its support for the employment market in mathematics, rises to that "central and indispensable" level at its best.

I hope to work for the AMS by thinking about change and by listening to suggestions for change with attitudes informed by the mathematical experiences I have mentioned. Not surprisingly, some of the areas where we mathematicians have made the greatest efforts are still the areas where the greatest efforts are required: making mathematics open to everyone, thinking about how we teach at every level, smoothing the process of finding and holding a job in mathematics. These problems are clearly unsolvable, and therefore worthy of our best efforts.

Vice President

Raymond L. Johnson



Professor of Mathematics, University of Maryland at College Park.

Born: June 25, 1943, Alice, Texas.
Ph.D.: Rice University, 1969.

AMS Committees: AMS-IMS Committee on Translations from Russian and Other Foreign Languages, 1983-1984; *Notices* Editorial Committee, 1984-1986; AMS-MAA Joint Program Committee for the Baltimore Meeting, 1991; Liaison Committee with AAAS, 1992-1994; Science Policy Committee, 1993-1996;

Task Force on Resource Needs for Excellence in Mathematics Scholarship, 1993-1999; Task Force on Participation for Underrepresented Minorities, 1995-1996.

Selected Addresses: National Association of Mathematicians, St. Louis, 1977; International Conference on Function Spaces, Gdansk, Poland, 1979.

Additional Information: **Administrative Posts:** Chair, Department of Mathematics, University of Maryland at College Park, 1991-1996. **Advisory Boards:** Board of Governors, Institute for Mathematics and Its Applications, 1993-1996; Board of Directors, National Association of Mathematicians, 1994-1996; Scientific Advisory Committee, Mathematical Sciences Research Institute, 1994-1998; Trustee, Mathematical Sciences Research Institute, 1998-2002. **Member:** AMS, AWM, MAA, NAM.

Selected Publications: 1. A survey on tent spaces and their application to weighted inequalities, *Nonlinear Analysis, Function Spaces and Applications, Vol. 3* (Litomyšl, Czechoslovakia, 1986), Teubner-Texte, 93, Teubner, Leipzig, 1986, pp. 54-68. MR 89g:46053; 2. with J. Benedetto and H. Heinig, Fourier inequalities with A_p weights, *General Inequalities V* (W. Walter, ed.), Internat. Schriftenreihe Numer. Math., vol. 80, Birkhäuser-Verlag, Basel, 1987, pp. 217-231. MR 90k:42015; 3. with J. Benedetto and H. Heinig, Weighted Hardy spaces and the Laplace transform II, *Math. Nachr.* 132 (1987), 29-55. MR 88m:44001; 4. with C. Neugebauer, Homeomorphisms preserving A_p , *Rev. Mat. Iberoamericana* 3 (1987), no. 2, 249-273. MR 90d:42013; 5. with C. Neugebauer, Change of variable results for A_p - and reverse Hölder RH_r classes, *Trans. Amer. Math. Soc.* 328 (1991), no. 2, 639-666. MR 92c:42019.

Statement: Ensuring the long-term vitality of mathematics as a subject and profession is the primary responsibility of the American Mathematical Society. The AMS works to promote research in the mathematical sciences, while individual mathematicians must assure that their departments are well respected in the university and convince university administrators of the centrality of mathematics to the university.

The AMS must work to convince Congress and the federal government of the increasing importance of mathematics as a discipline. This is made easier by applications of mathematics to other sciences. However, there are more resources devoted to mathematics in the budgets of universities than in all of the federal agencies combined. It is critical that the Society also help mathematicians and mathematics departments convince administrations of the increasing importance of mathematics as a discipline.

This will require cooperation from mathematicians themselves. Educating undergraduates, preparing future teachers, and increasing diversity is as important to the university as our scientific research is to the federal government.

If mathematics is to thrive in the twenty-first century, special attention must be paid to increasing opportunities for women and minorities in our profession; students want to enter a vibrant, viable profession. This is an area in which I have had success. I would gladly work on an AMS effort to assist departments that choose to respond to this challenge.

Hugo Rossi

Professor of Mathematics, University of Utah.

Born: April 17, 1935, Boston, Massachusetts.

Ph.D.: Massachusetts Institute of Technology, 1960.

AMS Offices: Member at Large of the Council, 1976-1978, 1989-1991; Associate Secretary, Far Western Section, 1982-1987.

AMS Committees: *Transactions and Memoirs* Editorial Committee, 1975-1978; Committee on Employment and Educational Policy, 1977-1978; Committee on Science Policy, 1983-1985; Committee on the Publication Program, 1985-1989; University Lecture Series Committee, 1988-1991 (chair); Executive Committee of the Council, 1989-1992; AMS-MAA-SIAM Joint Policy Board for



Mathematics, 1990–1992 (chair); Strategic Planning Task Force, 1990–1991 (chair); Committee to Study Relations with Soviet Mathematicians, 1990–1992; Long Range Planning Committee, 1990–1991 (chair, 1991); Committee to Review Member Publications, 1992–1993 (chair); *Notices* Editorial Committee, 1995–1997 (editor); Associate Editor for Research Reports, *Bulletin*, 1999–.

Selected Addresses: International Congress of Mathematicians, Moscow, 1966; Invited Address, Annual Meeting, Las Vegas, January 1972.

Additional Information: Alfred P. Sloan Foundation Fellow, 1965–1967; Guggenheim Fellow, 1969–1970; Dean, College of Science, University of Utah, 1987–1993; Deputy Director, Math. Sci. Research Inst., 1997–1999.

Selected Publications: 1. The local maximum modulus principle, *Ann. of Math.* **72** (1960), 1–11. MR **22**:8317; 2. Continuation of subvarieties of projective varieties, *Amer. J. Math.* **91** (1969), 565–575. MR **39**:5830; 3. with M. Vergne, Équations de Cauchy-Riemann tangentielles associées à un domaine de Siegel, *Ann. Sci. École Norm. Supp.* **9** (1976), 31–80. MR **56**:3364; 4. with J. Morrow, Some general results on equivalence of embeddings, *Recent Developments in Several Complex Variables*, Ann. of Math. Stud., vol. 100, Princeton University Press, 1981, pp. 299–325. MR **83g**:32006; 5. Lebrun's nonrealizability theorem in higher dimensions, *Duke Math. J.* **52** (1985), 457–474. MR **86i**:32027.

Statement: The AMS is the society for mathematicians with an interest in research; its mission is to satisfy that interest at all levels of intensity and to maintain the vitality of that interest. It is my belief that all mathematicians have an interest in what is happening at the frontiers of the discipline or, at the minimum, are conversant with new developments. So all mathematicians should be members of the Society. At the same time, the AMS must provide services for mathematicians at all levels: for example, providing conferences and journals where new research is presented in easily accessible form. Throughout my professional career I have been committed to this multileveled objective, be it as editor of the *Transactions* or *Bulletin* or as editor of the *Notices*. I am anxious to continue this work for the AMS.

Trustee

Andy R. Magid

George Lynn Cross Research Professor of Mathematics, University of Oklahoma.

Born: May 4, 1944, Minneapolis, Minnesota.

Ph.D.: Northwestern University, 1969.

AMS Offices: Associate Secretary, 1988–1995; Trustee, 1997–2001.

AMS Committees: Central Section Program Committee, 1988–1996; *Notices* Editorial Board, 1995–2000; *Contemporary Mathematics* Editorial Committee, 1996–; Committee on

Education, 1998–2001; Committee on Committees, 1999–; Associate Editor for Book Reviews, *Bulletin*, 2001–.

Selected Addresses: AMS Invited Address, Houston, April 1978; **AMS Special Sessions:** Commutative Algebra and Probability Groups, Eugene, June 1994; Algebraic Groups and Invariant Theory, Orlando, January 1996; Invariant Theory, Montreal, September 1997; Differential Algebra and Related Topics and Combinatorial Group Theory, New York, December 2000.

Additional Information: **Coorganizer:** (with A. Fauntleroy), Special Session on Algebraic Groups, Kalamazoo, 1975; (with R. Resco), Special Session on Universal Enveloping Algebras and Group Algebras, Norman, 1983; (with H. Bass and W. Goldman), Summer Research Conference on Geometry of Group Representations, Boulder, 1987; (with E. Armendariz, D. Lewis, and R. Zimmer), Special Session on New Doctoral Work in Mathematics, Stillwater, 1994; (with L. Small), Special Session on Algebras, Cohomology, and Polynomial Identities, Orlando, 1995.

Selected Publications: 1. *The Separable Galois Theory of Commutative Rings*, Marcel Dekker, Inc., New York, 1974. MR **50**:4563; 2. *Module Categories of Analytic Groups*, Cambridge University Press, Cambridge, 1982. MR **84j**:22008; 3. with A. Lubotzky, *Varieties of Representations of Finitely Generated Groups*, Mem. Amer. Math. Soc., vol. 336, Amer. Math. Soc., Providence, RI, 1985. MR **87c**:20021; 4. *Lectures on Differential Galois Theory*, Univ. Lecture Ser., vol. 7, Amer. Math. Soc., Providence, RI, 1994. MR **95j**:12008; 5. with C. McKnight, T. Murphy, and M. McKnight, *Mathematics Education Research: A Guide for the Research Mathematician*, Amer. Math. Soc., Providence, RI, 2000. MR **2001f**:00001.

Statement: The American Mathematical Society is simultaneously a membership organization and an important publisher of mathematics. Both roles serve the Society's goals of advancing mathematics research. Its success as a publisher, including its MathSci services, generates revenues which allow the Society to advance mathematics through service to mathematicians and through public awareness far beyond what dues income alone would permit. It is always important for the Society to remember that the revenue so generated comes from sales to its members (individual and institutional) and to their libraries and that responsible management means keeping those sales reasonably priced. As a Trustee, I would work to see that the Society continues to balance its financial goals as a publisher with the understanding that its customers are, by and large, its members.

Carol S. Wood

Professor of Mathematics, Wesleyan University.

Born: February 9, 1945, Pennington Gap, Virginia.

Ph.D.: Yale University, 1971.

AMS Offices: Member at Large of the Council, 1987–1989.

AMS Committees: Employment Task Force, 1992–1994; Committee to Review Member Publications, 1992–1994; Nominating Committee, 1992–1994 (chair, 1993–1994); Committee to Select the Winner of the Satter Prize, 1995–1998 (chair, 1997–1998).



Additional Information: Chair of the Faculty, Wesleyan University, 2000-2001. **AWM:** President, 1991-1993; Executive Committee, 1988-1990. **MAA:** Committee on Undergraduate Program in Mathematics, 1989-1990; Chauvenet Prize Committee, 1993-1996. **ASL:** Cochair of Membership Committee, 1985-1990; Member, Executive Committee, 1998-2001; Chair, Program Committee, Logic Colloquium

2000, La Sorbonne, Paris. Mathematics Judge, Intel Science Talent Search, 1991-. **NSF:** DMS Program Officer (part-time), 1994-1996; Member, Advisory Committee, Division of Mathematical and Physical Sciences, 1997-2000. **MSRI:** Deputy Director, 1996-1997; Program Chair, Model Theory of Fields, spring 1998; Member, Board of Trustees, 1999-.

Statement: As Trustee, I would expect to participate in setting the direction of the AMS, as well as to ensure its continued health. I particularly enjoy problem solving in many venues. In serving as Trustee, I would try to build on my experiences within the research community in order to seek out what works best for mathematics now.

I would support recognition of a broad range of mathematical research, with its rich interplay with other disciplines, and would seek ways to celebrate and communicate successes. I dream that the demographic profile of mathematicians will become indistinguishable from that of our society at large; this dream informs my priorities for the profession.

Member at Large of the Council

Colin C. Adams



Francis C. Oakley Third Century Professor of Mathematics, Williams College.

Born: October 13, 1956, Tarrytown, New York.

Ph.D.: University of Wisconsin, 1983.

Selected Addresses: Low-Dimensional Topology Conference, Luminy, Marseille, France, July 1994; Geometry and Topology Conference, Technion Institute, Haifa, Israel, January 1999; AMS Special Session on Minimal Volume Maximal Cusps in Hyperbolic 3-Manifolds, Denton, May 1999; AMS Special Session on Invariants of Knots and 3-Manifolds, Washington, DC, January 2000. Korea-Japan Knot Theory Conference, Yong Pyong, Korea, August 2000.

Additional Information: MAA National Distinguished Teaching Award, 1998; MAA George Polya Lecturer, 1998-2000; Sigma Xi Distinguished Lecturer, 2000-; Member, MAA Haimo Distinguished Teaching Award Committee, 2000-; Chair, MAA Subcommittee on Undergraduate Research, 2001-.

Selected Publications: 1. with M. Hildebrand and J. Weeks, Hyperbolic invariants of knots and links, *Trans. Amer. Math. Soc.* **326** (1991), 1-56. MR **91j**:57004; 2. *The Knot Book*, W. H. Freeman and Co., New York, 1994. MR **94m**:57007; 3. Toroidally alternating knots and links, *Topology* **33** (1994), 353-369. MR **95e**:57006; 4. Unknotting tunnels in hyperbolic 3-manifolds, *Math. Ann.* **302** (1995), 177-195. MR **96c**:57004; 5. Maximal cusps, collars and systoles for hyperbolic surfaces, *Indiana Univ. Math. J.* **47** (1998), 419-437. MR **99h**:57011.

Statement: One of the key problems facing the mathematical community is the communication of the beauty and utility of mathematics to a broad audience, including legislators, press, administrators, and the general public. We must work hard to foster that communication in order to obtain the resources that mathematics deserves, as well as to attract the next generation of mathematicians.

Bruce E. Blackadar



Professor of Mathematics, University of Nevada, Reno.

Born: October 22, 1948, Nyack, New York.

Ph.D.: University of California, Berkeley, 1975.

AMS Committees: Western Section Program Committee, 1997-1998; *Transactions and Memoirs* Editorial Committee, 1998-2001; Committee on Academic Freedom, Tenure and Employment Security, 1999-2001.

Selected Addresses: AMS Invited Address, Claremont, November 1985; AMS Special Session on Operator Algebras, Joint AMS-LMS Meeting, Cambridge, England, June 1992; AMS Special Session on C^* -Algebras: A Fifty Year Celebration, San Antonio, January 1993; Invited Address, Conference on Operator Algebras, Shanghai, China, 1997; Invited Address, Joint U.S.-Japan Seminar on Operator Algebras, Fukuoka, Japan, 1999.

Additional Information: Forschungsstipendium, Alexander von Humboldt-Stiftung, Germany, 1982-1983; Outstanding Researcher Award, University of Nevada, Reno, 1986; Foundation Professor, University of Nevada, Reno, 1997-2000.

Selected Publications: 1. A simple unital projectionless C^* -algebra, *J. Operator Theory* **5** (1981), 63-71. MR **82h**:46076; 2. *K-Theory for Operator Algebras*, Math. Sci. Res. Inst. Publ., vol. 5, Springer-Verlag, New York, 1986. MR **88g**:46082; second edition, Cambridge University Press, Cambridge, 1998. MR **99g**:46104; 3. Symmetries of the CAR algebra, *Ann. of Math.* **131** (1990), 589-623. MR **91i**:46084; 4. with J. Cuntz, Differential Banach algebra norms and smooth subalgebras of C^* -algebras, *J. Operator Theory* **26** (1991), 255-282. MR **94f**:46094; 5. with E. Kirchberg, Generalized inductive limits of finite-dimensional C^* -algebras, *Math. Ann.* **307** (1997), 343-380. MR **98c**:46112.

Statement: Despite much attention and progress in recent years, a major enduring problem in our profession is the low level of understanding by the public (and politicians) of the nature and importance of mathematical research. We have begun making a dent in the level of ignorance and antipathy toward mathematics in our society, but more must be done. The primary function of the AMS is to promote the development of mathematics, both by providing information and communication opportunities within the profession and with related fields, and by representing the mathematical community to the society as a whole. We need to continue and expand our efforts to attract outstanding students of both traditional and non-traditional backgrounds into the subject and to proudly communicate to the public the beauty and importance of mathematics.

Sylvia T. Bozeman

Professor of Mathematics and Associate Provost for Science and Mathematics, Spelman College.

Born: August 1, 1947, Camp Hill, Alabama.

Ph.D.: Emory University, 1980.

AMS Committees: AMS-MAA Arrangements Committee for the Atlanta Meeting, 1987; AMS-AAAS-MAA Committee on Opportunities in Mathematics for Underrepresented Minorities, 1988-1992; Southeastern Section Program Committee, 1995-1996.

Selected Addresses: Colloquium of the University of North Carolina at Greensboro Department of Mathematics, 1982; Invited MAA Address, San Antonio, January 1993; The 1995 AAAS Annual Meeting and Science Innovations Exposition, Atlanta, 1995; Invited MAA Address, Southeastern Section Meeting, University of Alabama, Huntsville, 1996; Invited Lecture, Dr. Marjorie Lee Browne Colloquium, University of Michigan, Ann Arbor, 2000.

Additional Information: *National Association of Mathematicians:* Vice President, 1984-1988; Executive Board, 1993-2000; *MAA:* Board of Governors, 1989-1992; Recipient of the Distinguished College and University Teaching Award, Southeastern Section, 1995; Governor, Southeastern Section, 1997-2000; Notes Publication Committee, 1998-2000; Task Force on Guidelines for Programs and Departments in Undergraduate Mathematical Sciences, 1998-2000; Cochair, Committee on Minority Participation in Mathematics, 1990-1995; *Member:* Committee for the Award on Distinguished College and University Teaching, 1991-1996; Mathematical Sciences Education Board of the National Research Council, 1992-1995; AWM Executive Council, 1992-1996.

Selected Publications: 1. with L. Kramarz, Finite rank modifications and generalized inverses of Fredholm operators, *J. Math. Anal. Appl.* **80** (1981), 523-532. MR **82e**:47017; 2. with L. Kramarz, Approximating eigenfunctions of Fredholm operators in Banach spaces, *J. Math. Anal. Appl.* **105** (1985), 433-444. MR **86m**:47013; 3. with B. Martin, Cylindrical object identification using range data, Proceedings of the NASA HBCU Conference, Huntsville, March 1989; 4. Black women mathematicians: In short supply, *SAGE*, Vol. VI, March 1989; 5. with R. Hughes, Smoothing the transition

to graduate education, *Notices Amer. Math. Soc.*, **46** (1999), 347-348.

Statement: The AMS gives considerable attention to the development of productive research mathematicians. Its many professional development programs and its fine publication program are testimonies to this fact.

As a member of the Council, I would contribute to the analysis of AMS policy and programs and, if necessary, the expansion of AMS priorities in two areas which I believe are important to the health of the profession: (1) the establishment of a strong research community which is reflective of the diverse population of the U.S., and (2) increased attention to the decline in the number of mathematics graduate students among U.S. citizens. In addressing these issues I hope to bring the experience gained over the last fifteen years as a college administrator and codirector of a graduate bridge program. In both of these my goal has been to create a diverse mathematical community and a more diverse scientific work force. I believe that those who prepare future mathematicians and those who advance the discipline must all share responsibility for the health of the profession.



Percy A. Deift

Professor of Mathematics, Courant Institute, New York University.

Born: September 10, 1945, Durban, South Africa.

Ph.D.: Princeton University, 1977.

AMS Committees: AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences, 1995-1998; Committee on Committees, 1995-1996; Committee to Select

the Gibbs Lecturer, 2000- (chair); St. Petersburg Travel Grants Panel, 2001 (chair).

Selected Addresses: Plenary Lecture, SIAM Annual Meeting, July 1996; Invited Address, International Congress of Mathematicians, Berlin, 1998; Plenary Speaker, Conference on Anal. and Math. Phys. in honor of Lars Gårding, Lund, August 1999; Amick Lectures, University of Chicago, April-May 2000; Gergen Lectures, Duke University, October 2001.

Additional Information: NSF Special Creativity Award, 1997-1999; Co-winner, Polya Prize, 1998; Guggenheim Fellow, 1990-2000; Member of IAMP.

Selected Publications: 1. with X. Zhou, A steepest descent method for oscillatory Riemann-Hilbert problems. Asymptotics for the MKdV equation, *Ann. of Math.* **137** (1993), 295-368. MR **94d**:35143; 2. with A. Its and X. Zhou, A Riemann-Hilbert approach to asymptotic problems arising in the theory of random matrix models, and also in the theory of integrable statistical mechanics, *Ann. of Math.* **146** (1997), 149-235. MR **98k**:47097; 3. with X. Zhou, Near integrable systems on the line. A case study—perturbation theory of the defocusing nonlinear Schrödinger equation, *Math. Res. Lett.* **4** (1997), 761-772. MR **98j**:35167; 4. with J. Baik and K. Johansson, On the distribution of the length

of the longest increasing subsequence of random permutations, *J. Amer. Math. Soc.* **12** (1999), 1119–1178. MR **2000e:05006**; 5. with T. Kriecherbauer, K. McLaughlin, S. Venakides, and X. Zhou, Uniform asymptotics for polynomials orthogonal with respect to varying exponential weights and applications to universality questions in random matrix theory, *Comm. Pure Appl. Math.* **52** (1999), 1335–1425.

Statement: My principal concerns as a Member at Large of the Council would be: (1) to maintain the level of mathematical research at U.S. institutions, (2) to provide opportunities (such as the Arnold Ross Lectures) for students across the country to learn about mathematics and the mathematical life, and (3) to provide opportunities for teachers in schools to learn new and more mathematics.

Irene M. Gamba



Professor of Mathematics, The University of Texas at Austin.

Born: February 17, 1957, Mar del Plata, Argentina.

Ph.D.: The University of Chicago, 1989.

AMS Committees: Central Section Program Committee, 2001–.

Selected Addresses: Fifth International Conference on Hyperbolic Problems, Stony Brook, NY, 1994; Minisymposium speaker, ICIAM, Hamburg, 1995; Minisymposium

speaker, ECMI, 1996; Minisymposium speaker, International Workshop of Computational Electronics, Notre Dame University, 1997; Invited Speaker, SIAM Annual Meeting, Section on Computational Methods for PDEs, 1999.

Additional Information: Conference and Seminar Organization: Coorganizer, AMS Special Session on Mathematical Problems in Transport Phenomena, Austin, October 1999; IMA Tutorial and Workshop organizer, Simulation of Transport in Transition Regimes, Minneapolis, May 2000; Minisymposium session coorganizer, Kinetic Models in Applied Sciences, SIAM Annual Meeting, Puerto Rico, July 2000. **Appointments:** NSF Mathematical Science Postdoctoral Research Fellow, Courant Institute of Mathematical Sciences, New York University, 1992–1994; Assistant Professor, Courant Institute of Mathematical Sciences, New York University, 1994–1996; Associate Professor, Courant Institute of Mathematical Sciences, New York University, 1996–1997; Professor, University of Texas at Austin, 1997–.

Selected Publications: 1. with C. Morawetz, A viscous approximation for a 2-D steady semiconductor or transonic gas dynamic flow: Existence theorem for potential flow, *Comm. Pure Appl. Math.* **49** (1996), 999–1049. MR **97g:35169**; 2. Sharp uniform bounds for steady potential fluid-Poisson systems, *Proc. Roy. Soc. Edinburgh Sect. A* **127** (1997), 479–516. MR **98j:35152**; 3. with A. Bobylev and J. Carrillo, On some properties of kinetic and hydrodynamic equations for inelastic interactions, *J. Statist. Phys.* **98** (2000), 743–773. MR **2001c:82063**; 4. with J. Carrillo and C. Shu, Computational macroscopic approximations to

the one-dimensional relaxation-time kinetic system for semiconductors, *Phys. D* **146** (2000), 289–306; 5. with A. Jüngel, Positive solutions to singular second and third order differential equations for quantum fluids, *Arch. Ration. Mech. Anal.* **156** (2001), 183–203.

Statement: The American Mathematical Society has a fundamental role in promoting mathematical research and support in the whole international mathematical community. At a time when new technologies are dramatically changing the mathematical landscape, it is essential that our community gets engaged in interdisciplinary research by pursuing new ideas and developing new tools that will allow scientific breakthroughs. This applies particularly to the field of rigorous modeling of new phenomena and to the validation of these models. All disciplines within mathematics are going to be needed.

Henri A. Gillet



Professor of Mathematics, University of Illinois at Chicago.

Born: July 8, 1953, Tangiers, Morocco.

Ph.D.: Harvard University, 1978.

AMS Committees: *American Journal of Mathematics*, Society's Representative, 1994 (chair).

Selected Addresses: AMS Invited Address, Chicago, May 1989; Number Theory Section, International Congress of Mathematicians, Kyoto, 1990.

Additional Information: AMS Special Session on K -Theory, Chicago, March 1985 (organizer); Alfred P. Sloan Foundation Fellow, 1986–1989; AMS Special Session on Arithmetic Geometry and Intersection Theory, Chicago, May 1989 (organizer); *American Journal of Mathematics*, 1994–1999 (editor); AMS Summer Research Institute on Algebraic Geometry, Santa Cruz, July 1995 (organizing committee); *International Mathematics Research Notices*, 1995–1997 (editor); Head, Department of Mathematics, Statistics, and Computer Science, University of Illinois at Chicago, 1995–2001; AMS-IMS-SIAM Joint Summer Research Conference on Algebraic K -Theory, Seattle, July 1997 (organizing committee).

Selected Publications: 1. Riemann-Roch theorems for higher algebraic K -theory, *Adv. in Math.* **40** (1981), 203–289. MR **83m:14013**; 2. with C. Soulé, Intersection theory using Adams operations, *Invent. Math.* **90** (1987), 243–277. MR **89d:14005**; 3. with P. Shalen, Dendrology of groups in low Q -ranks, *J. Differential Geom.* **32** (1990), 605–712. MR **92b:57003**; 4. with C. Soulé, An arithmetic Riemann-Roch theorem, *Invent. Math.* **110** (1992), 473–543. MR **94f:14019**; 5. with C. Soulé, Descent, motives and K -theory, *J. Reine Angew. Math.* **478** (1996), 127–176. MR **98d:14012**.

Statement: The mathematical community is currently faced with a remarkable combination of opportunities and challenges. On the positive side, there is a strong market for mathematicians in many areas (e.g., finance, consulting, and cryptography), there have been best-selling books about

math topics, and considerable attention is being paid to K-12 mathematics education. As the former head of a highly diverse mathematical sciences department, I am strongly aware of the benefits both of interdisciplinary activities and of a strong presence for the mathematical community in mathematics education, though I also believe that we should not be slaves to fashion. On the negative side, we are faced with a major challenge: federal support for mathematical sciences is anemic, and the new president's proposed budget, which is not favorable to basic science, does not augur well for the future. The AMS therefore has a critical role to play by educating decision makers, the public, and potential students of both the value of a mathematics education and of funding mathematical research. It is also extremely important, within the current funding environment, that as innovative methods are tried to fund mathematical sciences and education, funding of individual researchers should not be forgotten.

David R. Morrison



James B. Duke Professor of Mathematics and Physics, Duke University.

Born: July 29, 1955, Oakland, California.

Ph.D.: Harvard University, 1980.

AMS Committees: Committee on the Publication Program, 1994.

Selected Addresses: Six AMS Special Sessions, 1981-1990; Invited Address, Mathematical Society of Japan, Tokyo, 1985; AMS Invited

Address, Lexington, March 1994; Invited Address, International Congress of Mathematicians, Zurich, 1994; Invited Address, AAAS, Philadelphia, 1998.

Additional Information: AMS Centennial Fellowship, 1992-1994; Steering Committee, Institute for Advanced Study/Park City Mathematics Institute, 1995-; IMU Committee on Electronic Information and Communication, 1998-; **Member:** AAAS, AAUP, American Physical Society, MAA, Mathematical Society of Japan, Sigma Xi; **Editorial Boards:** *Advances in Theoretical and Mathematical Physics*, *New York Journal of Mathematics*.

Selected Publications: 1. Semistable degenerations of Enriques' and hyperelliptic surfaces, *Duke Math. J.* **48** (1981), 197-249. MR **82m**:14020; 2. On $K3$ surfaces with large Picard number, *Invent. Math.* **75** (1984), 105-121. MR **85j**:14071; 3. Mirror symmetry and rational curves on quintic threefolds: A guide for mathematicians, *J. Amer. Math. Soc.* **6** (1993), 223-247. MR **93j**:14047; 4. with B. Greene and A. Strominger, Black hole condensation and the unification of string vacua, *Nuclear Phys. B* **451** (1995), 109-120. MR **96m**:83085; 5. with P. Deligne, P. Etingof, D. Freed, L. Jeffrey, D. Kazhdan, J. Morgan, and E. Witten (eds.), *Quantum Fields and Strings: A Course for Mathematicians*, Vols. 1 and 2, Amer. Math. Soc., Providence, RI, 1999. MR **2000e**:81010.

Statement: The AMS has several key roles to play in today's society: (1) The AMS should be a major player in science policy discussions with legislators and government officials, ensuring that the collective voice of mathematicians is heard; (2) The AMS should play a leadership role in bringing together disparate segments of the mathematics community (pure and applied, researchers and educators, college and K-12), with the goal of promoting productive interaction among these groups; (3) The AMS should be a model publisher, publishing in a cost-effective manner and helping to develop open standards such as $\text{T}_\text{E}_\text{X}$ and Unicode which will smooth the transition from a paper literature to an electronic one.

Douglas C. Ravenel



Professor of Mathematics, University of Rochester.

Born: February 17, 1947, Alexandria, Virginia.

Ph.D.: Brandeis University, 1972.

Selected Addresses: International Congress of Mathematicians, Helsinki, 1978; Bourbaki Seminar, Paris, 1990; AMS Workshop for New Chairs, New Orleans, January 2001.

Additional Information: Alfred P. Sloan Foundation Fellow, 1977-1981; Department Chair, University of Rochester, 1996-.

Selected Publications: 1. *Complex Cobordism and Stable Homotopy Groups of Spheres*, Pure Appl. Math., vol. 121, Academic Press, Orlando and New York, 1986. MR **87j**:55003; 2. *Nilpotence and Periodicity in Stable Homotopy Theory*, *Ann. of Math. Stud.*, vol. 128, Princeton University Press, Princeton, 1992. MR **94b**:55011; 3. Rochester four years later: From crisis to opportunity, *Notices Amer. Math. Soc.* **46** (1999), 861-863.

Statement: Our community is at an interesting point in its history. The importance of mathematics is being increasingly recognized in this technological age, and the NSF has made increased funding for our discipline its top priority. At the same time, mathematics, like higher education in general, is under increasing financial and curricular pressure. Careful attention to instructional issues appears to be our best response.

My experience with the Rochester crisis of 1995-96 brought these issues into stark relief. My department was initially targeted for severe cutbacks, including the elimination of its graduate program, but with moral and tactical support from the AMS we were able to persuade our administration to modify its course. Improvements in our undergraduate program since then have made us a source of institutional pride.

As a Council member I would encourage the AMS to enhance its recent programs to increase awareness of these issues and to support the efforts of department chairs and other leaders to respond to them in constructive ways.

Frank Sottile



Assistant Professor of Mathematics, University of Massachusetts at Amherst.

Born: March 18, 1963, Grosse Pointe, Michigan.

Ph.D.: University of Chicago, 1994.

Selected Addresses: MSRI Workshop on Symmetric Functions and Representation Theory, Berkeley, 1997; Invited Address, MSRI Workshop on Solving Systems of Equations, Berkeley, 1998; Invited Address, Computational Commu-

tative Algebra VI, Torino, Italy, 1999; Invited Address, Effective Methods in Algebraic Geometry, Bath, England, 2000; AMS Invited Address, Hoboken, April 2001.

Additional Information: Churchill Scholar and NSF Graduate Fellow, Cambridge University, England, 1985–1988; Editorial Board, *Concerns of Young Mathematicians*, 1994–1999; Visiting Assistant Professor, University of Toronto, 1995–1998, and University of Wisconsin-Madison, 1999–2000; MSRI Postdoctoral Fellow, 1996–1997, and autumn 1998; Long-Term Visitor, Université de Genève, IRMA Strasbourg, and IRMAR, Rennes; Organizing Committee, Formal Power Series and Algebraic Combinatorics, The Fields Institute, Toronto, 1998; Steering Committee, Effective Methods in Algebraic Geometry, 2003, Kaiserslautern, Germany. **Member:** AMS, AWM, SIAM, YMN.

Selected Publications: 1. with W. Fulton, R. MacPherson, and B. Sturmfels, Intersection theory on spherical varieties, *J. Algebraic Geom.* **4** (1995), 181–193. MR **95j**:14004; 2. Enumerative geometry for the real Grassmannian of lines in projective space, *Duke Math. J.* **87** (1997), 59–85. MR **99a**:14079; 3. with N. Bergeron, Schubert polynomials, the Bruhat order, and the geometry of flag manifolds, *Duke Math. J.* **95** (1998), 373–423. MR **2000d**:05127; 4. with N. Bergeron, Hopf algebras and edge-labeled posets, *J. Algebra* **216** (1999), 641–651. MR **2000e**:16033; 5. Real rational curves in Grassmannians, *J. Amer. Math. Soc.* **13** (2000), 333–341. MR **2000j**:14080.

Statement: Mathematics currently enjoys some encouraging circumstances. Demographic change is finally leading to improvements in the academic job market, new funding initiatives support our research, and—hard as it is to believe—mathematics has even captured the imagination of popular culture. (Witness the play *Proof* and movies *A Beautiful Mind* (coming soon), *Good Will Hunting*, and π .) We know this attention and support is warranted as mathematics continues to be vital to the technologies that drive economic progress.

This fortuitous situation is, however, fragile, and our profession faces additional challenges. While the AMS has limited power to effect change, it does play an important role in leadership and outreach. We certainly need to preserve recent gains, effectively communicating the value and excitement of our research to the government and to the general public. Another serious challenge is the attraction and development of the next generation of mathematical scientists. This is complicated by the memory of the recent

job market, the trend toward longer postdoctoral careers, and the changing nature of American society.

If elected as your representative to the AMS Council, I will work vigorously to ensure that our society continues to run well, represents its membership, and imaginatively faces new challenges as they arise.

W. Stephen Wilson



Professor of Mathematics, The Johns Hopkins University.

Born: November 11, 1946, Iowa City, Iowa.

Ph.D.: Massachusetts Institute of Technology, 1972.

Selected Addresses: AMS Invited Address, Duluth, 1978; Main Speaker, CBMS Regional Conference, SUNY-Albany, 1980; 46th Annual Japanese Topology Symposium, Hokkaido University, 1999.

Additional Information: Alfred P. Sloan Foundation Research Fellow, 1977–1979; The Johns Hopkins University Homewood Student Council Award for Excellence in Teaching, 2000.

Selected Publications: 1. with H. Miller and D. Ravenel, Periodic phenomena in the Adams-Novikov spectral sequence, *Ann. of Math.* (2) **106** (1977), 469–516. MR **56**:16626; 2. *Brown-Peterson Homology: An Introduction and Sampler*, CBMS Regional Conf. Ser. in Math., vol. 48, Conference Board of the Mathematical Sciences, Washington, DC, 1982. MR **83j**:55005; 3. with J. Boardman and D. Johnson, Unstable operations in generalized cohomology, *Handbook of Algebraic Topology* (L. James, ed.), North-Holland, Amsterdam, 1995, pp. 687–828. MR **97b**:55022; 4. with D. Ravenel and N. Yagita, Brown-Peterson cohomology from Morava K -theory, *K-Theory* **15** (1998), 147–199. MR **2000d**:55012; 5. Hopf rings in algebraic topology, *Expo. Math.* **18** (2000), 369–388.

Statement: A primary focus of the American Mathematical Society is, as it should be, mathematical research. The Society should also be involved with the broader spectrum of concerns of professional mathematicians. These include issues relating to mathematics education from K–12 through graduate school, jobs for mathematicians, research funds, attracting more graduate students, and diversifying our graduate programs and faculty. The American Mathematical Society must do its best to influence government policy on these and other issues. A corollary is the need for a strong Washington presence for the American Mathematical Society in constant contact with policymakers at the National Science Foundation and in the legislature.

Nominating Committee

Alejandro Adem

Professor of Mathematics, University of Wisconsin-Madison.

Born: November 24, 1961, Mexico City, Mexico.

Ph.D.: Princeton University, 1986.



AMS Committees: AMS-IMS-SIAM Committee on Joint Summer Research Conferences in the Mathematical Sciences, 1997-2000; AMS-SMM Joint Program Committee, Mexico Meeting, 2000-2001.

Selected Addresses: Plenary Lecture, Conference on Topology and Its Connections to Geometry and Modular Representation Theory, Evanston, 1992; Plenary Lecture, AMS Summer Institute on Cohomology of Groups, Seattle, July 1996; AMS Invited Address, Columbia, November 1996; Plenary Lecture, Midwest Topology Seminar, Bloomington, 2000; Plenary Lecture, Singapore International Symposium on Geometry and Topology, 2001.

Additional Information: Alfred P. Sloan Doctoral Dissertation Fellowship, 1985; NSF Young Investigator Award, 1992; Romnes Faculty Fellowship, Wisconsin Alumni Research Foundation, 1995; Chair, Department of Mathematics, University of Wisconsin-Madison, 1999-.

Selected Publications: 1. with W. Browder, The free rank of symmetry of $(S^n)^k$, *Invent. Math.* **92** (1988), 431-440. MR **89e**:57034; 2. Characters and K -theory of discrete groups, *Invent. Math.* **114** (1993), 489-514. MR **95j**:55006a; 3. with R. J. Milgram, *Cohomology of Finite Groups*, Grundlehren Math. Wiss., vol. 309, Springer-Verlag, Berlin, 1994. MR **96f**:20082; 4. Recent developments in the cohomology of finite groups, *Notices Amer. Math. Soc.* **44** (1997), 806-815. MR **98j**:20077; 5. with D. Karagueuzian and J. Mináč, On the cohomology of Galois groups determined by Witt rings, *Adv. Math.* **148** (1999), 105-160. MR **2001b**:12010.

Statement: The AMS plays a critical role in promoting mathematical research and education. On both fronts we are facing important challenges. As chair of a large department I am very much aware of the decisive impact that key individuals may have on committees and other organizational jobs. The Nominating Committee must strive to identify highly qualified and motivated candidates with an interest in serving the entire mathematical community.

Sheldon Axler



Chair and Professor, Mathematics Department, San Francisco State University.

Born: November 6, 1949, Philadelphia, Pennsylvania.

Ph.D.: The University of California, Berkeley, 1975.

AMS Offices: Member at Large of the Council, 1990-1992.

AMS Committees: Committee to Monitor Problems in Communication, 1987-1989; AMS-MAA Joint Program Committee for the

Phoenix Meeting, 1989 (chair); AMS-MAA Joint Program Committee for the Boulder Meeting, 1989 (chair); Committee to Review Member Publications, 1992-1994; Committee on Copyright Policy, 1992-1993; *Notices* Editorial

Committee, 1993-1994; Publications Committee, 1993-1994; Committee on Academic Freedom, Tenure, and Employment Security, 1995-1997.

Selected Addresses: AMS Special Session on Bergman Spaces, Baltimore, January 1992; AMS Special Session on Operator Theory and Operator Algebras, Dayton, October 1992; AMS Special Session on Holomorphic Spaces, San Francisco, January 1995; AMS Special Session on Operator Theory and Function Spaces, Milwaukee, October 1997; AMS Special Session on Banach Spaces of Analytic Functions, San Antonio, January 1999.

Additional Information: Editor in Chief, *Mathematical Intelligencer*, 1987-1991; Cochair, AMS Summer Research Conference on Bergman Spaces, July 1994; MAA Lester R. Ford Award for expository writing, 1996.

Selected Publications: 1. Factorization of L^∞ functions, *Ann. of Math.* **106** (1977), 567-572. MR **57**:1127; 2. Multiplication operators on Bergman spaces, *J. Reine Angew. Math.* **336** (1982), 26-44. MR **84b**:30052; 3. The Bergman space, the Bloch space, and commutators of multiplication operators, *Duke Math. J.* **53** (1986), 315-332. MR **87m**:47064; 4. *Linear Algebra Done Right*, Undergrad. Texts Math., second edition, Springer-Verlag, New York, 1997. MR **98i**:15001; 5. with P. Bourdon and W. Ramey, *Harmonic Function Theory*, Grad. Texts Math., vol. 137, second edition, Springer-Verlag, New York, 2001.

Statement: The Nominating Committee finds candidates for key officers of the Society, including president-elect (ultimately president), vice president, trustee, and member-at-large of the Council. As a member of the Nominating Committee, I would seek candidates who could effectively promote the missions of the American Mathematical Society: to support mathematical research, to increase the public's understanding of the value of mathematics, and to foster excellence in the teaching of mathematics. To help meet the challenges currently facing the AMS, the Nominating Committee should recommend outstanding candidates reflecting the diverse membership of the Society.

Robert M. Fossum



Professor, University of Illinois at Urbana-Champaign; Affiliate, Beckman Institute.

Born: May 1, 1938, Northfield, Minnesota.

Ph.D.: The University of Michigan, 1965.

AMS Offices: Associate Secretary, 1984-1987; Secretary, 1989-1998; Former Secretary, 1999-2000.

AMS Committees: *Proceedings* Editorial Committee, 1974-1977; Committee to Select Hour Speakers

for Central Sectional Meetings, 1984-1987; *Abstracts* Editorial Committee, 1984-1987, 1989-1998 (chair); Ad Hoc Committee on the Proposed Structure of the Joint Policy Board for Mathematics, 1986-1987; AMS-MAA Arrangements Committee for the San Antonio Meeting, 1987; Ad Hoc Committee on NCTM Standards, 1989; Ad Hoc

Committee to Review the Procedures of the Council in Considering Issues, 1989; Committee on Vending Software, 1989 (chair); Committee on the Publication Program, 1989-1994; Agenda and Budget Committee, 1989-1998; AMS-MAA Joint Meetings Committee, 1989-1998 (chair: 1992, 1994, 1996, 1998); AMS-MAA-SIAM Joint Administrative Committee, 1989-1998 (chair); Committee on Agenda for Business Meetings, 1989-1998 (chair); Committee on Committees, 1989-1998; Committee on Long Range Planning, 1989-1998; Committee on Meetings and Conferences, 1989-1998; Committee on National Awards and Public Representation, 1989-1998; Executive Committee of the Council, 1989-1998; Liaison Committee, 1989-1998; *Notices* Editorial Committee, 1989-1994 (chair), 1995-1998 (associate editor); Program Committee for National Meetings, 1989-1998; Nominating Committee Scheduling Committee, 1990 (chair); AMS-London Mathematical Society Joint Program Committee, 1990-1992 (chair); Committee to Select the Winner of the Public Service Award, 1990-1992 (chair, 1990); Liaison Committee with Deutsche Mathematiker Vereinigung, 1990-1993; AMS-MAA Committee on Summer Meetings, 1991-1992; AMS-MAA Committee on Cooperation, 1991-1998; Subcommittee to Study Committee Structure, 1992; Ad Hoc Committee on Nominating Procedures, 1992-1993; Committee on Publications, 1992-1998; AMS-Sociedad Math. Mexicana Joint Program Committee, 1993; Committee on Special 100th Meeting Celebration, 1993; Committee on Meetings of the Council, 1993-1994 (chair); Subcommittee on Summer Meetings, 1993-1996; Committee on Education, 1993-1998; Committee on the Profession, 1993-1998; Committee on Science Policy, 1993-1998; Search Committee for Executive Director, 1994; Task Force on AMS Conferences, 1994; AMS-IMU Joint Program Committee, 1994-1995; AMS-MAA Exhibits Advisory Subcommittee, 1994-1998 (chair, 1997-1998); Blue Ribbon Committee for World Mathematical Year 2000, 1994-1999; AMS-MAA-SIAM Joint Policy Board for Mathematics, 1996-1997; Search Committee for AMS Secretary, 1996-1997 (consultant); Search Committee for the Editor of *Notices*, 1996-1997 (co-chair, 1997); AMS-Nordic Joint Program Committee, 1998-2000; AMS Representative to AAAS, 1998-2000; Liaison Committee with AAAS, 1998-2000; AMS-MAA Joint Archives Committee, 1998-2001; Committee on Archives, 1998-2001.

Selected Addresses: AMS Invited Address, Bloomington, Indiana, April 1980; Numerous special sessions.

Additional Information: Det Kongelig Norske Videnskabers Selskab (The Royal Norwegian Society of Science and Letters), Elected 1994; Fellow, American Association for the Advancement of Science (AAAS), Elected 2000. **Member:** Association for Computing Machinery (ACM); Dansk Matematisk Forening; European Mathematical Society; IEEE Computer Society; Institute for Algebraic Meditation (secretary); International Association of Mathematical Physics; New York Academy of Sciences; Society for the Advancement of Scandinavian Studies (SASS); Society for Industrial and Applied Mathematics (SIAM); \TeX Users Group (TUG); UIUC Senate Chair, 2001-2002.

Selected Publications: 1. with L. Claborn, Class groups of n -Noetherian rings, *J. Algebra* **10** (1968), 263-285. MR

39:5541; 2. with L. Claborn, Generalizations of the notion of class group, *Illinois J. Math.* **12** (1968), 228-253. MR 37:200; 3. Vector bundles over spheres are algebraic, *Invent. Math.* **8** (1969), 222-225. MR 40:3537; 4. *The Divisor Class Group of a Krull Domain*, *Ergeb. Math. Grenzgeb.*, Band 74, Springer-Verlag, New York-Heidelberg, 1973. MR 52:3139; 5. with W. Haboush, The cohomology algebra of a commutative group scheme, *Trans. Amer. Math. Soc.* **339** (1993), 553-565. MR 93m:14041.

Statement: The Nominating Committee identifies the leaders of the AMS by nominating candidates for member at large of the Council, vice president, president-elect, and trustee. It is vital that candidates selected represent the broad cross section of the general membership of the Society. The candidates who are elected are called upon to set policy for the Society, exercise fiduciary responsibilities, and represent the Society and mathematics in many and diverse settings. As a member of the Nominating Committee, I hope to help identify and put forth candidates from all sections of the Society who we believe will excel as officers of the Society in the same manner as they have excelled as mathematicians and citizens of the mathematical community.

As a former secretary of the Society, I know the duties of each position and will be able to help the Nominating Committee in its task of identifying candidates who are suitable for the vacant positions.

Jane Hawkins



Professor of Mathematics, University of North Carolina at Chapel Hill.

Born: October 27, 1954.

Ph.D.: University of Warwick, 1981.

AMS Offices: Member at Large of the Council, 1998-2000.

AMS Committees: Committee on Science Policy, 1998-2000.

Selected Addresses: AMS Invited Address, Tuscaloosa, March 1992; Sonya Kovalevsky High School Mathematics Day Keynote Address,

North Dakota State University, 1999; AMS Special Session on Ergodic Theory and Dynamical Systems, Lowell, April 2000; AMS Special Session on Ergodic Theory and Dynamical Systems, Toronto, September 2000; Leonard Sulski Memorial Mathematics Lecture, College of the Holy Cross, 2001.

Additional Information: Assistant Professor, State University of New York at Stony Brook, 1980-1986; Visiting Member, MSRI, 1984; Visiting Assistant Professor, California Institute of Technology, 1986-1987; University of North Carolina Chancellor's Award for Instructional Technology, 1998; Faculty Member for NSA-Sponsored Summer Program for Women in Mathematics, George Washington University, 1999-2001.

Selected Publications: 1. with K. Schmidt, On C^2 -diffeomorphisms of the circle which are of type III_1 , *Invent. Math.* **66** (1982), 511-518. MR 84g:58069; 2. Rohlin factors,

product factors, and joinings for n -to-one maps, *Indiana Univ. Math. J.* **42** (1993), 237–258. MR **94h**:28012; 3. Amenable relations for endomorphisms, *Trans. Amer. Math. Soc.* **343** (1994), 169–191. MR **94g**:28027; 4. with H. Bruin, Examples of expanding C^1 maps having no σ -finite invariant measure equivalent to Lebesgue, *Israel J. Math.* **108** (1998), 83–107. MR **2000i**:37051; 5. with H. Bruin, Exactness and maximal automorphic factors of unimodal interval maps, *Ergodic Theory Dynam. Systems*, to appear.
Statement: Officers of the American Mathematical Society represent the wide variety of interests of the membership. Professional mathematicians are located at colleges, universities, and industries of all sizes throughout North America, and their roles run the gamut from fundamental research to recruitment of capable undergraduates into the profession to the incorporation of technology into our curriculum. The Society's officers should be attuned to the trends in federal funding, interdisciplinary activities, and the training of the future mathematical and scientific work force. The role of the Nominating Committee is to listen to its electors, perform a wide search, and present qualified officer candidates for election by the AMS membership.

Michael Starbird



University Distinguished Teaching Professor and Professor of Mathematics, University of Texas at Austin.

Born: July 10, 1948.
Ph.D.: University of Wisconsin, 1974.
AMS Offices: Member at Large of the Council, 1998–2001.
AMS Committees: Meetings and Conferences Committee, 1998–2001.

Selected Addresses: AMS Invited Address, Norman, March 1983; Invited Address, MAA Regional Meeting, San Diego, 1983; AMS Special Session on the Evolving Undergraduate Mathematics Curriculum, Stillwater, October 1994; Christie Lecture, Mathematics for Future Lawyers, Legislators, and Business Leaders, MAA Northeastern Section Fall Meeting, Springfield, 1997; Mathematics 2000 Colloquium, The Ohio State University, October 2000; Invited Address, MAA Mathfest, Madison, 2001.

Additional Information: Visiting Member, Institute for Advanced Study, 1978–1979; Minnie Stevens Piper Professor (awarded to ten professors each year in the state of Texas), 1984; President's Associates Teaching Excellence Award, 1989; UT Recreational Sports Super Racquets Champion, 1989; Associate Dean, College of Natural Sciences, University of Texas at Austin, 1989–1997; Member of the Board, Mathematicians and Education Reform (MER) Network, 1992–; MER Task Force on the Departmental Network, 1993–; Jean Holloway Award for Teaching Excellence, 1995; Chad Oliver Plan II Teaching Award, 1997; Member, Academy of Distinguished Teachers, 1998–; Friar Society Centennial Teaching Fellowship, 2000.

Selected Publications: 1. with M. Rudin, Products with a metric factor, *General Topology and Appl.* **5** (1975), 235–248. MR **52**:1606; 2. Cell-like, 0-dimensional decompositions of E^3 , *Trans. Amer. Math. Soc.* **249** (1979), 203–216. MR **80h**:57016; 3. with R. Denman, Shrinking countable decompositions of S^3 , *Trans. Amer. Math. Soc.* **276** (1983), 743–756. MR **84f**:57004; 4. with F. Ancel, The shrinkability of Bing-Whitehead decompositions, *Topology* **28** (1989), 291–304. MR **90g**:57014; 5. with E. Burger, *The Heart of Mathematics: An Invitation to Effective Thinking*, Key College Publishing in cooperation with Springer-Verlag, New York, 2000.

Statement: The future vitality of the mathematics profession will be determined largely by decisions made by non-mathematicians. When I was associate dean, I attended a meeting at which nationally prominent deans were asked to describe their departments of mathematics. “Insular” was the word most commonly used by the other deans. They described their mathematics departments as largely uninterested in strategic planning, general education, or connections with other departments. I am keenly aware of the perceptions of mathematics held by faculty members in other departments, by administrators, by donors, and by the nonacademic community. We mathematicians must learn how to listen to these external voices and better meet their needs, and we have made some progress recently in this direction. Mathematics is exciting, useful, and one of the ongoing, crowning achievements of human thought—an expanding adventure for all people. This outward-looking perspective shapes ideas on funding of research and teaching, revisions of graduate and undergraduate curricula, outreach activities, inclusion of underrepresented populations, and building an infrastructure for systematically bringing mathematical research activity within the grasp of many. Mathematics has far more to give the whole society than we have traditionally offered. This philosophy would inform my contributions to the Nominating Committee.

Daniel W. Stroock



Professor of Mathematics, Massachusetts Institute of Technology.

Born: March 20, 1940, New York, New York.
Ph.D.: Rockefeller University, 1966.
AMS Committees: *Transactions and Memoirs* Editorial Committee, 1975–1978; Committee to Select Hour Speakers for Far Western Sectional Meetings, 1979–1980; *Proceedings* Editorial Committee, 1983–1987; Advisory Committee on Former Soviet Union Mathematics, 1992–1995; Centennial Fellowships Committee, 1994–1996; Special Donations of Publications Committee, 1996–1997 (chair); Committee on Committees, 1997–1998 (chair); Committee on Science Policy, 1998–2000.

Selected Addresses: AMS Invited Address, Claremont, October 1978; Invited Address, International Congress of

Mathematicians, Warsaw, 1983; AMS Invited Address, International Joint Mathematics Meetings of the AMS and the Sociedad Matemática Mexicana (SMM), Merida, Mexico, December 1993; AMS Colloquium Lectures, San Diego, January 1997.

Additional Information: Awards and Affiliations: Steele Prize (with S. R. S. Varadhan), 1997. **Member:** American Academy of Arts & Sciences; National Academy of Sciences.

Selected Publications: 1. with R. Holley, In one and two dimensions, every stationary measure for a stochastic Ising model is a Gibbs state, *Comm. Math. Phys.* **55** (1977), 37–45. MR **56**:9741; 2. with S. R. S. Varadhan, *Multidimensional Diffusion Processes*, Springer-Verlag, Berlin and New York, 1979. MR **81f**:60108; 3. The Malliavin calculus and its application to second order parabolic differential equations. I. *Math. Systems Theory* **14** (1981), 25–65. MR **84d**:60092a; The Malliavin calculus and its application to second order parabolic differential equations. II. *Math. Systems Theory* **14** (1981), 141–171. MR **84d**:60092b; 4. *Probability Theory, an Analytic View*, Cambridge University Press, Cambridge, 1993. MR **95f**:60003; 5. *An Introduction to the Analysis of Paths on a Riemannian Manifold*, Mathematical Surveys and Monographs, vol. 74, Amer. Math. Soc., Providence, RI, 2000.

Statement: I believe that the community of research mathematicians in the U.S. should have a voice and that the AMS should be that voice. My selection of candidates would reflect this belief.

Editorial Boards Committee

Clifford J. Earle



Professor of Mathematics, Cornell University.

Born: November 3, 1935, Racine, Wisconsin.

Ph.D.: Harvard University, 1962.

AMS Offices: Council Representative, *Proceedings* Editorial Committee, 1997–2001.

AMS Committees: *Proceedings* Editorial Committee, 1989–2001 (chair and managing editor, 1997–2001).

Selected Addresses: Numerous special sessions at regional or national AMS meetings, 1968–1995; AMS Invited Address, New York, April 1973.

Selected Publications: 1. with J. Eells, A fibre bundle description of Teichmüller theory, *J. Differential Geom.* **3** (1969), 19–43. MR **43**:2737a; 2. with R. Hamilton, A fixed point theorem for holomorphic mappings, *Global Analysis*, Proc. Sympos. Pure Math., vol. XVI (Berkeley, CA, 1968), Amer. Math. Soc., Providence, RI, 1970, pp. 61–65. MR **42**:918; 3. with A. Douady, Conformally natural extension of homeomorphisms of the circle, *Acta Math.* **157** (1986), 23–48. MR **87j**:30041; 4. with C. McMullen, Quasiconformal isotopies, *Holomorphic Functions and Moduli, Vol. I*, Math. Sci. Res. Inst. Publ., vol. 10, Springer, New York, 1988, pp. 143–154. MR **89h**:30028; 5. with F. Gardiner, Teichmüller

disks and Veech's \mathcal{F} -structures, *Extremal Riemann Surfaces*, Contemp. Math., vol. 201, Amer. Math. Soc., Providence, RI, 1997, pp. 165–189. MR **97k**:32031.

Statement: Producing high-quality journals is one of the most important activities of the AMS, and maintaining the quality of the journals requires continual recruiting of good editors. During my four years as managing editor of the *Proceedings*, I found that the Editorial Boards Committee can provide very useful suggestions and advice in the recruiting process, helping to make sure that no good candidates are overlooked. If elected, I will work to maintain the high quality of the journals and their editorial committees.

Benson S. Farb



Professor of Mathematics, University of Chicago.

Born: October 25, 1967.

Ph.D.: Princeton University, 1994.

Selected Addresses: Cornell Topology Festival, May 1995; International Conference on Non-positive Curvature in Group Theory, Topology and Geometry, Vanderbilt, May 1998; Borel (“Swiss”) Seminar (3-lecture series), Neuchatel, June 2000; Groups and Low-Dimensional Topology (3-lecture minicourse),

CRM, Montreal, July 2000; AMS Invited Address, Toronto, September 2000.

Additional Information: Editorial Boards/Service: Managing Editor (with R. Zimmer), *Geometriae Dedicata*; Editorial Board, Chicago Lectures in Mathematics Series, University of Chicago Press; Coorganizer: Geometric and Topological Aspects of Group Theory, MSRI, May 2000. **Selected Awards:** NSF CAREER Award, 2000–2005; Alfred P. Sloan Foundation Fellowship, 1999–2001.

Selected Publications: 1. with R. Dennis, *Noncommutative Algebra*, Grad. Texts in Math., vol. 144, Springer-Verlag, New York, 1993. MR **94j**:16001; 2. with A. Eskin, Quasi-flats and rigidity in higher rank symmetric spaces, *J. Amer. Math. Soc.* **10** (1997), 653–692. MR **98e**:22007; 3. with L. Mosher, Quasi-isometric rigidity for the solvable Baumslag-Solitar groups. II, *Invent. Math.* **137** (1999), 613–649; I, *Invent. Math.* **131** (1998), 419–451. MR **99b**:57003; 4. with P. Shalen, Real-analytic actions of lattices, *Invent. Math.* **135** (1999), 273–296. MR **2000c**:22017; 5. with L. Mosher, On the asymptotic geometry of abelian-by-cyclic groups, *Acta Math.* **184** (2000), 145–202. MR **2001e**:20035.

Robert Friedman

Professor of Mathematics, Columbia University.

Born: April 15, 1955, Boston, Massachusetts.

Ph.D.: Harvard University, 1981.

Selected Addresses: Clifford Lectures, Tulane University, New Orleans, 2000.

Selected Publications: 1. Global smoothings of varieties with normal crossings, *Ann. of Math.* **118** (1983), 75–114.

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From the AMS-Election Special Section

MR 85g:32029; 2. with J. Morgan, *Smooth Four-Manifolds and Complex Surfaces*, *Ergeb. Math. Grenzgeb.* 3, vol. 27, Springer-Verlag, Berlin-Heidelberg-New York, 1994. MR 95m:57046; 3. with Z. Qin, On complex surfaces diffeomorphic to rational surfaces, *Invent. Math.* 120 (1995), 81-117. MR 96d:57032; 4. with J. Morgan and E. Witten, Principal G -bundles over elliptic curves, *Math. Res. Lett.* 5 (1998), 97-118. MR 99j:14037; 5. with J. Morgan and E. Witten, Vector bundles over elliptic fibrations, *J. Algebraic Geom.* 8 (1999), 279-401. MR 2000b:14053.

Svetlana Jitomirskaya



Professor of Mathematics, University of California, Irvine.

Born: June 4, 1966, Kharkov, Ukraine.

Ph.D.: Moscow State University, 1991.

Selected Addresses: XI International Congress of Mathematical Physics, Paris, July 1994; Plenary Address, International Conference on Differential Equations and Mathematical Physics, GATECH, Atlanta, March 1997; AMS Invited

Address, Santa Barbara, March 2000; XIII International Congress of Mathematical Physics, London, July 2000; Invited Address, International Congress of Mathematicians, Beijing, 2002.

Selected Publications: 1. with B. Simon, Operators with singular continuous spectrum. III. Almost periodic Schrödinger operators, *Comm. Math. Phys.* 165 (1994), 201-205. MR 97a:47003; 2. Anderson localization for the almost Mathieu equation: A nonperturbative proof, *Comm. Math. Phys.* 165 (1994), 49-57. MR 95i:81045; 3. with A. Gordon, Y. Last, and B. Simon, Duality and singular continuous spectrum in the almost Mathieu equation, *Acta Math.* 178 (1997), 169-183. MR 98f:47041; 4. with Y. Last, Power-law subordinacy and singular spectra. I. Half-line operators, *Acta Math.* 183 (1999), 171-189. MR 2001a:47033; 5. Metal-insulator transition for the almost Mathieu operator, *Ann. of Math.* 150 (1999), 1159-1175. MR 2000k:81084.

ASSOCIATE SECRETARY

(Western Section)

Position

The American Mathematical Society is seeking applications and nominations of candidates for the post of Associate Secretary of the Western Section. The section is loosely described as the states and provinces from the Rocky Mountains to the Pacific Ocean. Bernard Russo, the current Associate Secretary there, wishes to step down at the end of his present term.

An Associate Secretary is an officer of the Society and is appointed by the Council to a two-year term, ordinarily beginning on 01 February. In this case the term could begin 01 February 2002 and end 31 January 2004. Reappointments are possible and desirable. All necessary expenses incurred by an Associate Secretary in performance of duties for the Society are reimbursed, including travel and communications.

Duties

The primary responsibility of an Associate Secretary is to oversee scientific meetings of the Society in the section. Once every four years an Associate Secretary has primary responsibility for the Society's program at the January Joint Mathematics Meeting. An Associate Secretary is a member of the Secretariat, a committee consisting of all Associate Secretaries and the Secretary, which approves all applications for membership in the Society and approves all sites and dates of meetings of the Society. Occasionally an Associate Secretary is in charge of an international joint meeting. Associate Secretaries are the principal contact between the Society and its members in the various sections. They are invited to all Council meetings and have a vote on the Council on a rotating basis.

Applications

An Associate Secretary is appointed by the Council upon recommendation by the Executive Committee and Board of Trustees. Applications should be sent to: Robert J. Daverman, Secretary, American Mathematical Society, 312D Ayres Hall, University of Tennessee, Knoxville TN 37996-1330; email: daverman@math.utk.edu.

Applications received by 30 September 2001 will be assured full consideration.

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The AMS, founded in 1888 to further the interests of mathematical research and scholarship, serves the national and international community through its publications, meetings, advocacy, and other programs, which

- promote mathematical research, its communication and uses;
- encourage and promote the transmission of mathematical understanding and skills;
- support mathematical education at all levels;
- advance the status of the profession of mathematics, encouraging and facilitating full participation of all individuals;
- foster an awareness and appreciation of mathematics and its connections to other disciplines and everyday life.

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The Executive Committee and Board of Trustees have established the Thomas S. Fiske Society to honor those who have made provisions for the AMS in their estate plans. For further information contact the Development Office at 800-321-4AMS, or development@ams.org.

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 Dyczyj-Edlinger, Romanus
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 * Hahn, William D.
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 Hawkins, Jane
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 Hayden, Richard G.
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 Hethcote, Herbert W.
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 Hicks, Troy L.
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 Higgins, John A.
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 Hildebrandt, Theodore W.
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 * Hill, E. Stamford, II

Acknowledgment of Contributions

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Hillman, Abraham P.
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- * Hoffmann, Detlev W.
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 * Schwarz, Fritz

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- * Schwarz, Gerald W.
 * Schwarz, Willi
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 * Schweitzer, Eric
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- * Vamanamurthy, Mavina K.
- * Van Assche, Walter
- * Van Bendegem, Jean Paul
- * Van Casteren, Johannes A.
- * Vance, Elbridge P.
- * Van Daalen, Diederik T.
- * Van Daele, Alfons
- * Vandell, Robert C.
- * Van den Bergh, Michel
- * Van der Geer, Gerard
- * Vanderschoot, Mary Helen
- * Van de Wetering, R. Lee
- * Van Duijn, Cornelis J.
- * Van Eck, H. N.
- * Van Keer, Roger
- * Van Osdol, Donovan H.
- * Van Rootselaar, Bob
- * Van Tuyl, A. H.
- * Varberg, Dale E.
- * Vardanega, Pedro Emilio
- * Varino, Francis H.
- * Varnhorn, Werner
- * Vasak, Janet Trzcinski
- * Vasconcelos, Wolmer V.
- * Vassalotti, Alfred G.
- * Vassiliadou, Sophia
- * Vasy, Andras
- * Vaz Pinto, Maria Rasquilha
- * Veith, Christian Paul
- * Velasco Hernandez, Jorge
- * Velazquez, Robert
- * Verduyn Lunel, Sjoerd M.
- * Verger-Gaugry, Jean-Louis
- * Vergne, Michele
- * Verriest, Erik I.
- * Vesentini, Edoardo
- * Vetter, Udo
- * Vinsonbaler, Charles I.
- * Vitale, Richard A.
- * Vogt, Dietmar
- * Vogtmann, Karen
- * Voichick, Michael
- * Voiculescu, Dan
- * Vojta, Paul A.
- * Volkmer, Hans W.
- * Vonatsos, Konstantinos N.
- * Vought, Eldon J.
- * Vrbik, Jan
- * Vybornov, Maxim Y.
- * Wachman, Murray
- * Wada, Hidekazu
- * Wagoner, John B.
- * Wagreich, Philip D.
- * Wahl, Jonathan M.
- * Wainger, Stephen
- * Wainwright, John
- * Wakae, Masami
- * Wakayama, Masato
- * Waldinger, Hermann V.
- * Wales, David B.
- * Walker, Homer F.
- * Walker, Peter Leslie
- * Wallach, Nathan S.
- * Walsler, Hans R.
- * Walsh, John Thomas
- * Walter, John H.
- * Walter, Martin E.
- * Walter, Wolfgang L.
- * WaluŪs, Herwig
- * Wang, Baoxiang
- * Wang, Frank Y. H.
- * Wang, Hsiao-Lan
- * Wang, Paul K. C.
- * Wang, Pei-yong
- * Wangneo, Chaman Lal
- * Wantland, Evelyn K.
- * Wanzong, Robert C.
- * Ward, Kevin M.
- * Ward, Lesley A.
- * Ware, Buck
- * Warner, Seth L.
- * Warnock, Robert L.
- * Warren, Bette L.
- * Washburn, Robert B., Jr.
- * Washburn, Sherwood
- * Wasserman, Arthur G.
- * Watabe, Mutsuo
- * Watanabe, Michiaki
- * Watanabe, Shōji
- * Watanabe, Shuji
- * Watanabe, Takao
- * Watanabe, Toshihiro
- * Watatani, Yasuo
- * Waterhouse, William C.
- * Watkins, David S.
- * Watkins, Mark E.
- * Wauters, Paul
- * Wawrzynczyk, Antoni
- * Waylen, Peter Charles
- * Weatherly, Michael R.
- * Weaver, George E.
- * Webb, David L.
- * Webb, Glenn F.
- * Weber, John William
- * Weber, John William
- * Wechsler, Martin T.
- * Wedel, Arnold M.
- * Wee, In-Suk
- * Wefelmeyer, Wolfgang
- * Wehausen, John V.
- * Wehnen, Joseph A., Jr.
- * Weidner, Anthony A.
- * Weil, Clifford E.
- * Weinberger, Hans F.
- * Weinberger, Peter J.
- * Weiner, Joel L.
- * Weiner, Paul A.
- * Weinstein, Michael I.
- * Weintraub, Alexander H.
- * Weiss, Michael S.
- * Weiss, Norman J.
- * Weiss, Richard M.
- * Weissman, John
- * Welch, Lloyd R.
- * Wellner, Jon A.
- * Wells, David M.
- * Wells, Raymond O., Jr.
- * Welmers, Everett T.
- * Welters, Gerald E.
- * Wend, David V. V.
- * Wendel, James G.
- * Wendland, Wolfgang L.
- * Wene, Gregory P.
- * Wente, Henry C.
- * Werly, Aric J.
- * Werner, Dirk
- * Werner, Elisabeth
- * Werner, Peter
- * Wernick, Robert J.
- * West, James E.
- * Western, D. W.
- * Westheimer, Ellen
- * Westphal-Schmidt, U.
- * Wetzel, John E.
- * Wheeler, Robert F.
- * Whitaker, John Joseph
- * White, Alvin M.
- * White, Arthur T.
- * White, Brian Cabell
- * White, Denis A.
- * White, Edward C., Jr.
- * White, James V.
- * White, John T.
- * White, Neil L.
- * Whitehead, George W.
- * Whitehead, Kathleen B.
- * Whitfield, John H. M.
- * Whitman, Andrew P.
- * Whitney, D. Ransom
- * Whitt, Lee B.
- * Whittle, Geoffrey Peter
- * Whyburn, Kenneth G.
- * Wickerhauser, Mladen Victor
- * Wickman, Brian Joseph
- * Widom, Harold
- * Wieand, Kelly L.
- * Wiegand, Roger A.
- * Wiegand, Sylvia Margaret
- * Wiegmann, Klaus Werner
- * Wiesenberger, Agnes Arvai
- * Wiggins, Stephen R.
- * Wightman, Arthur S.
- * Wihstutz, Volker
- * Wik, Anders
- * Wilcox, Theodore W.
- * Wilkins, J. Ernest, Jr.
- * Wilkinson, Jennifer S.
- * Wilkinson, John F.
- * Willcox, Alfred B.
- * Williams, David A.
- * Williams, David E.
- * Williams, Lawrence R.
- * Williams, Susan Gayle
- * Williamson, Charles K.
- * Williamson, Richard E.
- * Williamson, Susan
- * Willis, Paul A.
- * Wills, Michael D.
- * Wilmshurst, Alan Stephen
- * Wilson, Leslie Charles
- * Wilson, Richard
- * Wilson, Robert L.
- * Wilson, Robert Lee
- * Wilson, Robert S.
- * Wilton, Melissa M.
- * Wimbush, George Washington
- * Wingate, Beth A.
- * Wingate, John W.
- * Winkler, Eric J.
- * Winters, Harry J., Jr.
- * Wintrobe, F.
- * Wirszup, Izaak
- * Wiskott, Bettina
- * Wissner, Heinz-Wolfgang
- * Witherspoon, Sarah J.
- * Witsch, K. J.
- * Witsenhausen, Hans S.
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- * Witten, Louis
- * Wittenberg, Ralf
- * Woepffel, James J.
- * Wolfe, Dorothy W.
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- * Wolfmann, Jacques
- * Wolk, Elliot S.
- * Wollman, Stephen
- * Wolpert, Scott A.
- * Wong, James S. W.
- * Wong, Po Kee
- * Woo, Sung-Sik
- * Wood, Alastair D.
- * Wood, Jay A.
- * Wood, John W.
- * Woodbury, Max A.
- * Woodrow, George V., III
- * Woodrow, Robert Edward
- * Woods, Jerry D.
- * Worner, Tamara S.
- * Wouk, Arthur
- * Wrana, Bogumil
- * Wright, Charles R. B.
- * Wright, David G.
- * Wright, David J.
- * Wright, Mary H.
- * Wright, Weldon W.
- * Wu, T. C.
- * Wyman, Bostwick F.
- * Wymore, A. Wayne
- * Wyn-Jones, Alun
- * Xenos, Philippos John
- * Xiong, Zhen Xiang
- * Xu, Jia Gu
- * Yaacob, Yusof Bin
- * Yagasaki, Tatsuhiko
- * Yaku, Takeo
- * Yamada, Hiro-Fumi
- * Yamada, Hiromichi
- * Yamada, Miyuki
- * Yamada, Osanobu
- * Yamada, Toshihiko
- * Yamagata, Hideo
- * Yamaguti, Kiyosi
- * Yamakawa, Mineo
- * Yamashita, Michinori
- * Yamashita, Yasushi
- * Yamazaki, Masao
- * Yang, Gan-Shang
- * Yanowitch, Michael
- * Yaqub, Fawzi M.
- * Yaqub, Jill S.
- * Yarmush, David L.
- * Yasugi, Mariko
- * Yasuhara, Mitsuru
- * Yau, Shing-Tung
- * Yeager, Joseph E.
- * Yebra, Jose Luis Andres
- * Yen, David H. Y.
- * Yilmaz, Murteza
- * Yohe, J. Michael
- * Yokota, Hisashi
- * Yomdin, Yosef N.
- * Yong, Chi Hsing
- * Yood, Bertram
- * Yoshihara, Ken-Ichi
- * Yoshioka, Akira
- * Young, Donald F.
- * Young, Paul M.
- * Youree, Roger Kent
- * Yu, Lucille Chieh
- * Yui, Noriko
- * Zafrullah, Muhammad
- * Zahn, Charles T.
- * Zak Benbury, K. E.
- * Zakharevich, Michael
- * Zakharov, V. E.
- * Zalar, Borut
- * Zama, Nobuo
- * Zambrini, Jean-Claude
- * Zanolin, Fabio
- * Zapf, Hermann
- * Zara, François
- * Zarea, Stefan
- * Zaslavsky, Thomas
- * Zedek, Mishael
- * Zehnder, Eduard J.
- * Zeidler, Eberhard
- * Zelinsky, David S.
- * Zeller, Karl
- * Zhang, Jin Hao
- * Zhang, Yong
- * Zia, Lee L.
- * Ziebarth, Jennifer Joy
- * Ziegler, Zvi
- * Zierler, Neal
- * Zinterhof, Peter
- * Ziolkowski, Mariusz
- * Zirilli, Francesco
- * Zitarelli, David E.
- * Zó, Felipe
- * Zomorrodian, Reza
- * Zsidó, László
- * Zucker, Steven M.
- * Zuckerman, Gregg J.
- * Zuidwijk, Rob A.
- * Zweibel, John A.
- * Zweifel, Paul F.
- * Anonymous (174)

CONTRIBUTORS

- * Alexander, Daniel S.
- * Alspach, Dale E.
- * Chang, Weita
- * Cheeger, Jeff
- * Dayton, Barry H.
- * Elia, Michele
- * Estrada, Luis
- * Feingold, Alex J.
- * Foth, Philip A.
- * Friedberg, Stephen H.
- * Gerig, Stephen R.
- * Goldstine, Susan W.
- * Hanna, J. Ray
- * Hannon, Joseph A.
- * Hogesteeger, F. W.
- * Holberton, John V.
- * Hunt, Bruce
- * Johnson, D. Randolph
- * Johnson, Dale Martin
- * Johnson, Theodore D.
- * Katsuda, Atsushi
- * Kavanagh, John P.
- * Keen, Linda
- * Knight, Frank B.
- * Koelzer, John G., III
- * Komatsu, K.
- * Korchmaros, Gabor
- * Kraines, David P.
- * Lanza de Cristoforis, M.I.
- * Lavalee, Lorraine D.
- * Lee, John M.
- * Lepowsky, James I.
- * Liddell, Gerrard F.
- * Lubin, Jonathan D.
- * Mayberry, John P.
- * McNinch, George Joseph
- * Mullin, Albert A.
- * Natarov, Andrei A.
- * O'Leary, Michael L.
- * O'Shea, Donal B.
- * Ozeki, Michio
- * Paciorek, Joseph W.
- * Pustlinik, Seymour W.
- * Reznikoff, Jegor
- * Robinson, Mark Preuss
- * Sahab, Salem A.
- * Sakai, Makoto
- * Santos, Pedro Ferreira
- * Schillo, Paul J.
- * Schweitzer, Paul A.
- * Sée, Richard
- * Sinai, Iakov G.
- * Slowikowski, Wojciech
- * Sniatycki, Jędrzej
- * Stasheff, James
- * Strelbel, Ralph
- * Taber, Christopher Scott
- * Tsoularis, Anastasios
- * Wellinger, David
- * Zacharia, Dan
- * Anonymous (21)



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The Americas

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Asia

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The Korean Mathematical Society

Apply to: Ms. Jung Suk Chung, The Korean Mathematical Society, Korea Science and Technology Center 214,

635-4 Yeoksam-dong, Kangnam-ku, Seoul 135-703, Korea; e-mail: kms@kms.or.kr; http://www.kms.or.kr/.

Dues: U.S. \$40, payable to The Korean Mathematical Society.

Privileges: Members will receive six volumes of *Journal of the KMS* and four volumes of *Bulletin of the KMS*.

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Dues: Category I: 9,000 yen; Category II: 10,800 yen, payable to Mathematical Society of Japan at the above address.

Privileges: Category I: *Journal of the Mathematical Society of Japan*, *Sugaku-Tsusin* (2 issues); Category II: *Journal of the Mathematical Society of Japan*, *Sugaku* (in Japanese), *Sugaku-Tsushin* (4 issues).

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Privileges: Publications and newsletter of the Mathematical Society of the Philippines.

Officers: Jose Marasigan (President), Rene P. Felix (Vice-President), Aurora Trance (Treasurer), Rolando Ramos (Secretary).

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Address for mail: National Chiao Tung University, Department of Applied Mathematics, Hsin-Chu 300, Taiwan, Republic of China; e-mail: mathsoc@math.nctu.edu.tw; http://www.math.nctu.edu.tw/~mathsoc/.

Apply to: Tsang-Hai Kuo at the above address.

Dues: U.S. \$45, payable to Hung-Lin Fu at the above address.

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Apply to: R. Enhbat, Secretary, Mongolian Mathematical Society, P. O. Box 46/635, Ulaanbaatar, Mongolia.

Dues: U.S. \$20, payable to R. Enhbat at the above address.

Privileges: Right to receive the *Journal of MMS* for free and to publish in *Journal of MMS*, participate in activities of MMS.

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Dues: U.S. \$20, payable to P. M. Bajracharya (Treasurer), Nepal Mathematical Society, at the address above.

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Address for mail: Pusat Pengajian Sains Matematik, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia; e-mail: maslina@pkriscc.ck.ukm.my.

Apply to: Dr. Maslina at the above address.

Dues: U.S. \$7.50, payable to Bendahari, PERSAMA, at the above address.

Privileges: *Warkah Berita PERSAMA* (two issues per year), *Bulletin of the Malaysian Mathematical Society* (two issues per year), *Menemui Matematik* (two issues per year).

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Punjab Mathematical Society*

Address for mail: Department of Mathematics, University of the Punjab, Quaid-i-Azam Campus, Lahore, Pakistan; e-mail: mathdept@paknet.ptc.pk.

Apply to: Zia ul Haq, Secretary, Punjab Mathematical Society, Department of Maths., University of the Punjab, Lahore, Pakistan.

Dues: U.S. \$30 for life membership, payable to Umar Farooq Qureshi, Treasurer, P.M.S.

Officers: G. Mustafa Habibullah (President), Zia Ullah Randhawa and Munir Ahmad Ch. (Vice-Presidents), Umar Farooq Qureshi (Treasurer), Nawazish Ali Shah (Secretary).

Ramanujan Mathematical Society

Address for mail: Ramanujan Institute for Advanced Study in Mathematics, University of Madras, Chennai-600005, India; e-mail: riasm@smi.ernet.in.

Apply to: Professor V. Thangaraj, Secretary, at the above address; e-mail: thangarajv@yahoo.com; http://rms.enmail.com/.

Dues: U.S. \$20 (annual), U.S. \$200 (life), payable to Professor V. Thangaraj at the above address.

Privileges: Complimentary copy of the *Journal of the Ramanujan Mathematical Society* and newsletter.

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Apply to: Secretary, Singapore Mathematical Society, c/o Department of Mathematics, National University of Singapore, 2 Science Drive 2, Singapore 117543, Singapore.

Dues: 10 Singapore dollars, payable to The Honorary Treasurer, Singapore Mathematical Society, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260, Singapore.

Privileges: Complimentary copy of *Mathematical Medley*, the Society's official magazine, and discounts on the Society's publications and activities.

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Apply to: Southeast Asian Mathematical Society, c/o Department of Mathematics, Chinese University of Hong Kong, Shatin, N.T., Hong Kong.

Dues: U.S. \$10, payable to Southeast Asian Mathematical Society.

Privileges: *SEAMS Newsletter*, *Southeast Asian Bulletin of Mathematics*.

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Apply to: H. M. Srivastava, Foreign Secretary, VPI, Department of Mathematics, University of Victoria, Victoria, British Columbia, V8W 2Y2 Canada; or R. C. Singh Chandel, Secretary, VPI, Department of Mathematics, D. V. Postgraduate College, Orai-285001, U.P., India.

Dues: U.S. \$10, payable to Vijnana Parishad of India, c/o Department of Mathematics, D. V. Postgraduate College, Orai-285001, U.P., India.

Privileges: *Jñānābha* (an interdisciplinary mathematical journal currently published once a year), back volumes available at 25% discount.

Officers: J. N. Kapur (President); G. S. Niranjana, G. C. Sharma, M. K. Singal (Vice-Presidents); R. C. Singh Chandel (Secretary-Treasurer).

Europe

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Apply to: A. Ali Novruzov, Department of Mechanics and Mathematics, Baku State University, Baku, Azerbaijan, 370145.

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Privileges: All privileges of ordinary members plus 50% discount on all AzMS publications.

Officers: O. A. Veliev (President), F. A. Abdullaev (Treasurer), V. A. Gasimov (Secretary).

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Dues: U.S. \$30 (except persons of countries with financial difficulties, U.S. \$10), payable to the Balkan Society of Geometers.

Privileges: Participation in meetings and all other privileges enjoyed by an ordinary member, discounts (at least 10%) on the prices of BSG publications.

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Belgian Mathematical Society*

Apply to: Jules Leroy, Secretary, C.P. 218/01, Campus Plaine, Bd du Triomphe, 1050 Bruxelles, Belgium; e-mail: LEROY@ULB.AC.BE; <http://www.ulb.ac.be/assoc/bms/>.

Dues: 500 Bef (around U.S. \$15), payable to Belgian Mathematical Society, preferably by International Money Order, VISA, or MasterCard.

Privileges: A free subscription to: *Bulletin of the Belgian Mathematical Society-Simon Stevin* (four issues per year), newsletter.

Officers: Jean Schmets (President), Adhemar Bultheel (Vice-President), Stefaan Caenepeel (Treasurer), Jules Leroy (Secretary).

Berliner Mathematische Gesellschaft

Address for mail: I. Math. Inst., FU Berlin, Arnimallee 3, 14195 Berlin, Germany; e-mail: begehr@math-fu-berlin.de.

Apply to: Prof. Dr. Heinrich Begehr at the above address.

Dues: DM 12, payable to Prof. Dr. Günter Ziegler, FB Mathematik, TU Berlin, Strasse des 17. Juni 136, 10623 Berlin, Germany.

Privileges: One free copy of *Sitzungsberichte der BMG*.

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Croatian Mathematical Society*

Address for mail: Bijenička 30, 10000 Zagreb, Croatia; e-mail: hmd@cromath.math.hr.

Apply to: Renata Svedrec at the above address.

Dues: U.S. \$10, payable to HMD, Zagrebačka banka d.d. Zagreb, HR 2x, 30101-620-16-25731-3688780.

Privileges: *Vjesnik HMD* (in Croatian) plus one of four journals edited by CMS free of charge. All publications of the CMS and all fees reduced by at least 25%.

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Address for mail: 36 Stasinou Street, Suite 102, Strovolos 2003, Nicosia, Cyprus; e-mail: cms@cyearn.pi.ac.cy.

Apply to: Gregory Makrides, 36 Stasinou Str. Suite 102, Strovolos 2003, Nicosia, Cyprus.

Dues: U.S. \$20, payable to Cyprus Mathematical Society at the above address.

Privileges: Receive the annual periodical *Mathematiko VEMA* in Greek. Invitations to conferences organized in Cyprus, invitations to Annual Summer Math School organized in Cyprus at the end of June.

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Address for mail: Department of Mathematics, Building 303, Technical University of Denmark, DK-2800 Lyngby, Denmark; e-mail: dmf@mathematics.dk; <http://www.dmf.mathematics.dk/>.

Apply to: Please use the electronic form on the home page at <http://www.dmf.mathematics.dk/>.

Dues: DKr. 150, payable to Viggo Andreasen, Treasurer, Dept. of Mathematics, Roskilde University, DK-4000 Roskilde, Denmark.

Privileges: *Mathematica Scandinavica* (DKr. 290 per volume), *Nord. Mat. Tidss. (Normat)* (Nkr. 260 per volume). (Members of the American Mathematical Society do not have to join Dansk Matematisk Forening to obtain the journals. Subscription orders should be sent directly to the journals: *Normat*, Universitetsforlaget, Avd. for tidsskrifter, Postbox 2959 Tøyen, Oslo 6, Norway; *Mathematica Scandinavica*, Matematisk Institut, Aarhus Universitet, 8000 Aarhus C, Denmark.) Members of the American Mathematical Society who join the Dansk Mathematical Society as reciprocity members will receive the newsletter *Matilde*.

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Dues: DM 30, payable to Volksbank Freiburg 6955002 (BLZ 680 900 00).

Privileges: *Mitteilungen der Deutschen Mathematiker-Vereinigung* and one of three publications: *Jahresbericht*

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Apply to: Dr. A. D. Gilbert, Honorary Secretary, Edinburgh Mathematical Society, James Clerk Maxwell Building, King's Buildings, Mayfield Road, Edinburgh EH9 3JZ, Scotland; e-mail: edmathsoc@maths.ed.ac.uk; <http://www.maths.ed.ac.uk/~edmathsoc/>.

Dues: U.S. \$12 (preferably £6 sterling) without Society's proceedings, U.S. \$32 (£16 sterling) with Society's proceedings, payable to the Honorary Secretary, as above.

Privileges: Proceedings are available at a concessionary rate; see above.

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Address for mail: Department of Mathematics, University of Helsinki, P. O. Box 4, FIN-00014 Helsinki, Finland; e-mail: tuulikki.makelainen@helsinki.fi; <http://www.emis.de/>.

Apply to: Tuulikki Mäkeläinen at the above address.

Dues: 30 euros payable to the European Mathematical Society.

Privileges: All privileges of a normal individual EMS member.

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Address for mail: V. Ulbricht, Institut für Festkörpermechanik, Technische Universität Dresden, D-01062 Dresden, Germany; e-mail: ulbricht@mfrks1.mw.tu-dresden.de.

Apply to: L. Gaul, Institut A für Mechanik, Universität Stuttgart, Pfaffenwaldring 9, D-70550 Stuttgart, Germany.

Dues: DM 100, payable to A. Frommer, Fachbereich 7-Mathematik, Universität-GH Wuppertal, Gausstrasse 20, D-42097, Wuppertal, Germany.

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Apply to: F. H. Goldman, Treasurer, Glasgow Mathematical Association, Department of Mathematics, University

of Glasgow, 15 University Gardens, Glasgow G12 8QW, Scotland; e-mail: fhg@maths.gla.ac.uk; <http://www.maths.gla.ac.uk/links/gma/>.

Dues: £7, payable to Glasgow Mathematical Association.

Privileges: *Glasgow Mathematical Journal* at reduced rate (£40).

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Apply to: Hellenic Mathematical Society, 34, Panepistimiou Street, 10679 Athens, Greece; e-mail: info@hms.gr; <http://www.hms.gr/>.

Dues: U.S. \$20 payable to Hellenic Mathematical Society at the above address.

Privileges: The *Bulletin of HMS*, News-Bulletin (Enimerosi), discounts that are available to all members.

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Address for mail: Icelandic Mathematical Society, Raunvisindastofnun Haskolans, Dunhaga 3, IS-107 Reykjavik, Iceland; e-mail: benedikt@talnakonnun.is; <http://www.raunvis.hi.is/is/>.

Apply to: Dr. Benedikt Johannesson at the above address.

Dues: U.S. \$10, payable to Dr. Geir Agnarsson at the above address.

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Address for mail: The Secretary of the IMS, c/o Department of Mathematics, University College Dublin, Belfield, Dublin 4, Ireland; e-mail: russell.higgs@ucd.ie; <http://www.maths.tcd.ie/pub/ims/>.

Apply to: Kevin Hutchinson, Treasurer, at the above address.

Dues: U.S. \$10, payable to K. Hutchinson, Treasurer, IMS, at the above address.

Privileges: Free copy of the *Bulletin of the Irish Mathematical Society* (two times per year), free registration at IMS annual conference (September).

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Dues: Are voluntary but should minimally cover duplication and mailing costs; for reciprocity members (residing outside Hungary) suggested fee is 1/8 of 1% of the member's net income, payable to ABN AMRO Bank, Account Number 10200830-32310243. Sponsoring members pay at least U.S. \$180 or equivalent per year.

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Address for mail: Union of Czech Mathematicians and Physicists, Žitná 25, 117 10 Praha 1, Czech Republic; e-mail: jcmf@math.cas.cz.

Apply to: Jiří Rákosník at the above address.

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Address for mail: Secretary of JSMF, MFF UK Pavilon F1, Mlynská dolina, 842 48 Bratislava, Slovak Republic; e-mail: JSMF@CENTER.FMPH.UNIBA.SK; http://www.uniba.sk/~jsmf/en_jsmf.htm.

Apply to: Hilda Draškovičová, MFF UK, KATC, Mlynská dolina, 842 48 Bratislava, Slovak Republic.

Dues: U.S. \$20, payable to Slovenská sporiteľňa, Záhradnícka 93, 821 08 Bratislava, Slovak Republic; č.u.: 101848-019/0900 IČO: 178705.

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Address for mail: London Mathematical Society, De Morgan House, 57-58 Russell Square, London

WC1B 4HS, United Kingdom; e-mail: lms@lms.ac.uk; <http://www.lms.ac.uk/>.

Apply to: Miss Susan M. Oakes at the address above.

Dues: £11.25 (U.S. \$22.50) payable to London Mathematical Society.

Privileges: *LMS Newsletter*; reduced rates for the *Bulletin, Journal, and Proceedings of the LMS; Nonlinearity; Journal of Applied Probability; Mathematical Proceedings of the Cambridge Philosophical Society; Quarterly Journal of Mathematics; Glasgow Mathematical Journal; LMS Lecture Notes; LMS Student Texts; LMS Monographs.* (Please write to the LMS for complete details.)

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Dues: U.S. \$12, payable to Beobanka A. D. (Swift Code: BEOBYUBG) Acct. No. 733782, Mathematical Society of Serbia (Društvo Matematicara Srbije) Acct. No. 718000-840-0708491900.

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Apply to: Erik Løw, Norsk Matematisk Forening, at the above address.

Dues: NOK 50, payable to Erik Løw, Norsk Matematisk Forening.

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Apply to: Karl Sigmund, Universität Wien, Institut für Mathematik, Strudlhofgasse 4, A-1090 Wien, Austria.

Dues: ATS 250, payable to ÖMG (PSK acct. nr. 7823.950), Karlsplatz 13, A-1040 Wien, Austria.

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Address for mail: Facultad de Matematicas, Universidad Complutense de Madrid, 28040 Madrid, Spain; e-mail: rsme@mat.ucm.es; <http://www.mat.ucm.es/rsme/>.

Apply to: Sr. Secretario de la RSME at the above address.

Dues: 20 euros, payable to Real Sociedad Matemática Española at the above address.

Privileges: *La Gaceta de la Real Sociedad Matemática Española*.

Officers: Carlos Andradas (President), Jesús Sanz Serna (Vice-President), Alberto Ibort (Treasurer), Patricio Cifuentes (Secretary).

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Apply to: Juan Luis Vázquez, President, SEMA, Departamento de Matemáticas, Univ. Autónoma de Madrid, Cantoblanco, 28049 Madrid, Spain; e-mail: SEMA@UAM.ES; juanluis.vazquez@uam.es; <http://www.uam.es/sema/>.

Dues: 3500 PTE, payable to Bosco García Archilla, Treasurer, Departamento de Matemáticas, Univ. Autónoma de Madrid, Cantoblanco, 28049 Madrid, Spain.

Privileges: Information concerning applied mathematics in Spain through *Boletín de la SEMA*, free membership list, publications at reduced prices, reduced inscription fee for activities sponsored by SEMA.

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Apply to: Pedro Freitas at the above address.

Dues: PTE 2500 (12.47 euros), payable to Antonieta Horta at the above address.

Privileges: *Boletim da Sociedade Portuguesa de Matemática* (2 issues per year). Additionally, members may subscribe to the following publications at reduced rates: *Portugaliae Mathematica* (4 issues) PTE 6300 (31.42 euros) and *Gazeta de Matemática* (2 issues) PTE 600 (2.99 euros).

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Address for mail: Carrer del Carme 47, 08001 Barcelona, Spain; e-mail: scm@iec.es; <http://www.iec.es/scm/>.

Apply to: Secretary, Catalan Mathematical Society, at the address above.

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Privileges: *Butlletí de la Societat Catalana de Matemàtiques* (two times per year) plus *SCM/Notices* (two times per year).

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Apply to: Horia I. Ene, Calea Grivitei 21, P. O. Box 1-764, 70700 Bucharest, Romania.

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Privileges: Reduced rates for participation in scientific conferences organized by SMR, *Bulletin Mathématiques* (four times per year) free.

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Dues: 800 Belgian francs, payable to Société Mathématique du Luxembourg at the above address.

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Address for mail: DMFA, P.P. 2964, 1111 Ljubljana, Slovenia; e-mail: peter.legisa@fmf.uni-lj.si; <http://www.dmfa.si/>.

Apply to: Peter Legiša, FMF, Jadranska 19, P.P. 2964, 1111 Ljubljana, Slovenia.

Dues: U.S. \$30, payable to SKB banka, Ajdovscina 4, 1000 Ljubljana, Slovenia; SKBASI2X, No. 042961.

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Dues: FIM 90, payable to Olof Staffans, Treasurer, at the above address.

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Apply to: Aziz Khanchi at the above address.

Dues: Students: U.S. \$10; Others: U.S. \$20, payable to Iranian Mathematical Society at the above address.

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Apply to: John A. Shanks, Department of Mathematics and Statistics, University of Otago, P. O. Box 56, Dunedin, New Zealand.

Dues: NZ \$16, payable to John A. Shanks, Department of Mathematics and Statistics, University of Otago, P. O. Box 56, Dunedin, New Zealand.

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Mathematics Calendar

The most comprehensive and up-to-date Mathematics Calendar information is available on e-MATH at <http://www.ams.org/mathcal/>.

September 2001

1–6 WSES, IEEE Conference: Speech, Signal and Image Processing 2001 (SSIP 2001), Malta. (June/July 2001, p. 626)

Information: <http://www.worldses.org/wses/conferences/malta/>.

1–6 2001 WSES International Conference on Simulation (SIM'01), Malta. (Feb. 2001, p. 251)

Sponsor: The World Scientific and Engineering Society (WSES); co-sponsored by HIEST (Highest Institute of Education, Science and Technology, Athens, Greece).

Information: For more details visit Web site: <http://www.worldses.org/> or <http://wses.tripod.com/>.

1–6 Number Theory and Arithmetical Geometry—Arithmetic Aspects of Fundamental Groups, Acquafredda di Maratea (near Naples), Italy. (May 2001, p. 530)

Description: The conference will highlight recent progress in understanding arithmetic structures on algebraic fundamental groups of schemes and related topics. It will focus on number-theoretic aspects of the theory of algebraic fundamental groups of schemes, where much progress has been made in recent years. The main themes of the meeting will be: Arithmetic aspects of Galois groups, Algebraic fundamental groups of schemes, Galois action on fundamental groups, The anabelian program, Higher class field theory and generalizations, Motivic Galois groups, Motivic structures on fundamental groups. The conference is open to researchers worldwide, whether from industry or academia. Participation will be limited to 100.

Speakers (provisional): P. Débes (Lille, France), P. Deligne (IAS), I. Efrat (Beersheba, Israel), I. Fesenko (Nottingham, UK), J.-M. Fontaine

This section contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete list of meetings of the Society can be found on the last page of each issue.

An announcement will be published in the *Notices* if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in every third issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

In general, announcements of meetings and conferences held in North America carry only the date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences

(Orsay, France); G. Frey (Essen, Germany); S. Goncharov (Brown, USA), Y. Ihara (RIMS, Japan), U. Jannsen (Regensburg, Germany), P. Lochak (ENS, France), M. Matsumoto (Keio U., Tokyo, Japan), H. Nakamura (Tokyo Metropolitan U., Japan), M. Raynaud (Orsay, France), M. Saïdi (Durham, UK), A. Schmidt (Heidelberg, Germany), L. Schneps (Paris VI, France), M. Spiess (Nottingham, UK), A. Tamagawa (RIMS, Japan), K. Wingberg (Heidelberg, Germany), Z. Wojtkowiak (Nice, France).

Deadline for Applications: May 11, 2001.

Information: <http://www.esf.org/euresco/>.

1–May 31 Institut Mittag-Leffler Call for Proposals, Djursholm, Sweden. (Sept. 2000, p. 979)

Aim: The institute runs programs in specialized areas of mathematics to which leading scientists in the area are invited. In a concurrent junior visiting program, postdocs and advanced graduate students are invited to participate. The programs can run for the whole year or be of semester length.

Criteria: The selection criteria for proposals are scientific strength and timeliness, and the degree to which the program would benefit mathematical research in Scandinavia, including Finland and Iceland. Proposals should contain: a description of the intended area of specialization; the names of the proposed committee; a list of suggested invitees, most of whom should have indicated an interest in the program and a willingness to participate; a description of the Scandinavian connection.

Steering Committee: The scientific programs are led by a steering committee of 2–4 persons which will work closely with the director and which will suggest invitees to the board. It is expected that at least one member of the committee be present at all times during the period of the program.

Information: Proposals should be addressed to The Board, Institut

should be sent to the Editor of the *Notices* in care of the American Mathematical Society in Providence or electronically to notices@ams.org or mathcal@ams.org.

In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence **six months** prior to the scheduled date of the meeting.

The complete listing of the Mathematics Calendar will be published only in the September issue of the *Notices*. The March, June, and December issues will include, along with new announcements, references to any previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.

The Mathematics Calendar, as well as Meetings and Conferences of the AMS, is now available electronically through the AMS website on the World Wide Web. To access the AMS website, use the URL: <http://e-math.ams.org/> (or <http://www.ams.org/>). (For those with VT100-type terminals or for those without WWW browsing software, connect to the AMS website via Telnet ([telnet e-math.ams.org](telnet://e-math.ams.org); login and password e-math) and use the Lynx option from the main menu.)

Mittag-Leffler and sent to: Institut Mittag-Leffler, Auravägen 17, S-182 62 Djursholm, Sweden. The deadline for applications is February 28, 2001. For further information, consult the institute's home page: <http://www.ml.kva.se/>, or contact the director, K.-O. Widman, e-mail: widman@ml.kva.se.

2-8 Optimal Transportation and Applications, Martina Franca (Taranto), Italy. (Apr. 2001, p. 438)

Sponsor: Fondazione C.I.M.E.

Scientific Direction: L. Caffarelli (Univ. of Texas, Austin), e-mail: caffarel@fireant.ma.utexas.edu; S. Salsa (Politecnico di Milano, Italy), e-mail: sansal@mate.polimi.it.

Courses: The Monge Ampere Equation, Optimal Transportation and Periodic Media (6 lectures), L. Caffarelli (Univ. of Texas, Austin), e-mail: caffarel@fireant.ma.utexas.edu; To be announced (6 lectures), L. C. Evans (Univ. of California, Berkeley), e-mail: evans@math.berkeley.edu; Shape Optimization Problems through Monge-Kantorovich Equation (4 lectures), G. Buttazzo (Univ. di Pisa), e-mail: buttazzo@dm.unipi.it; Geometric PDEs Related to Fluids and Plasmas (4 lectures), Y. Brenier (LAN-UPMC, Paris VI), e-mail: brenier@dm.ens.fr; Mass Transportation Tools for Dissipative PDEs (4 lectures), C. Villani, e-mail: villani@brahma.ticam.utexas.edu.

Information: <http://www.math.unifi.it/~cime/>.

3-7 School on Foundational Theories in Mathematics, Faculty of Science, Povo (Trento), Italy. (Aug. 2001, p. 749)

Scientific Organizers: S. Baratella (Trento) and G. Sommaruga (Freiburg).

Lectures: J. L. Bell (Western Ontario), "Set Theory" and "Synthesis"; I. Moerdijk (Utrecht), "Topos Theory"; G. Sambin (Padova), "Constructive Type Theory".

Deadline for Applications: July 31, 2001.

Information: A. Micheletti, Secretary of CIRM, Centro Internazionale per la Ricerca Matematica, Istituto Trentino di Cultura, 38050 Povo (Trento), Italy; tel: +39-0461-881628; telefax: +39-0461-810629; e-mail: michelet@science.unitn.it; <http://www.science.unitn.it/cirm/>.

3-7 Workshop on Foundational Theories in Mathematics, Department of Mathematics, University of Trento, Italy. (June/July 2001, p. 627)

Organizers: S. Baratella (Trento), G. Sommaruga (Freiburg).

Topic: The aim of the workshop is to present three different theories for the foundations of mathematics and to discuss their specific strengths, their mutual relationships, the extent to which they are comparable, and the open problems to be tackled in order to gain an even deeper understanding of the philosophical and technical interrelations between the various theories as potential foundations of mathematics.

Program and Speakers: There will be four series of lectures on: Set Theory, J. L. Bell (Univ. of Western Ontario); Topos Theory, I. Moerdijk (Univ. of Utrecht); Constructive Type Theory, G. Sambin (Univ. of Padua); and Synthesis, J. L. Bell. The intended audience for this workshop is mathematicians, philosophers, and computer scientists with a solid background in logic but who will not be expected to have a background in all three foundational theories mentioned above.

Deadline: July 31, 2001. No registration fee.

Information: Visit <http://www.science.unitn.it/~baratell/ftm.html>.

3-8 The Sixth International Conference on Function Spaces, Institute of Mathematics, Wrocław University of Technology, Wrocław, Poland. (Mar. 2001, p. 337)

Organizer: Institute of Mathematics, Wrocław Univ. of Technology.

Organizing Committee: M. Burnecki (secretary), R. Grzaslewicz (chair), H. Hudzik, J. Musielak, Cz. Ryll-Nardzewski.

Program: The topics are connected with functional analysis, e.g., operator theory, interpolation, geometry, topology, approximation in function spaces. There will be plenary lectures (about 45 min.) and short communications (not more than 20 min.).

Information: <http://www.im.pwr.wroc.pl/~fsp/>.

3-14 EuroWorkshop: Discrete Systems and Integrability, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK. (Jun/Jul 2001, p. 627)

Organizers: F. W. Nijhoff, J. Hietarinta, P. M. Santini.

Topics: Partial difference equations, ordinary difference equations, integrable dynamical mappings, discrete Painlevé equations, quantum systems on the lattice, cellular automata, special functions and orthogonal polynomials, and applications. The purpose of the workshop is to provide a platform for presenting state-of-the-art results as well as to critically discuss open problems in the subject area.

Expected Speakers: V. Adler (Inst. of Math., Ufa), P. Clarkson (Univ. of Kent, Canterbury), R. Conte (Saclay), A. Doliwa (Warsaw Univ.), P. Hydon (Univ. of Surrey), N. Joshi (Univ. of Adelaide), K. Kajiwara (Doshisha Univ.), M. Kruskal (Rutgers Univ.), M. Noumi (Kobe Univ.), A. Ramani (École Polytech., France), S. Ruijsenaars (Amsterdam), J. Sanders (Free Univ., Amsterdam), J. Satsuma (Univ. of Tokyo), A. Shabat (Landau Inst.), V. Sokolov (Landau Inst.), C. Viallet (Univ. Paris VI).

Support: The EuroWorkshop is supported by the European Community, and funding is available to support a limited number of young (under 35 years of age) researchers and overseas senior researchers who are nationals of EC Member States or of the Associated States (Iceland, Liechtenstein, Norway, Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Israel, Switzerland). Self-supporting participants of any age and nationality are welcome to apply.

Information: Visit the Web site <http://www.newton.cam.ac.uk/programs/ITS/itsw03.html>. Alternatively, information can be obtained from F. W. Nijhoff (frank@amsta.leeds.ac.uk).

3-21 School on Control Theory, Trieste, Italy. (Jan. 2001, p. 54)

Sponsors: Abdus Salam International Centre for Theoretical Physics.

Directors: A. Agrachev (SISSA, Trieste, and Steklov Math. Inst., Moscow, Russia), C. Lobry (CIMPA, Nice, France).

Deadline: March 31, 2001.

Information: Further details available by e-mail from smr1327@ictp.trieste.it.

3-21 Higher-Dimensional Varieties and Rational Points, Hungarian Academy of Sciences, Budapest, Hungary. (Mar. 2001, p. 337)

Cochairs: J.-L. Colliot-Thélène (Orsay) and J. Kollár (Princeton).

Local Organizers: K. Böröczky Jr. and T. Szamuely (Budapest).

Aim and Scope: The program is organized in order to encourage collaboration between specialists in higher-dimensional complex geometry and those studying arithmetic/diophantine questions. In recent years it has become apparent that the powerful geometric tools elaborated in connection with Mori's Minimal Model Program have applications over arithmetic ground fields as well. We hope that bringing together experts and graduate students specializing in higher-dimensional geometry or arithmetic will induce further cross-fertilization between the two fields and give rise to new powerful results. The main areas of research to be touched upon are: classification and minimal models of varieties, rationally connected varieties, rational and integral points, fundamental groups, and Galois groups.

Program: (1) During the first week (3-7 September) an instructional conference will take place featuring 6 speakers. Each of them will give a minicourse of 3 one-hour lectures. Roughly half of the courses will focus on geometric topics and the other half on arithmetic topics. They are intended to be accessible to graduate students and the other half to specialists. (2) The other two weeks (10-21 September) will be mainly devoted to research work of participants and informal discussions. There will also be a regular seminar featuring lectures on recent results by participants. The program will be elaborated in situ in order to be as up-to-date as possible. Tutorial sessions for graduate students are also planned.

Speakers: J.-L. Colliot-Thélène (Univ. de Paris-Sud), O. Debarre (IRMA, Strasbourg), B. Hassett (Rice Univ., Houston), J. Kollár

(Princeton Univ.), S. Kovács (Univ. of Washington, Seattle), E. Peyre (Institut Fourier, Grenoble).

Contact: arithgeo@renyi.hu.

Information: <http://www.renyi.hu/~arithgeo/homepage.html>.

4-7 **ECCOMAS 2001**, Swansea, UK. (Sept. 2000, p. 980)

Information: Pamela Bye, Conference Officer, The Institute of Mathematics and Its Applications, Catherine Richards House, 16 Nelson Street, Southend-on-Sea, Essex, SS1 1EF; tel: (01702) 354020; fax: (01702) 354111; e-mail: conferences@ima.org.uk; Web: <http://www.ima.org.uk/>.

6-8 **Current Geometry 2001**, Istituto Italiano di Studi Filosofici, Napoli, Italy. (Aug. 2001, p. 749)

Aim: To establish a periodic update about advances in both Italian and international geometry and their interactions with different areas, especially in theoretical physics.

Preliminary List of Speakers: F. Baldassarri, A. Bobenko, J.P. Bourguignon, F. Catanese, A. Corti (to be confirmed), R. Donagi, C. De Concini, B. Dubrovin (to be confirmed), K. Fukaya, L. Götsche, M. Kontsevich, J. Krasilshchik, Y. Manin (to be confirmed), A. Verra, O. Viro.

Information: A. M. Vinogradov, Università di Salerno, Dipartimento di Matematica e Informatica, Via S. Allende, 84081 Baronissi (Salerno); e-mail: curgeo@diffiety.ac.ru; fax: (+39) 089965226; tel: (+39) 089965395; Web: <http://diffiety.ac.ru/conf/curgeo01/index.html>.

9-13 **4th Dublin Differential Equations Conference**, Dublin City University, Dublin, Ireland. (Mar. 2001, p. 337)

Topics: The conference covers the theory, applications, and numerical solution of differential equations, and the interplay between these.

Principal Speakers: C. Budd (Bath), E. Delabaere (Angers), O. Diekmann (Utrecht), P. Glendinning (Manchester), S. Howison (Oxford), A. Il'in (Ekaterinburg), M. Lavrentiev (Novosibirsk), J. Ockendon (Oxford), R. O'Malley (Washington), G. Shishkin (Ekaterinburg).

Program: In addition to lectures from the invited speakers, other participants may give shorter contributed talks.

Information: <http://www.deconf.dcu.ie/> or Jürgen Burzlaff@dcu.ie.

9-15 **Multiscale Problems and Methods in Numerical Simulation**, Martina Franca (Taranto), Italy. (Apr. 2001, p. 438)

Sponsor: Fondazione C.I.M.E.

Scientific Direction: C. Canuto (Politecnico di Torino, Italy), e-mail: ccanuto@polito.it.

Courses: Multilevel Methods in Finite Elements (6 lectures), J. H. Bramble (Texas A&M Univ.); Nonlinear Approximation and Applications (6 lectures), A. Cohen (Univ. Pierre et Marie Curie Paris VI); Wavelet Methods for Operator Equations (6 lectures), W. Dahmen (Institut für Geometrie und Praktische Mathematik, RWTH Aachen); Variational Multiscale Methods, Physical Models and Numerical Methods (6 lectures), T. J. R. Hughes (Stanford Univ.).

Information: <http://www.math.unifi.it/~cime/>.

10-14 **3rd IMACS Seminar on Monte Carlo Methods MCM2001**, Salzburg University, Austria. (Nov. 2000, p. 1298)

Scope: The purpose of this conference (which is the third in a series, the previous ones being held in Bruxelles and Varna) is to provide a forum for the presentation of recent advances in the analysis, implementation, and applications of Monte Carlo simulation techniques and, in particular, to stimulate the exchange of information between specialists in these areas.

Deadlines: April 27, 2001: Deadline for submission of extended abstracts (1,000 words); June 15, 2001: Notification of acceptance/rejection; Sept. 10-14, 2001: Conference; Oct. 26, 2001: Deadline for submission of full papers for conference proceedings (intended to be published as special issue of the IMACS journal *Mathematics and Computers in Simulation*).

Information: <http://mcm2001.sbg.ac.at/>, or to be on the mailing list and get further information, please send an e-mail message to mcm2001@cosy.sbg.ac.at.

10-14 **Workshop on Coding and Cryptography**, Institute for Mathematical Sciences, National University of Singapore, Singapore. (May 2001, p. 530)

Organizing Committee: S.-P. Chan (Singapore), R. Deng (Singapore), S. Ling (Singapore), H. Niederreiter (Singapore, chair), E. Okamoto (Japan), I. E. Shparlinski (Australia), N. J. A. Sloane (USA), C. P. Xing (Singapore).

Description: The workshop is part of the inaugural program of the Institute for Mathematical Sciences on coding theory and data integrity which will run from July to December 2001. There will be invited talks and shorter contributed talks. Specific topics include (but are not limited to) constructions of codes, asymptotic theory of codes, decoding algorithms, public-key cryptosystems, digital signature schemes, authentication schemes, applications of curves and codes to cryptography, and lattice-based cryptology.

Call for Papers: Authors of contributed papers should e-mail an abstract of 300-500 words to H. Niederreiter (nieder@math.nus.edu.sg) by June 22, 2001. Authors of accepted papers will be notified by July 6, 2001.

Information: <http://www.ims.nus.edu.sg/programs/coding.html>.

12-15 **EuroConference on Combinatorics, Graph Theory and Applications**, Centre de Recerca Matemàtica, Bellaterra, Barcelona, Spain. (Apr. 2001, p. 438)

Invited Speakers: N. Alon, Tel Aviv Univ.; P. Cameron, Queen Mary and Westfield College; D. Eppstein, Univ. of California; L. Khachatryan, Univ. of Bielefeld; J. Matousek, Charles Univ.; K. Phelps, Auburn Univ.; V. T. Sós, Alfréd Rényi Inst. of Mathematics; C. Thomassen, Technical Univ. of Denmark; N. Wormald, The Univ. of Melbourne.

Information: <http://www.crm.es/comb01/>.

12-15 **International Conference on Nonlinear Operators, Differential Equations, and Applications (ICNODEA-2001)**, Babes-Bolyai University of Cluj-Napoca, Faculty of Mathematics and Informatics, Cluj-Napoca, Romania. (Apr. 2001, p. 438)

Conference Objective and Structure: The purpose of this conference is to get together experts in nonlinear analysis and to promote contacts between Romanian mathematicians and mathematicians from all over the world in order to discuss recent advances in the field. The program will consist of invited lectures, contributed papers, and a poster session. Papers related to the following topics are appropriate for submission to the conference: fixed point theory, ordinary differential equations, nonlinear integral equations, partial differential equations, analysis of multivalued mappings, applications to optimization, biomathematics and economics, approximation and numerical methods.

Correspondence and Information: All correspondence related to the conference should be addressed to: R. Precup or A. Petrusel, Babes-Bolyai University of Cluj-Napoca, Department of Applied Mathematics, 1. M. Kogalniceanu street, 3400 Cluj-Napoca, Romania; e-mail: nodeacj@math.ubbcluj.ro; fax: +40 64 191906.

14-18 **Function Spaces, Proximities and Quasi-Uniformities**, Caserta, Italy. (June/July 2001, p. 627)

Program: The conference will consist of 50-min. plenary lectures by invited speakers and 25-min. contributed talks. It will open with a special invited lecture by Som Naimpally on the occasion of his 70th birthday.

Invited Speakers: A. Arhangel'skii (New Mexico, USA - Univ. Moscow, Russia); U. B. Darji (Univ. Louisville, USA); P. de Lucia (Federico II, Naples); S. Dolecki (Univ. di Digione, France); J. Hocking (Michigan State Univ., USA); L. Hola (Accademia delle Scienze della Repubblica Slovacca, Rep. Slovakia); H.-P. Kunzi (Univ. Cape Town, So. Africa); R. Lowen (Univ. di Antwerp, Belgium); J. Pelant (Acad. delle Scienze, Prague, Czech Rep.); S. Watson (York Univ., Toronto, Canada).

Call for Papers: Participants are invited to present a 25-min. talk. They are invited to submit an abstract to topological.sun@unina2.it no later than June 30, 2001.

Deadlines: Registration and payment of conference fees: May 31, 2001. Reservation of hotel accommodations: May 31, 2001. Abstract submission: June 30, 2001. Registration, accommodations, forms and the submission of abstracts must be mailed to topological.sun@unina2.it.

Information: G. Di Maio-Topological SUN, Seconda Università degli Studi di Napoli-S.U.N., Facoltà di Scienze MM.FF.NN., Dipartimento di Matematica, Via Antonio Vivaldi, 43, 81100 Caserta, Italia; tel: +39+(0)823/274426; fax: +39+(0)823/274753; <http://www.unina2.it/topological.sun/homesun.html>.

17-21 Euroconference on Asymptotic Methods and Applications in Kinetic and Quantum-Kinetic Theory, Granada, Spain. (June/July 2001, p. 627)

Sponsors: European Commission, Spanish Government, Junta de Andalucía, Universidad Carlos III de Madrid, Universidad Autónoma de Madrid, Universidad de Granada.

Program: The program of the conference will offer invited talks, contributed talks, and a poster session. Talks and posters will be selected by the scientific committee from submitted abstracts. Submission: kinetic@ugr.es. Deadline for submission: May 31, 2001; Notification of acceptance: June 20, 2001.

Invited Speakers (to date): H. Andreasson, A. Bobylev, O. Bokanowski, L. Boudin, J. Brey, E. Caglioti, A. Carpio, M. Carvalho, F. Castella, I. Catto, C. Cercignani, L. Desvillettes, J. Dolbeault, M. Fischetti, I. Gamba, V. Garzo, P. Gerard, R. Glassey, F. Golse, T. Goudon, K. P. Hadeler, R. Illner, P.E. Jabin, A.P. Jauho, A. Juengel, A. Klar, H. Lange, C. LeBris, A. Linan, S. Mischler, E. Oran, G. Papanicolau, L. Pareschi, P. Pietra, F. Poupaud, M. Pulvirenti, V. Ricci, C. Ringhofer, C. Rosier, G. Russo, L. Saint-Raymond, P. Souganidis, W. Strauss, L. Vega, J. L. L. Velazquez, C. Villani, B. Wennberg, G. Wolansky, W. Zimmermann.

Information: J. Soler, Universidad de Granada (jsoler@ugr.es, kinetic@ugr.es).

17-26 Functional Analysis VII, Inter-University Center, Dubrovnik, Croatia. (Apr. 2001, p. 438)

Program: Functional Analysis VII is a conference and a postgraduate school on functional analysis with several more or less independent parts dealing with various aspects of functional analysis (see workshop topics). The program will include a series of lectures, single lectures, and short communications.

Workshop Topics: Operator algebras, representation theory, probability theory, harmonic analysis.

Organizer: Department of Mathematics, University of Zagreb, Croatia.

Speakers: A tentative list can be found on the Web page.

Deadlines: April 1, 2001, to register and submit abstract.

Information: <http://www.math.hr/~congress/Dubrovnik01/>; e-mail: congress@math.hr.

18-22 Euro Summer School on Proper Group Actions, Centre de Recerca Matemàtica, Bellaterra, Barcelona, Spain. (Apr. 2001, p. 438)

Speakers: G. Mislin, ETH Zürich; and A. Valette, Univ. de Neuchâtel.

Information: <http://www.crm.es/group-actions/>.

18-22 The Fifth International Workshop on Differential Geometry and Its Applications, Timisoara, Romania. (Feb. 2001, p. 251)

Invited Speakers: (confirmed until the end of October, 2000): W. Bertram (France), M. Bordoni (Italy), K. Buchner (Germany), P. Gauduchon (France), C. S. Gordon (USA), M. Goze (France), T. Hangan (France), E. Macias Virgos (Spain), S. Marchiafava (Italy), P. T. Nagy (Hungary), J.-P. Ortega (Switzerland), T. Pirashvili (Georgia), Th. M. Rassias (Greece), T. S. Ratiu (Switzerland), K. Richardson (USA), A. Savo (Italy), D. Schueth (Germany), L. Vanhecke (Belgium).

Organizers: M. Craioveanu, West University of Timisoara, e-mail: craiov@math.uvt.ro; R. Iordanescu, Institute of Mathematics of the Romanian Academy, Bucharest, e-mail: Radu.Iordanescu@imar.ro;

M. Puta, West University of Timisoara, e-mail: puta@math.uvt.ro; D. Acu, ASTRA Association, e-mail: dacu@science.sibiu.ro.

19-22 International Conference on Algebraic Geometry and Singularities (in Honour of Professor José Lui Vicente Córdoba on His 60th Birthday), University of Sevilla, Sevilla, Spain. (Aug. 2001, p. 749)

Information: <http://www.us.es/da/>.

20-22 5th Hellenic European Research on Computer Mathematics and Its Applications—Hercma 2001, Athens, Greece. (June/July 2001, p. 628)

Sponsor: IMACS.

Framework-Objectives: The main theme within the conference will be computer mathematics and its applications, and special emphasis will be given to computational mathematics, high-performance computing, operational research and statistics, mathematics in economics and industry.

Information: E. A. Lipitakis, Chairman of the HERCMA Conference, Athens University of Economics and Business, 74, Patission Street, Athens 104-34, Greece; tel: 301-8237-361; fax: 301-8226-204; e-mail: eal@aueb.gr; <http://www.aueb.gr/conferences/hercma2001/>.

20-22 Interphase 2001 Conference on Numerical Methods for Free Boundary Problems, University of Maryland, College Park, Maryland. (June/July 2001, p. 628)

Organizers: R. H. Nochetto, D. Levermore, J.-G. Liu, R. Pego.

Description: This ninth conference of the series will be held in College Park with the intention of encouraging more participation of U.S. researchers and stimulating the exchange of ideas between American and European peers. The conference will focus on scientific computing, numerical analysis, modeling and application issues of problems involving interfaces. Topics of interest include but are not limited to: thin films, epitaxial growth of crystals, surface tension effects and surface diffusion, morphological changes of stressed solids, microstructure evolution, solidification, image processing, free surface hydrodynamics, novel numerical methods, fast algorithms, and numerical analysis.

Invited Speakers: A. Bertozzi, J. Blowey, F. Bornemann, P. Colli-Franzone, K. Deckelnick, G. Dolzmann, G. Dziuk, W. E. C. Elliott, H. Garcke, K. Gaertner, P. Gremaud, G. Gruen, T. Hou, D. Kinderlehrer, R. Kohn, R. Kornhuber, R. Le Veque, B. Li, J. Lowengrub, M. Luskin, J. McFadden, S. Osher, C. Peskin, A. Quarteroni, A. Schmidt, J. Sethian, M. Shelley, K. Siebert, P. Smereka, W. Szymczak, A. Veiser, C. Verdi, P. Voorhees, N. Walkington, J. Weeks.

Scientific Committee: E. Baensch (Berlin, Germany), G. Dziuk (Freiburg, Germany), C.M. Elliott (Brighton, England), R.H. Nochetto (College Park, USA), J. Sprekels (Berlin, Germany), C. Verdi (Milano, Italy).

Information: <http://www.math.umd.edu/research/interphase/>

***20-24 Xth Oporto Meeting on Geometry, Topology and Physics, Faculty of Sciences, Univ. of Oporto, Portugal.**

Main Speakers and Titles: J. Barrett (Nottingham), Quantum gravity and the Lorentz group; V. Jones (Berkeley), Two subfactors; S. Sawin (Fairfield), Turaev-Viro theory and TQFTs with corners; T. S. Tsun (Oxford), Generalized electric-magnetic duality and the dualized standard model; B. Westbury (Warwick), A unified representation theory for simple Lie algebras.

Organizers: J. N. Tavares (Univ. Oporto), J. Mourao (IST, Lisbon), R. Picken (IST, Lisbon).

Information: J. N. Tavares, Faculdade de Ciências da Universidade do Porto, Praca Gomes Teixeira, 4099-002 Porto, Portugal; tel: +351-22-3401446, +351-22-3401400; fax: +351-22-3401453; <http://www.fc.up.pt/mp/actividades/om.html>.

Deadline: For registration and support: July 15, 2001.

21-24 Ph.D. EuroConference Foundations of the Formal Sciences III (FotFS III): Complexity in Mathematics and Computer Science, Universität Wien, Wien, Austria. (Jun/Jul 2001, p. 628)

Organizing & Scientific Committee: B. Löwe (Bonn, coordinator), B. Piwinger (Wien, local organizer), T. Räscher (Potsdam).

Speakers: P. Berenbrink (Warwick), J. Brendle (Kobe), R. Camerlo (Wien), L. Engebretsen (Cambridge, MA), M. Grohe (Edinburgh), J. D. Hamkins (New York), E. M. Camara (Zaragoza), S. Mikulas (London), R.-D. Schindler (Wien), H. Veith (Wien), J. Zapletal (Gainesville, FL).

Information: e-mail: fotfs@math.uni-bonn.de; <http://www.math.uni-bonn.de/people/fotfs/III/>.

22-23 International Conference on Optimization Techniques & Itô's Applications in Engineering and Technology, Agra, India. (June/July 2001, p. 628)

Theme: An international conference will be held to celebrate the 149th birthday of Raja Balwant Singhji. Papers on optimization techniques and its applications in modern industry, engineering, and technology with adequate mathematical input/applications are invited. Conference topics include: applied mathematics, electronics and communications, information technology, computer applications, artificial intelligence, chemical engineering, statistical signal processing, resource planning, variational and equilibrium problems, economic and financial decision making.

Information: Information about the conference can be obtained from: S. K. Mishra (Org. Secretary), Dept. of Mathematics, Faculty of Eng. & Tech., R.B.S. College, Bichpuri, Agra (283105), India; tel: +91 (0562) 776675; fax: +91 (0562) 520075; e-mail: shashikMishra@usa.net.

22-26 Application of Discrete Mathematics, Australian National University, Canberra, Australia. (Feb. 2001, p. 251)

Description: "Applications of Discrete Mathematics" will be a special session of the 45th Annual Meeting of the Australian Mathematical Society at the Australian National University in Canberra, Australia, Saturday, Sept. 22 (noon), until Wednesday evening, Sept. 26.

Information: Visit <http://www.maths.anu.edu.au/conferences/AustMS2001/>.

24-26 ECCOMAS 2001, Keble College, Oxford, UK. (Sept. 2000, p. 980)

Information: Pamela Bye, Conference Officer, The Institute of Mathematics and Its Applications, Catherine Richards House, 16 Nelson Street, Southend-on-Sea, Essex, SS1 1EF; tel: (01702) 354020; fax: (01702) 354111; e-mail: conferences@ima.org.uk; Web: <http://www.ima.org.uk/>.

24-28 Fourth European Conference on Elliptic and Parabolic Problems—Part II, Gaeta, Italy. (Jan. 2001, p. 54)

Organizing Committee: J. Bemelmans (Aachen), B. Brighi, A. Brillard (Mulhouse), M. Chipot (Zurich), F. Conrad (Nancy), I. Shafrir (Haifa), V. Valente (IAC, Rome), G. Vergara-Caffarelli (Rome).

Presentation: Starting this year, the former Pont-a-Mousson meeting will be split into two conferences. The second one, with more emphasis on applications, will take place in Gaeta, Italy. (The first one, devoted to more theoretical aspects, took place in Rolduc, Netherlands, June 18-22, 2001.)

Conference Topics: Besides elliptic and parabolic issues the topics of the conference include geometry, free boundary problems, fluid mechanics, evolution problems in general, calculus of variations, homogenization, control, modeling, and numerical analysis.

Invited Speakers: H. Amann (Zurich), C. Baiocchi (Rome), J. Ball (Oxford), A. Bermudez (Santiago), M. Bertsch (Rome), C. M. Brauner* (Bordeaux), A. Capuzzo-Dolcetta* (Rome), J. Escher (Hannover), E. Fereisl (Prague), A. Friedman (Minneapolis), G. Geymonat (Montpellier), W. Hackbusch (MIP), A. Henrot* (Nancy), M. Iannelli* (Trento), M. Mimura (Hiroshima), P. Podio-Guidugli (Rome), J. Rubinstein (Haifa), E. Sanchez-Palencia (Paris), S. Sauter* (Zurich), A. Sequeira (Lisbon).

Program: In addition to the main lectures, parallel sessions of short communications will be organized. In particular, thematic sessions will be organized by the starred names in the above list.

Deadlines: The deadline for submitting an abstract is April 1, 2001.

Information: e-mail: gaeta@amath.unizh.ch, <http://www.math.unizh.ch/rolducgaeta/>.

24-28 Vertical Integration in Biology: From Molecules to Organisms, Isaac Newton Institute, Cambridge, UK. (May 2001, p. 530)

Themes: Biological systems exhibit prominent behavior at the levels of both individuals and populations. Empirical and theoretical research at each of these levels has led to tremendous advances in knowledge; however, much less is understood about the mechanisms underlying the integration and coordination of behaviour at the individual level to produce coherent population-level behaviour (vertical integration). This workshop will bring together leading experimental and theoretical researchers, together with those working at the interface between the two communities. The aim will be to identify and explore new interdisciplinary approaches to the problem of vertical integration.

Confirmed Speakers: R. Adams (Bath), F. Ashcroft (Oxford), D. Bray (Cambridge), G. Forgacs (Missouri), T. Hofer (Berlin), P. Hunter (Auckland), J. Jack (Oxford), R. Keller (Virginia), P. Kulesa (Caltech), M. Levine (Berkeley), J. Lewis (London), A. McCulloch (San Diego), D. Noble (Oxford), J. Reintz (New York), J. Sherratt (Edinburgh), K. Weijer (Dundee).

Location and Cost: The workshop will take place at the Newton Institute, and accommodations for participants will be provided in single study bedrooms with shared bathrooms at Wolfson Court, a hall of residence adjacent to the institute. The workshop package costs £250, which includes registration fee, accommodations, breakfast, dinner, lunches, and refreshments on the days that lectures take place.

Further Information and Application Forms: These are available from the WWW at <http://www.newton.cam.ac.uk/programs/ICB/icbw01.html>, where further information about the workshop will be posted and updated. Completed application forms should be sent to M. Clark at the above address or via e-mail to m.clark@newton.cam.ac.uk.

Scientific Enquiries: May be addressed to N. Monk (n.monk@sheffield.ac.uk) or P. Maini (maini@maths.ox.ac.uk).

Deadline: For receipt of applications is April 30, 2001.

24-30 11th International Symposium on Classical Analysis, Kazimierz Dolny, Poland. (Dec. 2000, p. 1437)

Topics: Several complex variables (especially L^2 -methods), Riemannian and Hermitian geometry, spectral theory in Hilbert spaces, probability, and mathematical physics. Particular consideration will be given to the interrelation of ideas from different areas and to promotion of wider knowledge of some important classical theories.

Program: The scientific program will consist of plenary lectures and thirty 45-min. scientific communications in English. The president of Scientific Committee is M. Skwarczyński.

Information: T. Mazur, Technical University, Dept. of Math., Malczewskiego 29, 26-600 Radom, Poland; fax: (4848)26333 or (4848)23969; e-mail: mazurt@kiux.man.radom.pl or krupa@alpha.sggw.waw.pl.

25-29 Algebraic Geometry Conference, University of Genova, Italy. (Apr. 2001, p. 438)

Conference Topics: The conference (in memory of Paolo Francia) is focused on classification of algebraic varieties, Mori's theory and Minimal Model Program, surfaces of general type (the research fields of P. Francia), and related topics.

Information: <http://www.dima.unige.it/STAFF/BELTRAME/convegno.pdf/>; e-mail: beltrame@dima.unige.it, or pedrini@dima.unige.it.

26-28 ASCM 2001 (The Fifth Asian Symposium on Computer Mathematics), Ehime University, Matsuyama, Japan. (Jan. 2001, p. 54)

Program: ASCM 2001 will provide an international forum for active researchers to review the current state of the art and trends, to report research results and progress, and to exchange ideas for future

developments on computer mathematics. Research papers on all aspects of the interaction between computers and mathematics are solicited for the symposium. Specific topics include but are not limited to: Symbolic, algebraic, and geometric computation; Automated mathematical reasoning; Computer-aided problem solving and instruction; Computational algebra and geometry; Symbolic/numeric hybrid methods; Parallel/distributed/network computing; Applications in CAGD/CAD, robotics, and computer vision; Mathematical software design and implementation. The symposium will consist of plenary sessions by invited speakers, regular sessions of contributed papers, and software demonstration.

Information: M.-T. Noda, General Chair of ASCM 2001: Department of Computer Science, Ehime University, Matsuyama 790-8577 Japan; e-mail: ascm2001@hpc.cs.ehime-u.ac.jp; <http://www.mmrc.iss.ac.cn/~ascm/>; <http://www.hpc.cs.ehime-u.ac.jp/~ascm/>.

26-28 First SIAM Conference on Imaging Science, Boston Park Plaza Hotel, Boston, Massachusetts. (Feb. 2001, p. 251)

About the Conference: Current developments in the technology of imaging have led to an explosive growth in the interdisciplinary field of imaging science. With the advent of new devices capable of seeing objects and structures not previously imagined, the reach of science and medicine have been extended in a multitude of different ways. The impact of this technology has been to generate new challenges associated with the problems of formation, acquisition, compression, transmission, and analysis of images. By their very nature, these challenges cut across the disciplines of physics, engineering, mathematics, biology, medicine, and statistics. While the primary purpose of this conference is to focus on mathematical issues, the biomedical aspects of imaging will also play an important role.

This conference represents the first official function organized by the newly formed SIAM Activity Group on Imaging Science (SIAG/IS). This SIAG and the SIAG on the Life Sciences were both created in recognition of the fact that the mathematics community should participate more directly in these nontraditional areas. Since these two activity groups have such a strong overlap in the area of biomedical imaging, this conference has been scheduled to overlap with the Conference on the Life Sciences, chaired by James Collins, set for September 24-26, 2001.

Conference Themes: Imaging Acquisition and Formation, Image Storage, Compression, and Retrieval, Imaging Coding and Transmission, Imaging Processing, PDEs in Image Processing, Image Modeling and Analysis, Image Restoration, Statistical Aspects of Imaging, Biomedical Imaging, Applications.

Invited Plenary Speakers: Electromagnetic Inverse Problems: M. Cheney, Rensselaer Polytechnic Institute; Mathematical Morphology and Genomic Regulation: E. Russell Dougherty, Texas A&M Univ.; Sparse Geometrical Image Representations for Processing: S. Mallat, École Polytechnique, France, and Courant Institute of Mathematical Sciences, New York Univ.; Stochastic Models for Natural Images: D. Mumford, Brown Univ.; Level Set/PDE Based Algorithms for Image Restoration, Surface Interpolation and PDEs on Manifolds: S. Osher, Univ. of California, Los Angeles.

Minisymposia: A minisymposium is a two-hour session consisting of four presentations on a well-focused topic. A number of minisymposia have been solicited by the conference Organizing Committee to supplement the conference themes. The Organizing Committee also encourages proposals for minisymposia in areas related to the conference themes. Prospective minisymposium organizers are asked to submit a proposal consisting of a title, a description (not to exceed 100 words), and a list of speakers and titles of their presentations using the Conference Management System available at: <http://www.siam.org/meetings/is01/part.htm>. Deadline for submission of minisymposium proposals is: March 2, 2001.

Contributed Presentations in Lecture Format: Contributed presentations in lecture format are invited in all areas of imaging science consistent with the conference themes. A lecture format involves a 15-minute oral presentation with an additional five minutes for discussion. Deadline for submission of contributed abstracts for a lecture or poster: April 6, 2001.

Contributed Presentations in Poster Format: A poster presentation consists of the use of visual aides on a 4' x 6' poster board presented in a two-hour informal session that allows presenters to discuss their research with attendees.

Electronic Submission: Every presenter of a contributed or poster presentation must submit a 75-word abstract, which must be sent electronically using the Conference Management System available at: <http://www.siam.org/meetings/is01/part.htm>. The 75-word abstract will appear in the final program.

Information: ross@siam.org.

26-28 Fluid Structure Interaction 2001, Halkidiki, Greece. (Jan. 2001, p. 54)

Organizer: Wessex Institute of Technology, UK.

Abstract Deadline: January 13, 2001.

Contact: Conference Secretariat, Fluid Structure Interaction 2001, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK; tel: 44(0) 238 029 3223; fax: 44 (0) 238 029 2853; e-mail: gcosutta@wessex.ac.uk; <http://www.wessex.ac.uk/conferences/2001/fsi01/>.

26-28 International Conference "Differential Equations and Their Applications", Institute of Mathematics, Almaty, Republic of Kazakhstan. (June/July 2001, p. 628)

Organizers: Institute of Mathematics of Education and Science Ministry of the Republic of Kazakhstan.

Organizing Committee: U. M. Sultangazin (Kazakhstan, co-chair), A. M. Samoilenko (Ukraine, co-chair), S. N. Kharin (Kazakhstan-Pakistan, co-chair), N. K. Blied (Kazakhstan), A. A. Zhensykbayev (Kazakhstan), Ki Sik Ha (Korea), L. D. Kudryavzev (Russia), B. Kendirli (Turkey), M. I. Imanaliev (Kyrgyzstan), M. S. Salakhitdinov (Uzbekistan), R. Kh. Rozov (Russia), V. M. Amerbayev (Russia), I. T. Pak (Kazakhstan), K. K. Kenzhebayev (Kazakhstan), K. A. Kasymov (Kazakhstan), M. O. Otelbayev (Kazakhstan), M. I. Rakhimberdiev (Kazakhstan), D. S. Dzhumabayev (Kazakhstan), M. T. Dzenaliev (Kazakhstan), L. A. Alexeyeva (Kazakhstan), G. I. Bizhanova (Kazakhstan), G. K. Zakiryanova (Kazakhstan, scientific secretary).

Program: The conference is organized in sessions as Differential Equations and Mathematical Physics.

Deadlines: For submission of applications is April 10, 2001; for submission of theses, June 20, 2001.

Information: Information on the conference is on the Web site http://www.math.kz/info/diffeq_conf.html. Z. G. Kozhahmetovna, Institute of Mathematics of the ME&S of the RK, Pushkin street, 125, Almaty 480100, Kazakhstan; tel: +7(3272) 913764; fax: +7(3272) 913740; e-mail: zakir@math.kz.

27-30 WSES Conference AITA 2001: Automation and Information: Theory and Applications, Skiathos Island, Greece. (June/July 2001, p. 628)

Information: <http://www.worldses.org/wses/conferences/skiathos/aita/>.

28-30 Workshop on Mathematical Modeling and Scientific Computation, Fredericton, New Brunswick, Canada. (Aug. 2001, p. 749)

Program: The aim of this workshop is to bring together mathematical modelers and computational scientists working in a wide range of applications and to highlight the state-of-the-art computational techniques driving the progress of research in these fields. The workshop will be organized around applications from four areas: (1) biology, (2) finance, (3) fluid dynamics, (4) relativistic physics.

Organizers: V. Husain, J. Stockie, and J. Watmough.

Information: <http://www.math.unb.ca/~masc01/>; e-mail: masc01@math.unb.ca.

October 2001

* 1-3 **2nd International Symposium on PLS and Related Methods**, Island of Capri (Naples), Italy.

Description: This is an exceptional event where the most outstanding experts in PLS methods from all over the world will meet. The state-of-the-art in PLS methods will be presented as well as

the most recent developments and the most challenging advances demanded for the future of PLS by the application areas of: (1) multivariate modelling of a process; (2) improvement and optimization of industrial production performances (agro-alimentary, cosmetics, chemical, petrol, etc.); (3) quantification of relations between chemical structures and biological activities, etc.; (4) evaluation of customer satisfaction and related issues.

Invited Lecturers: B. Abraham, Canada; G. Dijksterhuis, The Netherlands; H. Martens and M. Martens, Denmark; M. Forina, Italy; I. Helland, Norway; S. de Jong, The Netherlands; N. Kettaneh-Wold and S. Wold, Sweden; A. Langsrud and T. N os, Norway; D. L. Massart, Belgium; A. Phatak, Australia.

Information: e-mail: binici@unina.it, or visit <http://www.dms.unina.it/PLS2001.html>.

1-5 Aspects of Hyperbolic Geometry, University of Fribourg, Fribourg, Switzerland. (May 2001, p. 530)

Description: There will be about 22 invited talks covering a wide range of hyperbolic geometry.

Scientific Board: C. Bavard (Univ. of Bordeaux I), G. Besson (Univ. of Grenoble I), R. Kellerhals (Univ. of Fribourg), V. Schroeder (Univ. of Z urich).

Information: e-mail: hyp-geom@unifr.ch or <http://www.unifr.ch/math/conference/>.

1-5 International Conference on Numerical Algorithms, Dedicated to Claude Brezinski on the occasion of his 60th birthday, Marrakesh, Morocco. (Oct. 2000, p. 1146)

Organizing Committee: B. Beckermann (Univ. of Lille I, France), A. Bentbib (Faculty of Sciences and Technologies, Marrakesh, Morocco), B. Germain-Bonne (Univ. of Lille I, France), J.-P. Chehab (Univ. of Lille I, France), M. El Alaoui-Talibi (Faculty of Sciences Semlalia, Marrakesh, Morocco), A. Fdil (ENS, Marrakesh, Morocco), A. Lembarki (Faculty of Sciences Semlalia, Marrakesh, Morocco), M. Pr evost (Univ. of Littoral, Calais, France), A. Matos (Univ. of Lille I, France), A. Messaoudi (ENS, Rabat, Morocco), M. Redivo-Zaglia (Univ. of Calabria, Cosenza, Italy), R. Sadaka (ENS, Rabat, Morocco), H. Sadok (Univ. of Littoral, Calais, France), J. Van Iseghem (Univ. of Lille I, France).

Program: An international conference to celebrate the 60th birthday of Claude Brezinski and the 10th anniversary of the journal *Numerical Algorithms* that he founded in 1991 and where contributed papers will be published. The themes of the conference will cover all aspects of numerical analysis, in particular those that are related to numerical algorithms.

Deadline: For abstracts: May 1, 2001.

Information and Registration: A Web site containing all the information about this conference and a registration form can be found at <http://www-lmpa.univ-littoral.fr/~na2001/>. If interested in participating, please respond to this address: na2001@lmpa.univ-littoral.fr.

1-6 Workshop: Circuit and Proof Complexity, International Centre for Mathematical Sciences, Edinburgh, UK. (June/July 2001, p. 628)

Information: Please see the ICMS Web pages for further details on programme, speakers, registration, etc.: <http://www.ma.hw.ac.uk/icms/current/>.

*** 5-9 Trends in Banach Spaces and Operator Theory**, The University of Memphis, Memphis, Tennessee.

Sponsors: National Science Foundation, The University of Memphis, and The University of Mississippi.

Organizing Committee: J. Jamison, A. Kamińska, P.-K. Lin (Univ. of Memphis), P. Kranz (Univ. of Mississippi).

Principal Speakers: Y. Abramovich (Indiana Univ.-Purdue, Indianapolis), S. Axler (San Francisco State Univ.), J. B. Conway (Univ. of Tennessee, Knoxville), C. C. Cowen (Purdue Univ.), J. Diestel (Kent State Univ. in Kent, Ohio), N. Kalton (Univ. of Missouri in Columbia), B. MacChuer (Univ. of Virginia in Charlottesville), E. W. Odell (The Univ. of Texas at Austin), A. Pełczyński (Polish Academy of Sciences in Warsaw, Poland), G. Pisier (Univ. de Paris VI, Texas A&M Univ.), H.

Rosenthal (The Univ. of Texas at Austin), T. Berthold Schlumprecht (Texas A&M Univ. in College Station), N. Tomczak-Jaegermann (Univ. of Alberta in Edmonton, Canada).

Topics: A variety of topics in Banach spaces and operator theory, including: isomorphic and isometric theory of Banach spaces, Banach lattices, interpolation theory, Banach and Hilbert spaces of analytic functions, spaces of measurable functions, the geometry of finite- and infinite-dimensional convex bodies, C^* -algebras, linear spaces and algebras of operators, weighted-composition, Hankel and Toeplitz operators, normal and subnormal operators on Hilbert spaces.

Information: The principal speakers will deliver one-hour plenary lectures. Twenty-minute contributed talks will be organized in parallel sessions. Partial funding for advanced graduate students and beginning researchers may be available through the organizers. For further information on the conference organization, registration, location, lodging, submission of abstracts and other details, visit the conference website at <http://www.msci.memphis.edu/banachconf.html>.

13-14 AMS Eastern Sectional Meeting, Williams College, Williamstowne, Massachusetts. (Sept. 1997, p. 1031)

Information: W. Drady, wsd@ams.org.

*** 15-19 International Conference on Arithmetic Geometry**, Korea Institute for Advanced Study, Seoul, Korea.

Organizer: M. Kim (KIAS and the Univ. of Arizona).

Confirmed Speakers: F. Oort (Utrecht), A. Abbes (Paris-Nord), M. Bhargava (Princeton), S. Bloch (Chicago), K. Joshi (TIFR), G. Kings (Muenster), B. Moonen (Amsterdam), A. Ogus (Berkeley), T. Saito (Tokyo), A. Tamagawa (Kyoto).

Support: Limited support available for participation by students and recent Ph.D.'s. Apply by September 1.

Information: For further information, contact the organizer at mkim@kias.re.kr.

*** 18-21 (NEW INFORMATION) 2001 Ahlfors-Bers Colloquium**, University of Connecticut at Storrs. (Apr. 2001, p. 439)

Program: The colloquium will consist of a one and one-half day workshop followed by two and one-half days of plenary lectures. Workshops will depend on colloquium participants and their interests. R. Canary will organize one workshop which will cover deformations of Kleinian groups and link with the lectures of Brock, Bromberg and his own. Others will be announced at the Web site for the colloquium: <http://www.math.uconn.edu/~abcollq/>.

Areas of Attention: The general subject matter of the colloquium follows, in the broadest sense, the tradition set by Lars Ahlfors and Lipman Bers. The subject areas will be Riemann surfaces, Kleinian groups, Teichm uller theory, theta and entire functions and other areas of mathematics that interact with the core areas of geometric function theory.

Plenary Lecturers: J. Brock, K. Bromberg, D. Canary, A. Eremenko, J. Heinonen, M. Kapovich, V. Markovic, H. Masur, O. Schramm, C. Series, E. Taylor.

Organizing Committee: W. Abikoff (chair), A. Basmajian, R. Canary, C. Earle, F. Gardiner, F. Gehring, A. Haas, I. Kra, A. Marden and B. Maskit.

Support: It is expected that partial support will be available for participants.

Information: Further details may be found at <http://www.math.uconn.edu/~abcollq/>.

*** 19-20 Midwest Probability Colloquium**, University of Chicago, Chicago, Illinois.

Organizer: S. Lalley, Department of Statistics, Univ. of Chicago.

Program: C. Tracy (Univ. of California, Davis), two lectures; J. Rosinski (Univ. of Tennessee), one lecture; Q.-M. Shao (Univ. of Oregon), one lecture. On Thursday, October 18, there will be a workshop on random matrices.

Information: Further details of the program will be posted on the conference Web page when they become available. The Web page

also has links to maps and other information about the Univ. of Chicago, the city of Chicago, and the Lakeshore Ramada. The address of the conference Web page is <http://www.math.nwu.edu/mwp/>; or contact S. Lalley, tel: 773-902-9890, fax: 773-902-9810.

*** 22-27 International Conference on Stochastic Analysis and Applications**, Hammamet, Tunisia.

Organizers: R. Boukhris (Tunis), R. Hachaichi (Tunis), R. Gannoun, H. Ouerdiane (Tunis), A. Rezgui (Bizerte), H. Sadraoui (Tunis), L. Silva (Madeira).

Topics: Infinite dimensional analysis, Dirichlet forms, quantum fields, quantum probability, statistical mechanics, Gaussian and non-Gaussian analysis, Feynman path integrals, stochastic partial differential equations, stochastic analysis and financial markets, analytic and stochastic techniques in physics, mathematical modelling.

Information: <http://www.uma.pt/ccm/icsaa-2001.html>.

24-26 DIMACS Workshop on Analysis of Gene Expression Data, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Feb. 2001, p. 252)

Short Description: The gene expression array is a significant new technology aimed at providing a top down picture of the intimate genetic processes of an organism. It allows quantification of transcription levels of large numbers of genes simultaneously. There remain unsolved image processing as well as computational and mathematical difficulties associated with extraction and validation of data from gene expression microarray assays. This workshop will address the research areas and problems associated with this topic.

Sponsors: DIMACS Center.

Organizers: L. Heyer, Davidson College; G. Stolovitsky, IBM; S. Yoosheph, Celera Genomics.

Contacts: S. Yoosheph, Celera Genomics, shibu.yoosheph@celera.com; Local Arrangements: J. Herold, DIMACS Center, jessicah@dimacs.rutgers.edu,

Information: 732-445-5928; <http://dimacs.rutgers.edu/Workshops/index.html>.

25-28 2001 Annapolis Algebraic Geometry Conference in Memory of Ruth Michler, U.S. Naval Academy, Annapolis, Maryland. (June/July 2001, p. 629)

Topics: Singularities, commutative algebra, computational methods and applications.

Organizers: C. G. Melles, U.S. Naval Academy, tel: 410-293-6708, fax: 410-293-4883, cgg@usna.edu; L. J. McEwan, Ohio State Univ., mcewan@math.ohio-state.edu; G. Kennedy, Ohio State Univ., tel: 419-755-4291, kennedy@math.ohio-state.edu; K. Lauter, Microsoft Research, tel: 425-703-8335, klauter@microsoft.com.

Confirmed Speakers: S. Abhyankar (Purdue), E. Bierstone (Univ. Toronto), A. Brudnyi (Univ. Calgary), E. Hironaka (Florida State Univ.), G. Kennedy (Ohio State Univ.), K. Lauter (Microsoft), D. Massey (Northeastern Univ.), A. Nemethi (Ohio State Univ.), H. Schenck (Harvard), M. Seppala (Florida State Univ.), A. Silverberg (MSRI/Ohio State), K. Smith (Univ. Michigan), H. Stark (UC San Diego), H. Srinivasan (Univ. Missouri), A. Szilard (Barnard), M. Vitulli (Univ. Oregon), J. F. Voloch (Univ. Texas, Austin).

Registration: \$25 for mathematicians with full-time employment; \$15 for graduate students and others.

Information: <http://mathweb.mathsci.usna.edu/Faculty/Conferences/AlgGeom2001/aagc.html>.

28-November 2 School on Semigroups Applied to Evolution Equations, Grand Hotel Bellavista Levico, Terme (Trento), Italy. (Aug. 2001, p. 749)

Scientific Organizers: M. Iannelli (Trento), R. Nagel (Tuebingen), and S. Piazzera (Ulm).

Deadline for Applications: September 30, 2001.

Information: A. Micheletti, Secretary of CIRM, Centro Internazionale per la Ricerca Matematica, Istituto Trentino di Cultura, 38050

Povo (Trento); tel: +39-0461-881628; telefax: +39-0461-810629; e-mail: michelet@science.unitn.it; <http://www.science.unitn.it/cirm/>.

29-November 1 Introductory Lectures by A. A. Kirillov (Pennsylvania) and V. Guillemin (MIT), Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 749)

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

31-November 2 Computational Issues in Game Theory and Mechanism Design, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Aug. 2001, p. 750)

Organizers: V. Vazirani, Georgia Tech; and N. Nisan, Hebrew Univ. **Short Description:** The research agenda of computer science is undergoing significant changes due to the influence of the Internet. Together with the emergence of a host of new computational issues in mathematical economics, as well as electronic commerce, a new research agenda appears to be emerging. This area of research is collectively labeled under various titles, such as "foundations of electronic commerce", "computational economics", or "economic mechanisms in computation", and deals with various issues involving the interplay between computation, game-theory, and economics.

Information: V. Vazirani, Georgia Tech, vazirani@cc.gatech.edu; Local Arrangements: J. Herold, DIMACS Center, jessicah@dimacs.rutgers.edu, 732-445-5928. WWW Information: <http://dimacs.rutgers.edu/Workshops/index.html>.

November 2001

2-3 21st Annual Southeastern-Atlantic Regional Conference on Differential Equations, Wake Forest University, Winston-Salem, North Carolina. (Jun/Jul 2001, p. 629)

Description: The primary purpose of the conference is to promote research and education in the field of differential equations. These meetings bring together established and new researchers and advanced graduate students for an exchange of ideas and discussions on all aspects of differential equations. The conference will consist of a series of four plenary one-hour lectures and sessions for contributed papers.

Invited Speakers: A. Castro (Univ. of Texas at San Antonio), S. Lenhart (Univ. of Tennessee), J. Selgrade (N.C. State Univ.), and J. Serrin (Univ. of Minnesota).

Contributed Talks: There will be sessions of contributed talks. Deadline for submission of abstracts for contributed talks is October 12, 2001.

Financial Assistance: Contingent on NSF funding, some financial assistance may be available to offset travel and housing expenses for graduate students and recent Ph.D. recipients. Requests postmarked by October 1, 2001, are guaranteed consideration. Eligible persons who belong to currently underrepresented groups are especially encouraged to apply to the conference for financial assistance.

Information: Updated information can be obtained at the conference Web site: http://www.math.wfu.edu/SEARCDE_2001/ or by contacting: J. Baxley, SEARCDE Coordinator, Dept. of Math., Wake Forest Univ., Winston-Salem, NC 27109; tel: (336) 758-5336; fax: (336) 758-7190; e-mail: baxley@mathsc.wfu.edu.

2-6 Workshop on the Geometry of Infinite-Dimensional Lie Groups, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 750)

Participants: P. Deift (Pennsylvania), P. Etingof (MIT), V. Fock (ITEP), V. Guillemin (MIT), L. Jeffrey (Toronto), M. Kapranov (Toronto), A. A. Kirillov (Pennsylvania), F. Lalonde (Montréal), J. Leslie (Howard), E. Meinrenken (Toronto), P. Michor (Vienna), P. Olver (Minnesota), H. Omori (Tokyo), V. Ovsienko (CNRS-Luminy), T. Ratiu (EPFL Lausanne),

T. Robart (Howard), P. Slodowy (Hamburg), I. Zakharevich (Ohio State).

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

5 Workshop on Streaming Data Analysis and Mining, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Aug. 2001, p. 750)

Organizers: A Buchsbaum, AT&T Labs-Research, R. Motwani, Stanford Univ., J. Rexford, AT&T Labs.

Description: Speakers at the workshop will discuss current work in all aspects of data stream analysis: theoretical issues, including modeling; practical issues, including work on existing systems; and bridges and bottlenecks, both current and potential, between theory and practice. The goal of the workshop and the ensuing working group is to foster interdisciplinary collaborations among researchers studying data streams from many disparate perspectives and application areas.

Contact: A. Buchsbaum, AT&T Labs-Research, alb@research.att.com.

Local Arrangements: J. Herold, DIMACS Center, jessicah@dimacs.rutgers.edu, 732-445-5928.

Information: <http://dimacs.rutgers.edu/Workshops/index.html>.

5-8 Seventh SIAM Conference on Geometric Design (SIAG/GD) (GD01), Holiday Inn Capitol Plaza Hotel, Sacramento, California. (Sept. 2000, p. 980)

Information: SIAM, Society for Industrial and Applied Mathematics, 3600 University City Science Center, Philadelphia, PA 19104; phone: 215-382-9800; fax 215-386-7999; e-mail: meetings@siam.org; Web: <http://www.siam.org/meetings/>.

*** 8-11 Symposium on Partial Differential Equations to Celebrate the 75th Birthday of James Serrin**, University of Minnesota, Minneapolis, Minnesota.

Speakers: H. Brezis, C. Dafermos, E. DiBenedetto, A. Friedman, J. Hale, H. Levine, L. A. Peletier, P. Pucci, P. Rabinowitz, G. Todorova, H. Weinberger, W. Ziemer, H. Zou.

Organizers: A. Ambrosetti, H. Brezis, W. Littman, N. Meyers, P. Pucci.

Information: For further information contact meyers@math.umn.edu.

12-15 Short Course on Finite Volume Methods for Free-Surface Shallow Flows (with Applications to Environmental Problems), San Francisco, California. (Aug. 2001, p. 750)

Organizers: Numeritek Limited UK.

Lecturer: E. F. Toro.

Information: Visit <http://www.numeritek.com/>; e-mail: courses@numeritek.com.

19-22 Short Course on Finite Volume Methods for Compressible Flow, San Francisco, California. (Aug. 2001, p. 750)

Organizer: Numeritek Limited, UK.

Lecturer: E. F. Toro.

Information: Visit <http://www.numeritek.com/>; e-mail: courses@numeritek.com.

*** 26-30 (NEW INFORMATION) AAECC-14, The 14th International Symposium on Applied Algebra, Algebraic Algorithms, and Error-Correcting Codes**, RMIT University, Melbourne, Australia. (Jan. 2001, p. 55)

Sponsor: Australian Mathematical Society.

Chairs: K. Horadam (RMIT Univ., Australia) and T. Hoeholdt (Tech. Univ. of Denmark, Denmark).

Invited Speakers: R. Calderbank (AT&T, USA), J. Massey (Copenhagen, Denmark), G. Norton (Queensland, Australia), V. Pless

(Chicago, USA), A. Shokrollahi (Digital Fountain Inc., USA), M. Sudan (MIT, USA).

Topics: Algebra, algebraic algorithms, algebraic coding theory, codes and combinatorics, coding techniques, sequences, cryptography. The aim of the conference is to encourage cross-fertilization between areas developing algebraic methods and those applying them, especially in error-correcting codes.

Deadlines: The early registration deadline (for reduced rates) is August 15, 2001.

Publication: The accepted refereed papers will appear as a volume of the Springer LNCS series, available at the conference. A recent results session will also be organized during AAECC-14.

Information and Registration: See the conference website for further information, a list of accepted papers, registration and accommodation forms: <http://www.ma.rmit.edu.au/aaecc/index.html>; e-mail: aaecc@gauss.ma.rmit.edu.au; conference administration: juliann_smith@hotmail.com.

December 2001

1-3 First International Conference on Neutrosophy, Neutrosophic Logic, Set, Probability and Statistics, University of New Mexico, Gallup, New Mexico. (May 2001, p. 531)

Organizer: F. Smarandache, Univ. of New Mexico, 200 College Road, Gallup, NM 87301; e-mail: smarand@unm.edu; tel: (505) 863-7647; fax: (505) 863-7532 (Attn. Neutrosophic Conference).

Invited Speakers: J. Dezert (France), Charles Le (USA), I. Stojmenovic (Canada).

Workshop Topics: Neutrosophy—a new branch of philosophy, Neutrosophic Logic—a unifying field in logics, Neutrosophic Set—a unifying field in sets, Neutrosophic Probability—a generalization of classical and imprecise probabilities, and Neutrosophic Statistics.

Information: Deadline for contributed papers: November 30, 2001. The papers will be published in the proceedings of the conference. For more information see: <http://www.gallup.unm.edu/~smarandache/FirstNeutConf.htm>.

2-4 DIMACS-CTS (Chiaotung University) Conference on the Interconnections among Codes, Designs, Graphs and Molecular Biology, Center of Theoretical Science, Chiaotung University, Hsinchu, Taiwan. (Aug. 2001, p. 750)

Sponsors: DIMACS Center, Rutgers University; and Chiaotung University.

Organizers: F. Hwang, Chiaotung Univ.; F. Roberts, DIMACS, Rutgers Univ.; D. Torney, Los Alamos National Labs.

Deadlines: If you are interested in giving a talk, please submit a short abstract (maximum two pages) by October 10, 2001. Abstracts should be submitted via e-mail to any one of the organizers. Notification will be made on November 1, 2001.

Contacts: F. Hwang, Chiaotung Univ., fhwang@math.nctu.edu.tw; F. Roberts, DIMACS, Rutgers Univ., froberts@dimacs.rutgers.edu; D. Torney, Los Alamos National Labs, dct@lanl.gov.

Local Arrangements: J. Herold, DIMACS Center, jessicah@dimacs.rutgers.edu, 732-445-5928.

Information: <http://dimacs.rutgers.edu/Workshops/index.html>.

2-8 Quantum and Classical Integrability and Infinite Dimensional Systems, International Centre for Mathematical Sciences, Edinburgh, UK. (June/July 2001, p. 629)

Information: Please see the ICMS Web pages for further details on programme, speakers, registration, etc.: <http://www.ma.hw.ac.uk/icms/current/>.

3-7 LPAR'2001: 8th International Conference on Logic for Programming, AI and Reasoning, Havana, Cuba. (June/July 2001, p. 629)

Information: <http://www.lsi.upc.es/~roberto/lpar2001.html>.

3-7 Workshop on Applied Cryptology, Institute for Mathematical Sciences, National University of Singapore, Singapore. (June/July 2001, p. 629)

Organizing Committee: S.-P. Chan (Singapore), R. Deng (Singapore), S. Ling (Singapore), H. Niederreiter (Singapore, chair), E. Okamoto (Japan), I. E. Shparlinski (Australia), N. J. A. Sloane (USA), C. P. Xing (Singapore).

Description: The workshop is part of the inaugural program of the Institute for Mathematical Sciences on coding theory and data integrity which will run from July to December 2001. There will be invited talks and shorter contributed talks. Specific topics include (but are not limited to) software implementations, design of cryptochips, key management, quantum cryptography, security issues in applications (e-commerce, banking, mobile communications), and current standards.

Call for Papers: Authors of contributed papers should e-mail an abstract of 300–500 words to H. Niederreiter (nied@math.nus.edu.sg) by September 21, 2001. Authors of accepted papers will be notified by October 5, 2001.

Information: <http://www.ims.nus.edu.sg/programs/coding.html>.

3–8 NIPS 2001, Neural Information Processing Systems: Natural and Synthetic, Vancouver, Canada. (June/July 2001, p. 629)

Information: Submissions: due June 20, 2001. Contact nipsinfo@salk.edu, or see <http://www.cs.cmu.edu/Web/Groups/NIPS/>.

7–10 2001 Australasian Research Symposium on Lie Groups, Algebraic Groups, Quantum Groups, and Their Representations (LAQ'2001), The University of Auckland, Auckland, New Zealand. (June/July 2001, p. 629)

Organizers: R. Gover (Auckland), r.gover@auckland.ac.nz; and V. Pestov (Wellington), vova@mcs.vuw.ac.nz.

Information: <http://www.mcs.vuw.ac.nz/~vova/laq.html>.

10–13 International Congress on Modelling and Simulation-Modsim 2001, Australian National University, Canberra, Australia. (June/July 2001, p. 629)

Sponsor: IMACS.

Theme: Integrating Models for Natural Resources Management across Disciplines, Issues and Scales.

Information: F. Ghassemi, Centre for Resource and Environmental Studies, The Australian National University, Canberra ACT 0200, Australia; tel: 61 2 6249 0653; fax: 61 2 6249 0757; e-mail: fredg@cres.anu.edu.au; <http://cres.anu.edu.au/~tony/modsim2001.htm>.

10–14 ICMI Study Conference on the Future of the Teaching and Learning of Algebra, University of Melbourne, Australia. (Jan. 2001, p. 55)

Organizer: The International Commission on Mathematical Instruction (ICMI).

Program: This study is the twelfth in the series of studies organized by ICMI since 1985. The word "algebra" will be interpreted broadly to encompass the diversity of definitions around the world, extending beyond the standard curriculum in some countries. It will include, for example, algebra as a language for generalization, abstraction and proof; as a tool for problem solving through equation solving or graphing; and for modelling with functions; plus the way algebraic symbols and ideas are used in other parts of mathematics and other subjects. The principal interest of many participants is likely to be related to secondary school mathematics (ages 11–18) and algebra with real variables, but the study is also concerned with tertiary algebra (e.g., linear algebra and abstract algebra) and with algebra and its precursors for young children.

Call for Papers: Participation in the study conference will be by invitation, based on submitted papers. Details of the submission process and a more complete description of the project may be found at <http://www.edfac.unimelb.edu.au/DSME/icmi-algebra/>. Submissions may address any of a number of identified issues. New researchers and researchers from countries under-represented in mathematics education research meetings are especially invited to submit. The deadline for submissions is January 31, 2001.

Information: Study secretary: H. Chick, h.chick@edfac.unimelb.edu.au; Program chair: K. Stacey, k.stacey@edfac.unimelb.edu.au; <http://www.edfac.unimelb.edu.au/DSME/icmi-algebra/>.

10–14 Macroscopic Organisation from Microscopic Behaviour in Immunology, Ecology and Epidemiology, Isaac Newton Institute, Cambridge, UK. (May 2001, p. 531)

Themes: The purpose of this workshop is to bring together experimentalists and theoreticians working in immunology, ecology and epidemiology with the aim of fostering interaction and research.

Speakers: R. Antia (Emory), C. Bangham (Imperial College), S. Bonhoeffer (Friedrich Miescher Institute), C. Godfray (Imperial College), B. Grenfell (Cambridge), A. Hastings (UC Davis), S. Levin (Princeton), M. Lewis (Utah), A. Lloyd (Princeton), A. Perelson (Los Alamos), D. Rand (Warwick), A. Sasaki (Kyushu), L. Segel (Weizmann Institute), D. Wodarz (Institute for Advanced Study).

Location and Cost: The workshop will take place at the Newton Institute, and accommodations for participants will be provided in single study bedrooms with shared bathrooms at Wolfson Court, a hall of residence adjacent to the Institute. The workshop package costs £300, which includes registration fee, accommodations, breakfast, dinner, lunches, and refreshments on the days that lectures take place.

Further Information and Application Forms: These are available from the WWW at <http://www.newton.cam.ac.uk/programs/ICB/icbw03.html>, where further information about the workshop will be posted and updated. Completed application forms should be sent to M. Clark at the above address or via e-mail to m.clark@newton.cam.ac.uk. Scientific enquiries may be addressed to B. Sleeman (bds@amsta.leeds.ac.uk). Closing date for receipt of applications and abstracts is June 30, 2001.

10–14 QMath-8. Mathematical Results in Quantum Mechanics, Taxco, Mexico. (May 2001, p. 531)

Invited Speakers: J. M. Combes (Univ. de Toulon), M. Demuth (Technische Univ. Clausthal), V. Enss (RWTH-Aachen), A. Laptev (RIT, Stockholm), E. H. Lieb (Princeton Univ.), P.I. Naumkin (Univ. Michoacana), R. Schrader (Freie Univ. Berlin), B. Simon (California Institute of Technology), G. Uhlmann (Univ. of Washington), A. Uribe (Univ. of Michigan), K. Yajima (Univ. of Tokyo).

Topics: The following topics will be discussed: Bound state problems and scattering theory for Schrödinger operators; Inverse spectral and scattering theory of Schrödinger operators; Nonlinear Schrödinger equations; Quantum chaos, quantum dots and wave guides; Parameter dependent Hamiltonians; Spectral and localization properties of Schrödinger operators.

Conference Committee: A. Alonso y Coria, F. Brambila Paz, P. Exner, B. Grebert, R. Weder (chairman).

Information: <http://www.qmath-8.unam.mx/>; e-mail: mmnsec20@leibniz.iimas.unam.mx. QMath-8, Att. A. M. G. Ramirez, IIMAS-UNAM, Apartado Postal 20-726, Mexico, D.F. 01000, Mexico.

14–20 School on Quantum Markov Chains, Grand Hotel Bellavista, Levico, Terme (Trento), Italy. (Aug. 2001, p. 750)

Scientific Organizers: L. Accardi (Roma II) and T. Matsui (Fukuoka).

Deadline for Applications: September 30, 2001.
Information: A. Micheletti, Secretary of CIRM, Centro Internazionale per la Ricerca Matematica, Istituto Trentino di Cultura, 38050 Povo (Trento); tel: +39-0461-881628; telefax: +39-0461-810629; e-mail: michelet@science.unitn.it; <http://www.science.unitn.it/cirm/>.

15–19 The Sixth Asian Technology Conference in Mathematics (ATCM2001) (Applications of Technology in Teaching and Research for the 21st Century), RMIT University, Melbourne, Australia. (Apr. 2001, p. 439)

Program: ATCM 2001 is to provide an interdisciplinary forum for teachers, researchers, educators, and decision makers around the world in the fields of mathematics and mathematical sciences. It also provides a venue for researchers and developers of computer technology to present their results in using technology in both

basic research and pedagogical research and to exchange ideas and information in their latest developments. The conference will cover a broad range of topics on the relevancy of technology in mathematical research and teaching. These include, but are not limited to: Applications of computer algebra (systems) in research and teaching; Multimedia, computer-aided and distance in learning and teaching; Applications of graphing calculators in mathematical sciences; Mathematical research and teaching using technology; Mathematical tools and World Wide Web technology; Implementation of technology in education from K-12 to university level; Assessment of implementation of technology in education. The conference will consist of plenary sessions by invited speakers, parallel sessions of contributed papers, and tutorial sessions on software and hardware relevant to research and teaching. Books, software, and hardware may also be on display.

Deadlines: June 15, 2001: Deadline for submission of abstracts. July 31, 2001: Deadline for submission of full papers. August 31, 2001: Notification of acceptance.

Information: <http://www.cs.runet.edu/~atcm/ATCM01/>; e-mail: atcm@runet.edu/ or atcm01@rmit.edu.au.

17-19 Eighth Cryptography and Coding, Royal Agricultural College, Cirencester, UK. (Sept. 2000, p. 980)

Information: Pamela Bye, Conference Officer, The Institute of Mathematics and Its Applications, Catherine Richards House, 16 Nelson Street, Southend-on-Sea, Essex, SS1 1EF; tel: (01702) 354020; fax: (01702) 354111; e-mail: conferences@ima.org.uk; Web: <http://www.ima.org.uk/>.

17-21 2nd WSES Conference: Algorithms Theory, Discrete Mathematics, Systems and Control (ADISC 2001), Cairns, Queensland, Australia. (June/July 2001, p. 630)

Information: <http://www.worldses.org/wses/conferences/cairns/adisc/>.

17-22 First Announcement and Call for Papers, The Second International Congress of Chinese Mathematicians (ICCM 2001), The Grand Hotel, Taipei, Taiwan. (Apr. 2001, p. 439)

Description: The International Congress of Chinese Mathematicians is a triennial congress hosted by institutions in Mainland China, Taiwan, Hong Kong, and Singapore on a rotating basis. ICCM 2001 will have both plenary and invited addresses by distinguished researchers in every major field, as well as contributed talks and poster sessions. A list of plenary speakers can be found below in this announcement. Contributed papers on all major areas of mathematics are solicited. To make the congress a true worldwide gathering, all presentations will be given in English. ICCM 2001 will be dedicated to Professor Shiing-Shen Chern for his 90th birthday. A Lifetime Achievement Award and a Gold Medal will be awarded to Professor Chern at the opening ceremony of ICCM 2001.

Morningside Awards: The Morningside Medals were established, through the Morningside Foundation, Hong Kong, to encourage outstanding young mathematicians of Chinese descent in their pursuit of mathematical truths. Up to three gold medals, carrying a cash award of US\$25,000, and six silver medals, carrying a cash award of US\$6,250, will be awarded. Medalists are selected by a panel of internationally renowned mathematicians. The recipients will be announced during the award ceremony at the opening of ICCM 2001.

Plenary Speakers: C.-L. Chai (Univ. Penn.), T. Chan (UCLA), S. Chen (Fudan Univ., China), W. E (Princeton Univ.), J.-S. Li (Hong Kong UST), F.-H. Lin (NYU), A.-K. Liu (Berkeley Univ.), K. Liu (UCLA), Y.-T. Siu (Harvard Univ.), C.-L. Terng (Northeastern Univ.), D.-Q. Wan (UC Irvine), W. Wong (Harvard Univ.), A. Yao (Princeton Univ.), L.-S. Young (NYU), J. Yu (Academia Sinica, Taiwan), X. Zhou (Duke Univ.).

Call for Contributions: Papers on all aspects of mathematics are solicited. Plenary lectures and 45-minute talks by distinguished scientists who have played a significant role in the advancement of mathematics and its applications will be scheduled in the scientific program. Nonplenary lectures will be held in several parallel sessions, spanning a broad range of mathematics. The

official congress language will be English.

Information: Up-to-date information about all aspects of ICCM 2001 is available on the following Web site: <http://iccm2001.cts.nthu.edu.tw/>. It includes an application for entrance visa to Taiwan, accommodations, registration, and abstract submission, etc. Correspondence or questions regarding this congress should be directed to iccm2001@cts.nthu.edu.tw. The address, phone, and fax numbers of ICCM 2001 are: ICCM 2001, c/o National Center for Theoretic Sciences, National Tsing Hua University, Hsin-Chu 300, Taiwan; tel: +886-3-574-5254; fax: +886-3-572-8168.

19-21 International Conference on Statistics, Combinatorics and Related Areas and The Eighth International Conference of the Forum for Interdisciplinary Mathematics, University of Wollongong, Wollongong, NSW, Australia. (Mar. 2001, p. 338)

Conveners: S. N. Mishra, President of the Forum, Department of Mathematics and Statistics, Univ. of South Alabama, Mobile, AL 36688-0002; tel: +1-334-461-1642; fax: +1-334-460-7969; mishra@mathstat.usouthal.edu; C. M. Gulati, School of Mathematics and Applied Statistics, Univ. of Wollongong, Wollongong, NSW 2522, Australia; tel: +61-2-4221-3836; fax: +61-2-4221-4845; chandra_gulati@uow.edu.au.

Information: <http://www.uow.edu.au/informatics/maths/statconference/>.

January 2002

6-9 Joint Mathematics Meetings, San Diego Convention Center, San Diego, California. (Nov. 1998, p. 1378)

Information: Information will appear on the meetings pages on the AMS website.

7-12 School on Stochastic Partial Differential Equations and Applications-VI, Grand Hotel Bellavista, Levico, Terme (Trento), Italy. (Aug. 2001, p. 750)

Scientific Committee: G. Da Prato (S.N.S. Pisa), D. Nualart (Barcelona), E. Pardoux (Marseille), M. Roeckner (Bielefeld), and L. Tubaro (Trento).

Information: A. Micheletti, Secretary of CIRM, Centro Internazionale per la Ricerca Matematica, Istituto Trentino di Cultura, 38050 Povo (Trento); tel: +39-0461-881628; telefax: +39-0461-810629; e-mail: michelet@science.unitn.it; <http://www.science.unitn.it/cirm/>.

9-12 International Conference on Inverse Problems—Recent Development in Theories and Numeric, City University of Hong Kong, Hong Kong. (June/July 2001, p. 630)

Objective: The purpose of this conference is to establish a first and strong collaboration link between the universities of Hong Kong and worldwide leading researchers in inverse problems. The conference will address both theoretical (mathematics), applied (engineering) and development aspects of inverse problems.

Topics: Financial Problems, Image Processing Problems, Inverse Problems Related to the Industries, Medical Problems, Nodal Problems, Optimization Problems, Parameter Identification and Control, Sampling Problems, Spectral Problems. The following recent theoretical developments and numerical approaches related to the above topics are emphasized: Well-Posedness, Uniqueness, Stability, Reconstruction Scheme, Numerical Methods.

Invited Plenary Speakers (keynote talks): G. Bao (Michigan Univ.), J. Cheng (Fudan Univ., China), V. Isakov (Wichita State Univ., KS), P. C. Sabatier (Univ. des Sciences et Techniques du Languedoc, France),

Invited Speakers (introductory talks): D. Anikonov (Inst. of Applied Mathematics, Vladivostok, Russia), H. Engl (Johannes Kepler Univ., Linz, Austria), J. Frankel (Tennessee Univ.), D. Fujiwara (Kyoto Univ., Japan), A. Kirsch (Fridericiana Karlsruhe Univ., Germany), J. S. Pang (The Johns Hopkins Univ.), J. K. Seo (Yonsei Univ., Korea), K. Tanuma (Osaka Kyoiku Univ., Japan), D. D. Trong (Ho Chi Ming City Univ., Vietnam), J. Z. Zhang (City Univ. of Hong Kong).

Call for Papers: Titles and abstracts of contributed papers must be received by August 31, 2001. The abstracts should be typed in \LaTeX , not to exceed one A4 page, and sent to the secretary by e-mail.

Address: J. Hui, Secretary, Department of Mathematics, City Univ. of Hong Kong, 83 Tat Chee Avenue, Kowloon Tong, Hong Kong; tel: (852) 2788 7140; fax: (852) 2788 8561; e-mail: maip@cityu.edu.hk.

*11-15 NSF-CBMS Regional Research Conference Arrangements and Mathematical Physics, Louisiana State University, Baton Rouge, Louisiana.

Organizer: D. C. Cohen.

Focus: The focus of this conference will be on hyperplanes arrangements, multivariable hypergeometric functions, and their applications in mathematical physics. The principal lecturer, Alexander Varchenko, will deliver a series of ten lectures entitled "Arrangements, Hypergeometric Functions, and KZ-Type Equations". There will also be a limited number of talks by other speakers.

Information: <http://www.math.lsu.edu/~cbms/>; e-mail: cbms@math.lsu.edu.

14-17 International Conference on Combinatorial Matrix Theory, Postech, Pohang, Korea. (June/July 2001, p. 630)

Conference Themes: Combinatorics, combinatorial matrix theory and related areas of computational and core matrix theory.

Conference Chairs: R. A. Brualdi (Univ. of Wisconsin-Madison, brualdi@math.wisc.edu), S.-G. Hwang (Kyungpook Univ., Korea, sghwang@knu.ac.kr).

Invited Speakers: R. Brualdi, A. Kraeuter, B. Shader, J.-Y. Shao, S. Kirkland (plenary), J. Shen (plenary), D. Hershkowitz, J. Seberry, C. Onn, K. Okubo, Y. Nam, B. Liu, I. Wanless, M. Fiedler, T.S. Michael, J. Li, P. Tetali, F. Zhang, L. Qiao, W. Haemers, B.-S. Tam, C. Johnson.

Call for Papers: The program will consist of hour-long or 40-minute invited lectures and 25-minute contributed talks. Abstracts, at most one page and typed in English, are invited by June 15, 2001.

Information: e-mail: sglee@math.skku.ac.kr; fax: 82-31-290-7033; mailing address: Co-organizer, International Conference on Combinatorial Matrix Theory, Department of Mathematics, College of Science, SungKyunKwan University, Suwon 440-746, Korea; <http://matrix.skku.ac.kr/sglee/postech/postech.htm>.

*21-25 2nd MaPhySto Conference on Lévy Processes—Theory and Applications, University of Aarhus, Denmark.

Description: This conference is a sequel to the international conference with the same title, organized by MaPhySto January 7-22, 1999.

Organizing Committee: K.-I. Sato (Nagoya Univ.), T. Mikosch (Univ. of Copenhagen), E. Nicolato (Univ. of Aarhus), G. Peskir (Univ. of Aarhus), O. E. Barndorff-Nielsen (Univ. of Aarhus).

Information: Regularly updated information can be obtained from <http://www.mapzysto.dk/events/2ndLevyConf2002/>.

21-28 Winter School on Computations in Coxeter Groups, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada.

Organizers: W. Casselman (UBC), R. Bédard (UQAM), F. Du Cloux (Lyon I).

Description: These short courses are designed to show how techniques from computer algebra can be applied to effective computation in Coxeter groups.

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

28-February 1 The International Conference on Factorization, Singular Operators and Related Problems, Dedicated to the 70th Anniversary of Professor Gueorgui Litvinchuk, Madeira University, Madeira, Portugal. (June/July 2001, p. 630)

Scientific Program Committee: A. Antonevich (Belarussia), A. Boettcher (Germany), B. Bojarskii (Poland), R. Duduchava (Georgia), M. Kaashoek (Netherlands), N. Karapetiants (Russia), Yu. Karlovich (Mexico), V. Kokilashvili (Georgia), N. Krupnik (Israel), V. Mazya

(Sweden), V. Rabinovich (Mexico), B. Silbermann (Germany), I. Simonenko (Russia), I. Spitkovsky (USA), N. Vasilevskii (Mexico).

Information/Registration: <http://www.digiways.com/fsorp/>.

February 2002

2-3 9th Southern California Geometric Analysis Seminar, University of California at Irvine. (June/July 2001, p. 630)

Description: There will be six top mathematicians in geometric analysis giving talks. Enough time will be allowed for participants to communicate with each other in this two-day seminar.

List of Speakers: TBA.

Information: <http://www.math.uci.edu/~scgas/>. Contact Z. Lu, zlu@math.uci.edu.

27-March 3 Group Actions on Rational Varieties, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 750)

Organizer: P. Russell (McGill).

Focus: The workshop will focus on recent developments in automorphisms of affine spaces and related algebraic varieties with simple topology, in particular exotic affine spaces (algebraic varieties homeomorphic to an affine space).

Participants: T. Asanuma (Toyama), T. Bandman (Bar-Ilan), D. Daigle (Ottawa), A. Van den Essen (Nijmegen), G. Freudenburg (Southern Indiana), M. Gizatullin (UTFSM), R. Gurjar (Tata), I. Dolgachev (Michigan), J. Winkelmann (Bochum), S. Kaliman (Miami), K. Masuda (Himeji), F. Knop (Rutgers), M. Koras, H. Kraft (Basel), L. Makar-Limanov (Wayne State), L. Moser-Jauslin (Bourgogne), M. Miyanishi (Osaka), P. Cassou-Nogues (Bordeaux), V. Popov (MIEM), A. Sathaye (Kentucky), G. Schwarz (Brandeis), D. Wright, M. Zaidenberg (Grenoble), D. Zhang (Singapore).

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

March 2002

*15-17 The 49th Midwest Partial Differential Equations Seminar in Honor of David Adams, Ron Gariepy and John Lewis, University of Kentucky, Lexington, Kentucky.

Description: This conference will honor the achievements of D. Adams, R. Gariepy and J. Lewis on the occasion of their sixtieth birthdays. The speakers will discuss problems in the areas related to the research of these mathematicians, including elliptic partial differential equations, potential theory, and harmonic analysis.

Confirmed Speakers: M. G. Crandall, H. J. Choe, L. C. Evans, D. Danielli, B. Hardt, J. Heinonen, S. Hofmann, C. E. Kenig, M. Pierre, A. Vogel, C. Wang, W. P. Ziemer.

Organizing Committee: R. Brown, P. Hislop, Z. Shen.

Financial Assistance: Funds are available to support participants. Priority will be given to students and recent Ph.D.'s as well as members of underrepresented groups. This conference is supported by the NSF, the University of Kentucky, and the Institute for Mathematics and its Applications as part of its participating institutions (PIs) conference series. Participants from PIs may attend the conference with PI funds.

Information: <http://www.ms.uky.edu/~midwpde/>, or contact Z. Shen at Dept. of Math., Univ. of Kentucky, Lexington, KY 40506 (shenz@ms.uky.edu).

*18-20 International Conference on Algebra and Its Applications, Chulalongkorn University, Bangkok, Thailand.

Information: W. Hemakul, Dept. of Math., Chulalongkorn Univ., Bangkok 10330, Thailand; Wanida.H@Chula.ac.th.

21-22 8th Rhine Workshop on Computer Algebra, Mannheim, Germany. (May 2001, p. 531)

Topics: The topics of the workshop include all aspects of computer algebra, from theory to applications and systems.

Information: Updated information is available on the WWW at <http://www.uni-mannheim.de/RWCA/>.

21–23 Spring Topology and Dynamics Conference, University of Texas, Austin, Texas. (Aug. 2001, p. 751)

Program: The areas covered will include set-theoretic topology, continuum theory, dynamical systems, geometric topology, and geometric group theory. The program will include both invited and contributed talks.

Organizing Committee: C. Gordon, J. Luecke, A. Reid.

26–30 The 2002 UAB International Conference on Differential Equations and Mathematical Physics, University of Alabama at Birmingham, Birmingham, Alabama. (Aug. 2001, p. 751)

Program: Topics in the general area of linear and nonlinear differential equations and their relation to mathematical physics will be emphasized. This will include topics such as the analysis of Schrödinger operators, quantum electrodynamics, fluid dynamics, conservation laws, evolution equations, spectral and scattering theory including inverse problems, wave transport in disordered media, dynamical systems, as well as related topics.

Organizing Committee: Y. Karpeshina, G. Stolz, R. Weikard, Y. Zeng.

Plenary Speakers: M. Aizenman, Princeton Univ.; J. Fröhlich, ETH, Zürich; F. Gesztesy, Univ. of Missouri; J. Glimm, SUNY at Stony Brook; S. Jitomirskaya, UC Irvine; A. Laptev, KTH, Stockholm; J. Lebowitz, Rutgers Univ.; E. Lieb, Princeton Univ.; T.-P. Liu, Stanford Univ. and Academia Sinica (Taiwan); J. Sjöstrand, École Polytechnique, Paris; R. Weder, UNAM, Mexico City.

Special Sessions (organizer in parentheses): Conservation Laws (G.-Q. Chen, Northwestern Univ.); Dynamics and Mathematical Physics (N. Simanyi, UAB); Incompressible Flow (S. Friedlander, Univ. of Illinois at Chicago); Inverse Problems (J. McLaughlin, Rensselaer); Quantum Mechanics and Spectral Theory (G. M. Graf, ETH, Zürich); Spectral Problems in Solid State Physics (P. Kuchment, Wichita).

Information: <http://www.math.uab.edu/uab02/>.

26–April 4 Instructional Conference on Combinatorial Aspects of Mathematical Analysis, International Centre for Mathematical Sciences, Edinburgh, UK. (June/July 2001, p. 630)

Information: Please see the ICMS Web pages for further details on programme, speakers, registration, etc.: <http://www.ma.hw.ac.uk/icms/current/>.

April 2002

8–19 Invariant Theory, Queen's University, Kingston, Ontario, Canada. (Aug. 2001, p. 751)

Organizers: D. Wehlauf (Queen's), E. Campbell (Queen's).

Description: The first week will be devoted to introductory lectures aimed at graduate students by P. Fleischmann (Kent), H. Kraft (Basel), G. W. Schwarz (Brandeis), and H. Derksen (MIT). The second week will be devoted to a workshop on invariant theory.

Other Invited Speakers: M. Brion, B. Broer, C. De Concini, L. Helminck, M. Hunziker, G. Kemper, N. Kechagias, F. Knop, P. Littelmann, L. Moser-Jauslin, V. Popov, Y. Sanderson, R. J. Shank, N. Thiery, W. van der Kallen, E. Vinberg.

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

30–May 17 Concentration Period on the Langlands Programme for Function Fields, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 751)

Organizers: H. Darmon (McGill), J. Hurtubise (CRM).

Description: A three-week extended workshop, with the first two weeks devoted to survey lectures for graduate students: Week 1: Survey lectures on preliminary material: stacks, chtoucas, perverse

sheaves and D-modules,opers. Lectures by D. Ben Zvi (Chicago), D. Goss (Ohio State), A. Polishchuk (Boston), Ch. Sorger (Nantes), K. Vilonen (Northwestern). Week 2: Aisenstadt lectures given by L. Lafforgue (IHES) and E. Frenkel (Berkeley) covering recent results in the Langlands programme over function fields, in both characteristic 0 and characteristic p. During the first two weeks, R. Langlands will also give a series of lectures. Week 3: A conference, celebrating Robert Langlands's 65th birthday. The concentration period is to be followed by the 2002 Canadian Number Theory Association conference.

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

May 2002

20–25 6th International Conference on Clifford Algebras and Their Applications in Mathematical Physics, Tennessee Technological University, Cookeville, Tennessee. (Aug. 2001, p. 751)

Description: This is a continuation of a 16-year-old sequence of international conferences devoted to the mathematical aspects of Clifford algebras and their varied applications in mathematical physics, cybernetics, robotics, image processing, and engineering.

Information: See <http://math.tntech.edu/rafa1/cookeville/cookeville.html>, or contact the organizers: R. Ablamowicz, rablamowicz@tntech.edu; Dept. of Math., Box 5054, Tennessee Technological Univ., Cookeville, TN 38505; tel 931-372-3441, 372-3569; fax: 931-372-6353; home page: <http://math.tntech.edu/rafa1/>; and J. Ryan, jryan@comp.uark.edu; Dept. of Math., Univ. of Arkansas, Fayetteville, AR 72701; tel: 501-575-6334; fax: 501-575-8630; home page: <http://comp.uark.edu/~jryan/>.

24–27 The Fourth International Conference on "Dynamical Systems and Differential Equations", University of North Carolina at Wilmington, Wilmington, North Carolina. (Aug. 2001, p. 751)

Format: Plenary invited one-hour lectures, minisymposia (45-minute talks), special sessions (30-minute talks), and contributed sessions (20-minute talks).

Invited Speakers: M. Ghil, A. Giorgilli, T. Hou, H. Matano, W.-M. Ni, H. Othmer, C. V. Pao, N. S. Papageorgiou, P. Rabinowitz, M. Viana.

Topics: Analysis, applied analysis, differential equations and dynamical systems, in the broadest sense. Applications to real-world problems, including chemical, physical, and life sciences, in the forms of mathematical modeling and computations.

Call for Papers: Contributed papers are invited. Abstracts must be submitted by February 15, 2002, to X. Lu, Chair of Local Organizing Committee, Dept. of Mathematics & Statistics, Univ. of North Carolina at Wilmington, Wilmington, NC 28403. If you are interested in organizing a special session for the conference, please contact: S. Hu (shh209f@smsu.edu), Dept. of Math., Southwest Missouri State Univ., Springfield, MO 65804.

Deadlines: Abstracts: February 15, 2002; Preregistration: March 15, 2002 (both form and fees).

Information: Contact: X. Lu (lux@uncwil.edu; tel: 910-962-3673; fax: 910-962-7107), Dept. of Math. & Stat., Univ. of North Carolina at Wilmington, Wilmington, NC 28403. Or visit <http://www.uncwil.edu/mathconf/> for more detailed and regularly updated information (such as travel, hotel, abstract submission, proceedings, etc.) and downloadable registration forms.

27–June 10 Computational Lie Theory, Centre de Recherches Mathématiques (CRM), Université de Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 751)

Organizers: W. Casselman (UBC) and F. Knop (Rutgers).

Focus: This extended workshop is aimed at researchers interested in explicit computations in Lie theory, in particular Coxeter groups. In addition to the usual talks, there will also be several series of survey lectures suitable for graduate students by M. Brion (Grenoble), M. Geck (Lyon), F. Knop (Rutgers), P. Littelmann (Wuppertal), G.

Olshanskii (IITP), and J. Stembridge (Michigan). G. Lusztig (MIT) will be delivering some of his Aisenstadt lectures during the period of the conference.

Invited Participants: D. L. Alvis (Indiana), A. A. Klyachko (Bilkent), R. Bédard (UQAM), R. Bezrukavnikov (Chicago), S. Billey (MIT), M. Brion (Joseph Fourier), I. Cherednik (North Carolina), F. du Cloux (Lyon I), M. J. Dyer (Notre Dame), W. Fulton (Michigan), M. Geck (Lyon), M. Haiman (North Carolina, San Diego), G. J. Heckman (Nijmegen), A. G. Helminck (Carolina), F. Knop (Rutgers), S. Kumar (North Carolina at Chapel Hill), P. Littelmann (Bergische), R. MacPherson (IAS), J. McKay (Concordia), M. Noumi (Kobe), A. Okounkov (California, Berkeley), G. Olshanski (Moscow), E. M. Opdam (Amsterdam), A. Ram (Wisconsin), Y. B. Sanderson (William Paterson), T. A. Springer (Utrecht), J. R. Stembridge (Michigan), B. Sturmfels (California, Berkeley), P. Trapa (Harvard), J. F. van Diejen (Chile), M. van Leeuwen (Poitiers), D. A. Vogan Jr. (MIT), N. R. Wallach (California, San Diego), G. S. Warrington (Harvard), A. Zelevinski (Northeastern).

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, (Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

June 2002

*4-13 3rd Linear Algebra Workshop, Bled, Slovenia.

Program: The main theme of the meeting is the interplay between operator theory and algebra. A few hours of talks are scheduled for the morning sessions, while afternoons are reserved for work in smaller groups.

Organizers: R. Drnovsek, T. Kořir, M. Omladić.

Scientific Organizing Committee: R. Drnovsek, L. Grunenfelder, T. Kořir, M. Omladić, H. Radjavi.

Information: All information can be found on the Web site: <http://www.ijp.si/ftp/pub/stop/law/>.

10-13 The Tenth Conference of the International Linear Algebra Society, Auburn University, Auburn, Alabama. (June/July 2001, p. 630)

Theme: The theme of the conference is "Challenges in Matrix Theory" and will encompass all branches of linear algebra and matrix theory, i.e., core, applied, and numerical.

Information: More details on the conference, such as the list of invited speakers, social events, travel, registration, and hotel information, as well as abstract deadlines, etc., will be made available on the dedicated Web site <http://www.auburn.edu/event/ilas2002/> and on ILASNET.

10-15 Algebraic Transformation Groups, Centre de Recherches Mathématiques (CRM), Université e Montréal, Montréal (Québec), Canada. (Aug. 2001, p. 752)

Organizers: A. Broer (Montréal) and J. Carrell (UBC).

Description: The purpose of the meeting is to bring together experts in algebraic groups, algebraic geometry, representation theory and related areas, especially those touching on: geometric methods in representation theory using tools like equivariant cohomology and perverse sheaves, the Hilbert scheme of points on a surface and its connection with the $n!$ -conjecture in algebraic combinatorics, equivariant versions of cohomology and Chow groups related to flag manifolds and Schubert varieties, quantum cohomology and Schubert calculus.

Participants: A. Bertram (Utah), M. Brion (Grenoble), C. De Concini (Rome), W. Fulton (Michigan), V. Ginzburg (Chicago), M. Haiman (UCSD), M. Kapranov (Toronto), A. Knutson (Berkeley), B. Kostant (MIT), S. Kumar (North Carolina), L. Manivel (Grenoble), E. Meinrenken (Toronto), I. Mirkovic (Massachusetts), H. Nakajima (Kyoto), D. Peterson (UBC), C. Procesi (Rome), E. Vasserot (Cergy-Pontoise), C. Woodward (Rutgers).

Information: Those wishing to participate in the above activities are invited to write to: L. Pelletier, Centre de Recherches Mathématiques (CRM), Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal,

(Québec), Canada H3C 3J7; e-mail: ACTIVITES@CRM.UMontreal.CA; or visit <http://www.CRM.UMontreal.CA/geometry/>.

10-16 Aarhus Topology 2002, University of Aarhus, Aarhus, Denmark. (Jan. 2001, p. 55)

Description: The 6th Aarhus Topology Conference, celebrating Madsen's sixtieth birthday.

Organizing Committee: J. Dupont (chair), H. J. Munkholm, L. Hesselholt, L. Fajstrup.

Information: <http://www.math.auc.dk/~fajstrup/AT2002/index.html>.

17-21 Seventh International Conference on p-Adic Functional Analysis, University of Nijmegen, The Netherlands. (June/July 2001, p. 630)

Program: Research talks on analysis over valued fields other than the real or complex numbers (such as the p-adic number field or Krull valued fields). Main mathematics subject classifications: 46S10, 47S10, 32P05, 26E30.

Scientific Committee: W. Schikhof (Nijmegen, The Netherlands), A. Escassut (Clermont Ferrand, France), C. Perez-Garcia (Santander, Spain).

Speakers (preliminary list): J. Araujo, J. M. Bayod, M. Berz, A. Boutabaa, B. Diarra, A. Escassut, N. De Grande-De Kimpe, L. Van Hamme, J. Kakol, A. Katsaras, H. Keller, A. Khrennikov, A. Kochubei, A. Lemin, H. Ochsenius, C. Perez-Garcia, D. Pombo Jr., S. Priess, P. Ribenboim, A. Salinier, W. Schikhof, N. Shell, W. Sliwa, S. Vega.

Information: <http://www.sci.kun.nl/math/p-adic2002/> or e-mail: schikhof@sci.kun.nl.

23-28 Fourteenth U.S. National Congress of Theoretical and Applied Mathematics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia. (Dec. 2000, p. 1437)

Sponsors: The U.S. National Committee on Theoretical and Applied Mechanics and its participating societies: Acoustical Society of America, American Institute of Aeronautics and Astronautics, American Institute of Chemical Engineers, American Mathematical Society, American Physical Society, American Society of Testing and Materials, American Society of Civil Engineers, American Society of Mechanical Engineers, Society for Experimental Mechanics, Society for Industrial and Applied Mathematics, Society for Naval Architects and Marine Engineers, Society of Engineering Science, Society of Rheology.

Scientific Program Committee: F. Hussain, cochair; M. W. Hyer, cochair; R. J. Adrian; S. A. Berger; B. J. Cantwell; H. G. Hornung; G. Homsy; J. L. Junkins; F. C. Moon; Y. D. S. Rajapakse; J. Riley; W. N. Sharpe, Jr.; C. Wark.

Program: The scientific sessions of the congress will consist of general lectures, topical symposia of invited papers, and contributed paper sessions. Contributed papers are solicited in all areas of applied mechanics. Final selection for presentation will be made by the Scientific Committee of the congress based on 300-word abstracts submitted by January 31, 2002.

Abstract Submission: Prospective presenters are invited to either mail 3 copies of a one-page abstract or submit by e-mail, by fax (540-231-4574), or on the conference Web site (preferred mode of submission). Include on the abstract page: the author's name(s) (if multiple authors, indicate contact person), business affiliation(s), address(es), e-mail(s), phone and fax numbers, and up to 5 key words. See addresses below.

Information: Inquiries regarding the congress should be addressed to: USNCTAM14, ESM Department, Mail Code 0219, Virginia Tech, Blacksburg, VA 24061; e-mail: usncam14@vt.edu; tel: 540-231-5045 or 6505; fax: 540-231-4574. Congress Web site: <http://www.esm.vt.edu/usncam14/>.

30-July 14 5th Summer School/Conference: Let's Face Chaos through Nonlinear Dynamics, Maribor, Slovenia. (Aug. 2001, p. 752)

Program: Nonlinear dynamics, synergetics, physics of complex systems in pure and applied sciences, including pure and applied mathematics, theoretical and experimental physics, biophysics and

physiology, chemistry, astrophysics, econophysics, technology and engineering, and even sociology.

Organizers: M. Robnik, G. Casati, P. Cvitanovic, S. Grossmann, H. Haken, T. Bountis, H. Hasegawa, J.-L. Pichard, T. Prosen, A. Stefanovska.

Information: <http://www.camtp.uni-mb.si/chaos/2002/>.

July 2002

1-6 2nd International Conference on the Teaching of Mathematics, Island of Crete, Greece. (June/July 2001, p. 631)

Sponsors: Capital Univ., ETH-Zurich, Harvey Mudd College, The Ohio State Univ., Univ. of Crete, John Wiley & Sons.

Organizers: I. Vakalis, Capital Univ.; D. Hughes Hallett, Univ. of Arizona; C. Kourouniotis, Univ. of Crete, Greece; C. Tzanakis, Univ. of Crete, Greece.

Scope: The conference will address new ways of teaching undergraduate mathematics. It will provide a unique and centralized forum and bring together faculty members from countries with varied educational systems who are committed to introducing innovative teaching methods and new pedagogies. The conference will be of great interest to mathematics faculty as well as to anyone involved in the teaching and learning of mathematics.

Invited Speakers: (The following are confirmed speakers. List updated as invitations are accepted.) H. Bass, D. Ball (Univ. of Michigan); O.-N. Kwon (Ewha Women's Univ., Korea); A. Schoenfeld (UC, Berkeley); M. de Guzman (Univ. Complutense de Madrid, Spain); J. P. Bourguignon (Institut des Hautes Études Scientifiques, France); D. Smith (Duke Univ.).

Format of Proposals/Deadlines: Contributed papers will be 30-minute presentations. Proposals for papers and poster sessions should contain: (a) an identification of the proposal as an oral or poster presentation, (b) title and names of authors (full address and e-mail of the contact author), (c) a one-page abstract. More detailed submission guidelines and procedures will be posted on the Web site during summer 2001. Electronic submissions to: D. Quinney, Dept. of Mathematics, Keele University, UK; e-mail: D.Quinney@Keele.ac.uk.

Submission of Proposals: (received by): November 10, 2001; Notification to authors (sent by): January 15, 2002; Submission of full paper: February 28, 2002.

Information: <http://www.math.uoc.gr/~ictm2/>.

* **13-19 Symbolic Computational Algebra 2002: Fields Institute Special Meeting on Symbolic and Numeric Computation in Geometry, Algebra and Analysis**, Univ. of Western Ontario, London, Ontario, Canada.

Organizers: R. Corless, E. Green, S. Hosten, R. Laubenbacher, V. Powers, G. Reid.

Focus: A pre-conference workshop (July 13-14, 2002) is aimed at graduate students, nonspecialists, and researchers wishing to enter the field. The conference (July 15-19, 2002) will focus on recent theoretical developments in computational algebra and geometry, together with new applications and implementations using symbolic manipulation. Application areas include: differential and polynomial equation solving, coding theory, symbolic-numeric methods, signal processing, and invariantized methods.

Information: <http://www.orcca.on.ca/sca2002/>;
e-mail: sca2002@orcca.on.ca.

14-18 The Fourth International Conference on Matrix Analytic Methods in Stochastic Models, University of Adelaide, Adelaide, Australia. (June/July 2001, p. 631)

Scope: The conference will provide an international forum for the presentation of recent results on matrix-analytic methods in stochastic models. Its scope includes development of the methodology as well as the related algorithmic implementations and applications in communications, production and manufacturing engineering; it also includes computer experiments in the investigation of specific probability models. The program committee would particularly like to encourage submissions that report the application of ma-

trix analytic methods to practical problems which have arisen in industry.

Submission Procedure: Prospective authors are invited to submit a full paper. Manuscripts should be original, as they will be peer refereed, with the conference proceedings being published for broad circulation.

Deadlines: Full paper submission: September 1, 2001. Notification of acceptance/revision required/rejection: December 21, 2001. Revised version due: March 1, 2002. Final notification for papers with delayed decision: March 15, 2002.

Student Papers: The organizers wish to encourage students to attend the conference. To that effect, financial assistance will be made available on a limited basis and a streamlined submission procedure will be implemented. Details will be published on the conference Web page.

Information: <http://www.trc.adelaide.edu.au/mam4/>. Queries should be addressed to MAM4@trc.adelaide.edu.au.

August 2002

3-10 Logic Colloquium 2002 (ASL European Summer Meeting), Westfälische Wilhelms-Universität, Münster, Germany. (June/July 2001, p. 631)

Invited One-Hour Talks: J. Avigad (Pittsburgh, PA), A. Beckmann (Münster), T. Carlson (Columbus, OH), R. Constable (Ithaca, NY), K. Dosen (Toulouse), M. Gitik (Tel Aviv), V. Halbach (Konstanz), B. Khoussainov (Auckland), S. Lempp (Madison, WI), T. Pitassi (Tucson, AZ), R. Schindler (Wien), K. Tent (Würzburg).

Tutorials: L. Beklemishev (Moscow/Utrecht), S. Cook (Toronto, ON), O. Lessmann (Chicago, IL), S. Thomas (Piscataway, NJ).

Special Sessions: Computability Theory, Non-monotonic Logic, Set Theory.

Information: <http://www.math.uni-muenster.de/LC2002/>.

* **5-9 Conference on Ill-Posed and Inverse Problems**, Sobolev Institute of Mathematics, Novosibirsk, Russia.

Organizers: Sobolev Institute of Mathematics, Novosibirsk State University.

International Program Committee: V. G. Romanov (chair), Sobolev Inst. of Math., Novosibirsk, Russia; Ju. E. Anikonov, Sobolev Inst. of Math., Novosibirsk, Russia; M. I. Belishev, Steklov Math. Inst., Sankt-Petersburg Division, Sankt-Petersburg, Russia; A. L. Bukhgiem, Sobolev Inst. of Math., Novosibirsk, Russia; D. Colton, Univ. of Delaware, Newark, USA; A. M. Denisov, Moscow State Univ., Moscow, Russia; H. W. Engl, Industrial Math. Inst., Johannes Kepler Univ., Linz, Austria; A. M. Fedotov, Inst. of Comput. Tech., Novosibirsk, Russia; Y. Iso, Kyoto Univ., Kyoto, Japan; S. I. Kabanikhin (vice-chair), Sobolev Inst. of Math., Novosibirsk, Russia; O. A. Klimenko (secretary), Sobolev Inst. of Math., Novosibirsk, Russia; R. Kress, Inst. for Numerical and Appl. Math., Goettingen, Germany; M. M. Lavrent'ev Jr., Sobolev Inst. of Math., Novosibirsk, Russia; A. Lorenzi, Milan Univ., Milan, Italy; G. I. Marchuk, Inst. of Comput. Math., Moscow, Russia; Z. Nashed, Univ. of Delaware, Newark, USA; P. Sabatier, Montpellier Univ., France; O. Scherzer, Univ. of Bayreuth, Germany; S. I. Smagin, Computing Center, Khabarovsk, Russia; V. N. Strakhov, Inst. of Physics of Earth, Moscow, Russia; Y. M. Sultangazin, Inst. of Space Investigations, Alma-Ata, Kazakhstan; J. Sylvester, Univ. of Washington, Seattle, USA; G. Uhlmann, Univ. of Washington, Seattle, USA; V. V. Vasin, Inst. of Math. and Mech., Ekaterinburg, Russia; A. G. Yagola, Moscow State Univ., Moscow, Russia; Sh. Yarmuhamedov, Samarkand State Univ., Samarkand, Uzbekistan.

Information: Further information is available at <http://www.math.nsc.ru/conference/mml>.

5-15 New Directions in Dynamical Systems 2002 (ICM 2002 Satellite Conference), Ryukoku University and Kyoto University, Kyoto, Japan. (June/July 2001, p. 631)

Objective: The objective of the conference is to stimulate the exchange of new ideas in various fields of dynamical systems. Any field of dynamical systems theory will be treated in NDDS2002,

with special emphasis on new directions of research for future development. The topics include: smooth dynamical systems, complex dynamical systems and foliations, ergodic theory, Hamiltonian systems, low-dimensional dynamics, topological methods, rigidity, bifurcation theory.

Program: The conference will consist of two parts: The first week is mainly formed by a series of lectures on selected topics. This will be held at Ryukoku University from August 5 to 9. The second week is formed by invited and contributed talks, including short communications, which will be held at Kyoto University from August 11 to 15.

Invited Speakers: M. Lyubich (SUNY, Stony Brook), L.-S. Young* (Courant Institute), E. R. Pujals (UFRJ), J. Xia (Northwestern Univ.) (* to be confirmed).

Plenary Lecturers: V. Baladi (Univ. de Paris-Sud), V. Y. Kaloshin (Princeton Univ.), C. McMullen (Harvard Univ.), J. Palis (IMPA), M. Shub (IBM Watson), M. Viana (IMPA), J.-C. Yoccoz* (College de France), J. Yorke (Univ. of Maryland) (* to be confirmed).

Information: <http://ndds.math.h.kyoto-u.ac.jp/>.

*12–16 **Integrability and Topology**, South Ural State University, Chelyabinsk, Russia.

Scope: Integrable and partly integrable systems in mathematical physics, topology of manifolds, the interface between mathematical physics and topology.

Purpose: The very same mathematical structures often arise in both the theory of integrable systems of mathematical physics and topology. It is enough to mention the Yang-Baxter equation with its generalizations, such as tetrahedron equation, and the pentagon equation (and its generalizations, again). The purpose of this conference is to bring together people working in these areas.

Organizers: J. S. Carter (Univ. of South Alabama, USA), L. Crane (Kansas State Univ., USA), N. Euler (Lulea Univ. of Tech., Sweden), G. von Gehlen (Univ. Bonn, Germany), S. Kamada (Osaka City Univ., Japan), R. Kashaev (Steklov Math. Inst., St.-Petersburg, Russia), I. Korepanov (South Ural State Univ., Chelyabinsk, Russia), A. Kundu (Saha Inst. of Nucl. Phys., Calcutta, India), M. Mackaay (Univ. Algarve, Portugal), H. Murakami (Tokyo Inst. of Tech., Japan), V. Novokshenov (Inst. of Math., Ufa, Russia), J. Roberts (Univ. of California, San Diego, USA), C. Rovelli (Centre de Phys. Theor., CNRS Luminy, Marseille, France), M. Saito (Univ. of South Florida, USA), S. Sergeev (Joint Inst. for Nucl. Res., Dubna, Russia), J. Stasheff (Univ. of North Carolina, USA).

Information: <http://www.susu.ac.ru/en/pmf/duds/iat/> or http://www.sm.luth.se/~norbert/home_journal/chelyabinsk.html.

12–16 **MTNS 2002, Fifteenth International Symposium on Mathematical Theory of Networks and Systems**, University of Notre Dame, Notre Dame, Indiana. (Dec. 2000, p. 1437)

Symposium Chair: J. Rosenthal.

Information: Conference Web page: <http://www.nd.edu/~mtns/>.

16–18 **Symposium on Stochastics and Applications (SSA)—An ICM-2002 Satellite Conference**, National University of Singapore, Singapore. (June/July 2001, p. 631)

Topics: Financial mathematics, Gaussian random fields, Markov chain Monte Carlo, probability approximations, random matrices.

Organizing Committee: L. H. Y. Chen, National Univ. of Singapore (chair); Z. Bai, National Univ. of Singapore; K.-P. Choi, National Univ. of Singapore; A. Y. C. Kuk, National Univ. of Singapore; S.-L. Lee, National Univ. of Singapore; W.-L. Loh, National Univ. of Singapore; J.-H. Lou, National Univ. of Singapore; Q.-M. Shao, Univ. of Oregon; Y. Sun, National Univ. of Singapore; Y. K. N. Truong, National Univ. of Singapore and Univ. of North Carolina at Chapel Hill.

Contacts: The Organising Committee, SSA 2002, c/o Department of Mathematics, National Univ. of Singapore, 2 Science Drive 2, Singapore 117543, Republic of Singapore.

Information: fax: 65-779 5452; e-mail: ssa@math.nus.edu.sg; <http://www.math.nus.edu.sg/ssa/>.

20–28 **ICM-2002**, Beijing, China. (Oct. 2000, p. 1146)

Description: The Organizing Committee is pleased to announce that the next International Congress of Mathematicians will take place in Beijing, People's Republic of China, from Tuesday, August 20, through Tuesday, August 27, 2002. 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 one-hour plenary lectures covering recent developments in the major areas of mathematics and forty-five-minute invited lectures in nineteen sections. 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-2002; 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.

Awards: The Fields Medals and the Nevanlinna Prize will be awarded during the opening ceremony on the first day of the congress.

Information: Up-to-date information about all aspects of ICM-2002 is available on the following Web site: <http://www.icm2002.org.cn/>. This includes information about registration, abstract submission, etc. Correspondence should be directed to: icm2002@beijing.icm2002.ac.cn. Registration forms and accommodation requests will be made available on the ICM-2002 server in January 2002.

20–28 **Satellite Conferences for ICM 2002**, Beijing, China. (Aug. 2001, p. 752)

Information: <http://www.icm2002.org.cn/satellite/index.html>.

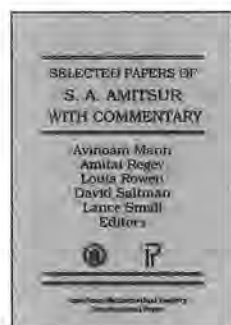
May 2003

*20–24 **The 31st Annual Canadian Operator Theory and Operator Algebras Symposium**, UNB, Fredericton, New Brunswick, Canada.

Information: <http://www.math.unb.ca/cos.html>.

New Publications Offered by the AMS

Algebra and Algebraic Geometry



Selected Papers of S. A. Amitsur with Commentary, Parts 1 and 2

Avinoam Mann, Hebrew
University of Jerusalem, Israel,
Amitai Regev, Weizmann
Institute of Science, Rehovot,
Israel, Louis Rowen, Bar-Ilan
University, Ramat-Gan, Israel,

David Saltman, University of Texas, Austin, and
Lance Small, University of California, San Diego,
La Jolla, Editors

A lead figure in twentieth century noncommutative algebra, S. A. Amitsur's contributions are wide-ranging and enduring. These volumes collect almost all of his work. The papers are organized into broad topic areas: general ring theory, rings satisfying a polynomial identity, combinatorial polynomial identity theory, and division algebras. Included are essays by the editors on Amitsur's work in these four areas and a biography of Amitsur written by A. Mann. These volumes make a fine addition to any mathematics book collection.

Contents for Part 1: *General ring theory:* L. Rowen, Commentary: Amitsur and ring theory; A generalization of a theorem on linear differential equations; A general theory of radicals. I. Radicals in complete lattices; A general theory of radicals. II. Radicals in rings and bicategories; A general theory of radicals. III. Applications; Algebras over infinite fields; Radicals of polynomial rings; Invariant submodules of simple rings; Derivations in simple rings; The radical of field extensions; Countably generated division algebras over nondenumerable fields; Commutative linear differential operators; Rings with a pivotal monomial; On the semi-simplicity of group algebras; Derived functors in abelian categories; Remarks on principal ideal rings; Generalized polynomial identities and pivotal monomials; Rings with involution; Rings of quotients and Morita contexts; Nil radicals. Historical notes and some new results; On rings of quotients; with G. Agnarsson and J. C. Robson, Recognition of matrix rings II; *Rings satisfying a*

polynomial identity: L. W. Small, Commentary: Amitsur and PI-rings; Nil PI-rings; An embedding of PI-rings; On rings with identities; The T^2 -ideals of the free ring; A generalization of Hilbert's Nullstellensatz; Groups with representations of bounded degree II; with C. Procesi, Jacobson-rings and Hilbert algebras with polynomial identities; Nil semi-groups of rings with a polynomial identity; Rational identities and applications to algebra and geometry; Prime rings having polynomial identities with arbitrary coefficients; Identities in rings with involutions; A noncommutative Hilbert basis theorem and subrings of matrices; Embeddings in matrix rings; Some results on rings with polynomial identities; A note on PI-rings; On universal embeddings in matrix rings; Polynomial identities and Azumaya algebras; Polynomial identities; Central embeddings in semi-simple rings; with L. W. Small, Polynomials over division rings; with L. W. Small, Prime ideals in PI-rings; with L. W. Small, Finite-dimensional representations of PI algebras; with L. W. Small, GK-dimensions of corners and ideals; Contributions of PI theory to Azumaya algebras; with L. W. Small, Finite-dimensional representation of PI algebras, II; with L. W. Small, Algebras over infinite fields, revisited.

Collected Works

November 2001, approximately 610 pages, Hardcover, ISBN 0-8218-2924-6, **Individual member \$62**, List \$103, Institutional member \$82, Order code CWORKS-AMITSUR1N

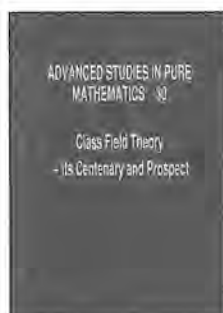
Contents for Part 2: *Combinatorial polynomial identity theory:* A. Regev, Commentary: Amitsur and combinatorial P.I. theory; with J. Levitzki, Minimal identities for algebras; with J. Levitzki, Remarks on minimal identities for algebras; The identities of PI-rings; Identities and generators of matrix rings; Identities and linear dependence; On a central identity for matrix rings; Alternating identities; PI-algebras and their cocharacters; The sequence of codimensions of PI-algebras; *Division algebras:* D. J. Saltman, Commentary: Amitsur and division algebras; Contributions to the theory of central simple algebras; La représentation d'algèbres centrales simples; Construction d'algèbres centrales simples sur des corps de caractéristique zéro; Non-commutative cyclic fields; Differential polynomials and division algebras; Generic splitting fields of central simple algebras; Finite subgroups of division rings; Some results on central simple algebras; On arithmetic functions; Simple algebras and cohomology groups of arbitrary fields; Some results on arithmetic functions; Finite dimensional central division algebras; Homology groups and double complexes for arbitrary fields; On a lemma in elementary proofs of the prime number theorem; Complexes of rings; On central division algebras; The generic division rings; Generic abelian crossed products and p -algebras; with L. H. Rowen and

J. P. Tignol, Division algebras of degree 4 and 8 with involution; On the characteristic polynomial of a sum of matrices; Generic splitting fields; Braver groups in ring theory and algebraic geometry; Extension of derivations to central simple algebras; with **J.-P. Tignol**, Kummer subfields of Malcev-Neumann division algebras; with **J. P. Tignol**, Symplectic modules; with **J.-P. Tignol**, Totally ramified splitting fields of central simple algebras over Henselian fields; Galois splitting fields of a universal division algebra; with **L. H. Rowen**, Elements of reduced trace 0; with **D. Baum**, Finite-dimensional subalgebras of division rings.

Collected Works

November 2001, approximately 625 pages, Hardcover, ISBN 0-8218-2925-4, **Individual member \$63**, List \$105, Institutional member \$84, Order code CWORKS-AMITSUR2N

Set: October 2001, approximately 1224 pages, Hardcover, ISBN 0-8218-0688-2, 2000 *Mathematics Subject Classification:* 01A75, 16-06, **Individual member \$119**, List \$198, Institutional member \$158, Order code CWORKS-AMITSURN



Class Field Theory—Its Centenary and Prospect

Katsuya Miyake, Tokyo Metropolitan University, Japan, Editor

A publication of the Mathematical Society of Japan.

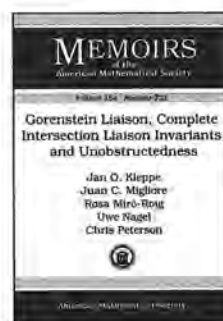
This volume is a collection of articles contributed by the speakers at the Mathematical Society of Japan's Seventh International Research Institute entitled, "Class Field Theory—Its Centenary and Prospect", held in Tokyo in June 1998. Some of the articles are expository; they discuss important and interesting aspects of class field theory and contain full references. Other articles are historical; they vividly explain how leading number theorists in Europe and Japan developed and exchanged their mathematical ideas.

Contents: **S. Iyanaga**, Memories of Professor Teiji Takagi; **M. R. Murty**, On Artin L -functions; **G. Frei**, How Hasse was led to the theory of quadratic forms, the local-global principle, the theory of the norm residue symbol, the reciprocity laws, and to class field theory; **I. Fesenko**, Nonabelian local reciprocity maps; **A. Nomura**, Embedding problems with restricted ramifications and the class number of Hilbert class fields; **H. Koch**, The history of the theorem of Shafarevich in the theory of class formations; **M. Yamagishi**, A survey of p -extensions; **T. Nguyen Quang Do**, Galois module structure of p -class formations; **T. Zink**, A Dieudonné theory for p -divisible groups; **P. Stevenhagen**, Hilbert's 12th problem, complex multiplication and Shimura reciprocity; **D. R. Kohel**, Hecke module structure of quaternions; **I. Satake**, On classification of semisimple algebraic groups; **B. Casselman**, The L -group; **R. Gillard**, Groupe des obstructions pour les déformations de représentations Galoisiennes; **R. Schoof**, Abelian varieties over $\mathbb{Q}(\sqrt{6})$ with good reduction everywhere; **H. Yanai**, Hodge cycles and unramified class fields; **N. Otsubo**, Recent progress on the finiteness of torsion algebraic cycles; **K. Sato**, Finiteness of a certain motivic cohomology group of varieties over local and global fields; **R. Greenberg**, Iwasawa theory—Past and

present; **M. Ozaki**, Iwasawa invariants of \mathbb{Z}_p -extensions over an imaginary quadratic field; **H. Taya**, On p -adic zeta functions and class groups of \mathbb{Z}_p -extensions of certain totally real fields; **W. Kohlen**, Class numbers of imaginary quadratic fields; **R. Okazaki**, On parities of relative class numbers of certain CM-extensions; **S. G. Hahn** and **D. H. Lee**, Some congruences for binomial coefficients; **J. Cougnard**, Stably free and not free rings of integers; **M. Ayadi**, **A. Azizi**, and **M. C. Ismaili**, The capitulation problem for certain number fields; **H. Suzuki**, On the capitulation problem; **M. Morishita** and **T. Watanabe**, Adele geometry of numbers; **T. Ono**, On Shafarevich-Tate sets; **P. Roquette**, Class field theory in characteristic p , its origin and development.

Advanced Studies in Pure Mathematics, Volume 30

May 2001, 631 pages, Hardcover, ISBN 4-931469-11-6, 2000 *Mathematics Subject Classification:* 11R37; 11F70, 11H99, 11M06, 11R23, 11R39, 11R42, 11R56, 11S37, 01A60, **Individual member \$66**, List \$110, Institutional member \$88, Order code ASPM/30N



Gorenstein Liaison, Complete Intersection Liaison Invariants and Unobstructedness

Jan O. Kleppe, Oslo University College, Norway, **Juan C. Migliore**, University of Notre Dame, IN, **Rosa Miró-Roig**,

University of Barcelona, Spain, **Uwe Nagel**, University of Paderborn, Germany, and **Chris Peterson**, Colorado State University, Fort Collins

Contents: Introduction; Preliminaries; Gaeta's theorem; Divisors on an ACM subscheme of projective spaces; Gorenstein ideals and Gorenstein liaison; CI-liaison invariants; Geometric applications of the CI-liaison invariants; Glicci curves on arithmetically Cohen-Macaulay surfaces; Unobstructedness and dimension of families of subschemes; Dimension of families of determinantal subschemes; Bibliography.

Memoirs of the American Mathematical Society

0065-9266, October 2001, 116 pages, Softcover, ISBN 0-8218-2738-3, LC 2001034317, 2000 *Mathematics Subject Classification:* 14M12, 14C05, 14H10, 14J15; 14N05, **Individual member \$26**, List \$43, Institutional member \$34, Order code MEMO/154/732N



Tilings of the Plane, Hyperbolic Groups and Small Cancellation Conditions

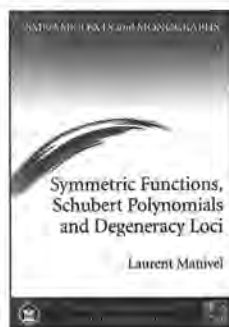
Milé Krajčevski, University of South Florida, Tampa

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

Contents: Preface; Acknowledgments; Introduction; Small cancellation theory of \mathcal{T} ; Tilings; Bibliography.

Memoirs of the American Mathematical Society

0065-9266, October 2001, 59 pages, Softcover, ISBN 0-8218-2762-6, LC 2001034318, 2000 *Mathematics Subject Classification*: 20F65, 20F67; 05B45, 52C20, 57M05, **Individual member \$24**, List \$40, Institutional member \$32, Order code MEMO/154/733N



Symmetric Functions, Schubert Polynomials and Degeneracy Loci

Laurent Manivel, *University of Grenoble, Saint Martin d'Herès, France*

From reviews of the French Edition:

Well-written book ... all of the concepts are clearly defined and presented in an informal and pleasant way ... an attractive book which presents the interplay between many diverse topics of algebraic combinatorics and their geometric realizations in Schubert calculus. It will be of great use to anyone wishing a brief and well-organized treatment of this material and particularly good for graduate students.

—*Mathematical Reviews*

Excellent text ... with numerous further-leading exercises and remarks, and with a rich bibliography, which makes the study of it very profitable.

—*Zentralblatt für Mathematik*

This text grew out of an advanced course taught by the author at the Fourier Institute (Grenoble, France). It serves as an introduction to the combinatorics of symmetric functions, more precisely to Schur and Schubert polynomials. Also studied is the geometry of Grassmannians, flag varieties, and especially, their Schubert varieties. This book examines profound connections that unite these two subjects.

The book is divided into three chapters. The first is devoted to symmetric functions and especially to Schur polynomials. These are polynomials with positive integer coefficients in which each of the monomials correspond to a Young tableau with the property of being "semistandard". The second chapter is devoted to Schubert polynomials, which were discovered by A. Lascoux and M.-P. Schützenberger who deeply probed their combinatorial properties. It is shown, for example, that these polynomials support the subtle connections between problems of enumeration of reduced decompositions of permutations and the Littlewood-Richardson rule, a particularly efficacious version of which may be derived from these connections. The final chapter is geometric. It is devoted to Schubert varieties, subvarieties of Grassmannians, and flag varieties defined by certain incidence conditions with fixed subspaces.

This volume makes accessible a number of results, creating a solid stepping stone for scaling more ambitious heights in the area. The author's intent was to remain elementary: The first two chapters require no prior knowledge, the third chapter uses some rudimentary notions of topology and algebraic geometry. For this reason, a comprehensive appendix on the topology of algebraic varieties is provided. This book is the English translation of a text previously published in French.

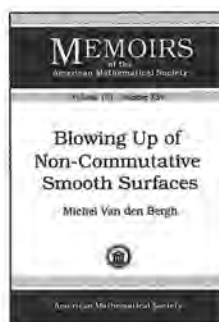
This item will also be of interest to those working in discrete mathematics and combinatorics.

SMF members are entitled to AMS member discounts.

Contents: Introduction; The ring of symmetric functions; Schubert polynomials; Schubert varieties; A brief introduction to singular homology; Bibliography; Index.

SMF/AMS Texts and Monographs, Volume 6

September 2001, approximately 176 pages, Softcover, ISBN 0-8218-2154-7, LC 2001041290, 2000 *Mathematics Subject Classification*: 05E05, 05E10, 14M15, 14N10, 20C30, 57T15, All **AMS members \$35**, List \$44, Order code SMFAMS/6N



Blowing Up of Non-Commutative Smooth Surfaces

Michel Van den Bergh, *University Centrum Limburg, Diepenbeek, Belgium*

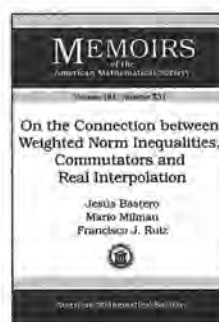
This item will also be of interest to those working in geometry and topology.

Contents: Introduction; Preliminaries on category theory; Non-commutative geometry; Pseudo-compact rings; Cohen-Macaulay curves embedded in quasi-schemes; Blowing up a point on a commutative divisor; Derived categories; The derived category of a non-commutative blowup; Some results on graded algebras and their sections; Quantum plane geometry; Blowing up n points in an elliptic quantum plane; Non-commutative cubic surfaces; Appendix A. Two-categories; Appendix B. Summary of notations; Appendix C. Index of terminology; Bibliography.

Memoirs of the American Mathematical Society

0065-9266, October 2001, 140 pages, Softcover, ISBN 0-8218-2754-5, LC 2001027925, 2000 *Mathematics Subject Classification*: 16E40, **Individual member \$29**, List \$49, Institutional member \$39, Order code MEMO/154/734N

Analysis



On the Connection between Weighted Norm Inequalities, Commutators and Real Interpolation

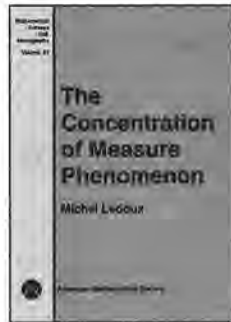
Jesús Bastero, *University of Zaragoza, Spain*, Mario Milman, *Florida Atlantic University, Boca Raton*, and Francisco J. Ruiz, *University of Zaragoza, Spain*

Contents: Introduction; Calderón weights; Applications to real interpolation: reiteration and extrapolation; Other classes of weights; Extrapolation of weighted norm inequalities via extrapolation theory; Applications to function spaces; Commutators defined by the K-method; Generalized commutators; The

quasi Banach case; Applications to harmonic analysis; BMO type spaces associated to Calderón weights; Atomic decompositions and duality; References.

Memoirs of the American Mathematical Society

0065-9266, October 2001, 80 pages, Softcover, ISBN 0-8218-2734-0, LC 2001034316, 2000 *Mathematics Subject Classification*: 46E30, 46B70, **Individual member \$26**, List \$43, Institutional member \$34, Order code MEMO/154/731N



The Concentration of Measure Phenomenon

Michel Ledoux, Université Paul-Sabatier, Toulouse, France

The observation of the concentration of measure phenomenon is inspired by isoperimetric inequalities. A familiar example is the way the uniform measure on the standard

sphere S^n becomes concentrated around the equator as the dimension gets large. This property may be interpreted in terms of functions on the sphere with small oscillations, an idea going back to Lévy. The phenomenon also occurs in probability, as a version of the law of large numbers, due to Emil Borel. This book offers the basic techniques and examples of the concentration of measure phenomenon. The concentration of measure phenomenon was put forward in the early seventies by V. Milman in the asymptotic geometry of Banach spaces. It is of powerful interest in applications in various areas, such as geometry, functional analysis and infinite-dimensional integration, discrete mathematics and complexity theory, and probability theory. Particular emphasis is on geometric, functional, and probabilistic tools to reach and describe measure concentration in a number of settings.

The book presents concentration functions and inequalities, isoperimetric and functional examples, spectrum and topological applications, product measures, entropic and transportation methods, as well as aspects of M. Talagrand's deep investigation of concentration in product spaces and its application in discrete mathematics and probability theory, supremum of Gaussian and empirical processes, spin glass, random matrices, etc. Prerequisites are a basic background in measure theory, functional analysis, and probability theory.

This item will also be of interest to those working in probability.

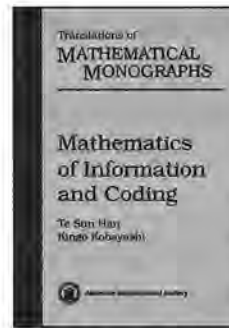
Contents: Concentration functions and inequalities; Isoperimetric and functional examples; Concentration and geometry; Concentration in product spaces; Entropy and concentration; Transportation cost inequalities; Sharp bounds of Gaussian and empirical processes; Selected applications; References; Index.

Mathematical Surveys and Monographs

September 2001, approximately 192 pages, Hardcover, ISBN 0-8218-2864-9, 2000 *Mathematics Subject Classification*: 28Axx, 46Bxx, 52Axx, 60-XX; 28C20, 28D20, 46G12, 58C30, 62G30, 82B44, **Individual member \$35**, List \$59, Institutional member \$47, Order code SURV-LEDouxN

Applications

Independent Study



Mathematics of Information and Coding

Te Sun Han and Kingo Kobayashi, The University of Electro-Communications, Tokyo, Japan

This book is intended to provide engineering and/or statistics students, communications engineers, and mathematicians with the firm theoretic basis of *source coding (or data compression)* in information theory. Although information theory consists of two main areas, source coding and channel coding, the authors choose here to focus only on source coding. The reason is that, in a sense, it is more basic than channel coding, and also because of recent achievements in source coding and compression. An important feature of the book is that whenever possible, the author describes *universal coding methods*, i.e., the methods that can be used without prior knowledge of the statistical properties of the data. The authors approach the subject of source coding from the very basics to the top frontiers in an intuitively transparent, but mathematically sound manner.

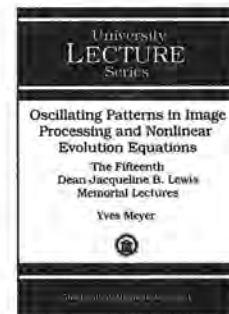
The book serves as a theoretical reference for communication professionals and statisticians specializing in information theory. It will also serve as an excellent introductory text for advanced-level and graduate students taking elementary or advanced courses in telecommunications, electrical engineering, statistics, mathematics, and computer science.

Contents: What is information theory?; Basics of information theory; Source and coding; Arithmetic code; Universal coding of integers; Universal coding of texts; Universal coding of compound sources; Data analysis and MDL principle; Bibliography; Index.

Translations of Mathematical Monographs

December 2001, approximately 296 pages, Hardcover, ISBN 0-8218-0534-7, LC 2001041262, 2000 *Mathematics Subject Classification*: 00A69, 94-02, 94A24, 94A29, 94A15, 94A45, 68P30, 62F03, 62F12, **Individual member \$59**, List \$99, Institutional member \$79, Order code MMONO-HANN

Independent Study



Oscillating Patterns in Image Processing and Nonlinear Evolution Equations

The Fifteenth Dean Jacqueline B. Lewis Memorial Lectures

Yves Meyer, École Normale Supérieure de Cachan, France

Image compression, the Navier-Stokes equations, and detection of gravitational waves are three seemingly unrelated scientific

problems that, remarkably, can be studied from one perspective. The notion that unifies the three problems is that of "oscillating patterns", which are present in many natural images, help to explain nonlinear equations, and are pivotal in studying chirps and frequency-modulated signals.

The first chapter of this book considers image processing, more precisely algorithms of image compression and denoising. This research is motivated in particular by the new standard for compression of still images known as JPEG-2000. The second chapter has new results on the Navier-Stokes and other nonlinear evolution equations. Frequency modulated signals and their use in the detection of gravitational waves are covered in the final chapter.

In the book, the author describes both what the oscillating patterns are and the mathematics necessary for their analysis. It turns out that this mathematics involves new properties of various Besov-type function spaces and leads to many deep results, including new generalizations of famous Gagliardo-Nirenberg and Poincaré inequalities.

This book is based on the "Dean Jacqueline B. Lewis Memorial Lectures" given by the author at Rutgers University. It can be used either as a textbook in studying applications of wavelets to image processing or as a supplementary resource for studying nonlinear evolution equations or frequency-modulated signals. Most of the material in the book did not appear previously in monograph literature.

This item will also be of interest to those working in analysis.

Contents: Still images compression; The role of oscillations in some nonlinear PDE's; Frequency modulated signals, chirps and the Virgo program; Conclusion; References.

University Lecture Series, Volume 22

September 2001, approximately 136 pages, Softcover, ISBN 0-8218-2920-3, 2000 *Mathematics Subject Classification:* 35Q30, 42C40, 65T60, 76D05, 76D06, All AMS members \$20, List \$25, Order code ULECT/22N

General and Interdisciplinary



Lebesgue's Theory of Integration: Its Origins and Development

Thomas Hawkins, Boston University, Massachusetts

From reviews for the original edition:

Thomas Hawkins has set out to place Lebesgue's early work on integration

theory ... within its proper historical context ... He has succeeded brilliantly ... [He] has been able to convey the excitement of discovery and groping that must attend the birth of any fundamental theory ... [He] has written a book that is the epitome of what a mathematical history should be.

—Science

This is a book which can be recommended to every mathematician.

—Zentralblatt für Mathematik

A clear exposition ...

—Nature

Hawkins has written an excellent book, of value both to mathematicians and historians of science ... Any teacher of advanced calculus will find the material in this book invaluable in motivating the introduction of Lebesgue's theory.

—Isis

The success of the book will be ensured because it is a genuinely historical study.

—British Journal of the History of Science

An interesting book ... valuable to the worker in the field ... brings out a number of ideas and results ... It can be recommended highly to students who are getting their introduction to Lebesgue integration, particularly because it shows how an important mathematical idea develops, sometimes slowly, until it becomes an aesthetically satisfying structure.

—MAA Monthly

Lebesgue integration is one of the great success stories of modern mathematics, and Hawkins tells it very well. An introductory chapter sets the scene, describing how the first rigorous theory of integration took shape at the hands of Cauchy and Riemann. The book then plunges into fifty years of ferment, as researchers struggle to deal with "assumptionless" functions which will not fit the theory. Differentiable functions turn up with bounded derivatives which are not (Riemann) integrable; do they satisfy the fundamental theorem of calculus? Rectifiable curves are defined without assuming differentiability; must we give up the integral formula for length? To prove uniqueness for trigonometric series, we need a term-by-term integration of a series not converging uniformly; can it be justified? [One] falls into traps through not understanding the complexity of nowhere-dense sets, and through confusing them with the sets negligible in integration. The valid theorems have complicated hypotheses and even more complicated proofs. At the end of the century Hermite exclaims, "I turn away with fright and horror from this lamentable plague of functions which do not have derivatives." And then the key idea enters from a quite unexpected source.

—Bulletin of the AMS

In this book, Hawkins elegantly places Lebesgue's early work on integration theory within in proper historical context by relating it to the developments during the nineteenth century that motivated it and gave it significance and also to the contributions made in this field by Lebesgue's contemporaries.

Hawkins was awarded the 1997 MAA Chauvenet Prize and the 2001 AMS Albert Leon Whiteman Memorial Prize for notable exposition and exceptional scholarship in the history of mathematics.

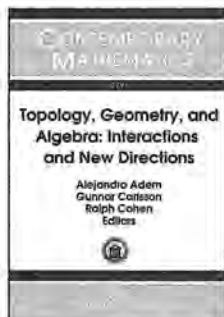
This item will also be of interest to those working in analysis.

AMS Chelsea Publishing

Contents: Riemann's theory of integration; The development of Riemann's ideas: 1870-80; Set theory and the theory of integration; The end of the century: A period of transition; The creation of modern integration theory; Pioneering applications of the Lebesgue integral; Epilogue: The Lebesgue-Stieltjes integral; Appendix: Dini's theorem on the differentiability of continuous functions; Glossary; Special symbols; List of abbreviations; Bibliography; Index.

September 2001, 227 pages, Hardcover, ISBN 0-8218-2963-7, 2000 *Mathematics Subject Classification*: 28-03, 01A05; 01A75, All AMS members \$26, List \$29, Order code CHEL/282.HN

Geometry and Topology



Topology, Geometry, and Algebra: Interactions and New Directions

Alejandro Adem, *University of Wisconsin, Madison*, and Gunnar Carlsson and Ralph Cohen, *Stanford University, CA*, Editors

This volume presents the proceedings from the conference on "Topology, Geometry, and Algebra: Interactions and New Directions" held in honor of R. James Milgram at Stanford University in August 1999. The meeting brought together distinguished researchers from a variety of areas related to algebraic topology and its applications.

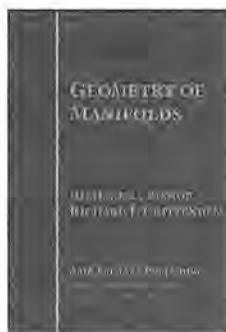
Papers in the book present a wide range of subjects, reflecting the nature of the conference. Topics include moduli spaces, configuration spaces, surgery theory, homotopy theory, knot theory, group actions, and more. Particular emphasis was given to the breadth of interaction between the different areas.

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

Contents: G. Carlsson, On Jim Milgram's mathematical work; M. Ando and J. Morava, A renormalized Riemann-Roch formula and the Thom isomorphism for the free loop space; M. Bendersky and D. M. Davis, The 1-line of the K -theory Bousfield-Kan spectral sequence for $Spin(2n+1)$; W. Browder, Homologically exotic free actions on products of S^m ; S. E. Cappell, R. Lee, and E. Y. Miller, Surgery formulae for analytical invariants of manifolds; F. R. Cohen, On genus one mapping class groups, function spaces, and modular forms; B. Hanke, Poincaré duality and deformations of algebras; S. Kallel, An analog of the May-Milgram model for configurations with multiplicities; S. Kallel, Configuration spaces and the topology of curves in projective space; M. Karoubi, Quantum methods in algebraic topology; K. Liu and W. Zhang, Adiabatic limits and foliations; K. Mohnke, Legendrian links of topological unknots; A. Ranicki, Algebraic Poincaré cobordism.

Contemporary Mathematics, Volume 279

September 2001, approximately 264 pages, Softcover, ISBN 0-8218-2063-X, 2000 *Mathematics Subject Classification*: 55Pxx, 55Rxx, 55Txx, 55Uxx, 57Nxx, 57Rxx, **Individual member \$38**, List \$64, Institutional member \$51, Order code CONM/279N



Geometry of Manifolds

Richard L. Bishop, *University of Illinois, Urbana*, and Richard J. Crittenden

From a review for the First Edition:

This book represents an excellent treatment of a wide section of modern differential geometry ... The style is elegant and at the same time considerate for the needs of a beginner ... a great number of well chosen problems with pertinent references ... anybody who chooses to base his course on differential geometry at the graduate level on this book could do no better.

—*Mathematical Reviews*

From the Preface of the First Edition: "Our purpose in writing this book is to put material which we found stimulating and interesting as graduate students into form. It is intended for individual study and for use as a text for graduate level courses such as the one from which this material stems, given by Professor W. Ambrose at MIT in 1958–1959. Previously the material had been organized in roughly the same form by him and Professor I. M. Singer, and they in turn drew upon the work of Ehresmann, Chern, and É. Cartan. Our contributions have been primarily to fill out the material with details, asides and problems, and to alter notation slightly.

"We believe that this subject matter, besides being an interesting area for specialization, lends itself especially to a synthesis of several branches of mathematics, and thus should be studied by a wide spectrum of graduate students so as to break away from narrow specialization and see how their own fields are related and applied in other fields. We feel that at least part of this subject should be of interest not only to those working in geometry, but also to those in analysis, topology, algebra, and even probability and astronomy. In order that this book be meaningful, the reader's background should include real variable theory, linear algebra, and point set topology."

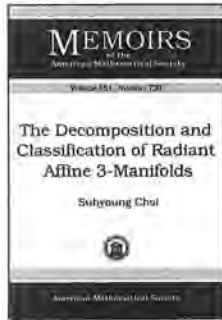
This volume is a reprint with few corrections of the original work published in 1964. Starting with the notion of differential manifolds, the first six chapters lay a foundation for the study of Riemannian manifolds through specializing the theory of connections on principle bundles and affine connections. The geometry of Riemannian manifolds is emphasized, as opposed to global analysis, so that the theorems of Hopf-Rinow, Hadamard-Cartan, and Cartan's local isometry theorem are included, but no elliptic operator theory. Isometric immersions are treated elegantly and from a global viewpoint. In the final chapter are the more complicated estimates on which much of the research in Riemannian geometry is based: the Morse index theorem, Synge's theorems on closed geodesics, Rauch's comparison theorem, and the original proof of the Bishop volume-comparison theorem (with Myer's Theorem as a corollary).

The first edition of this book was the origin of a modern treatment of global Riemannian geometry, using the carefully conceived notation that has withstood the test of time. The primary source material for the book were the papers and course notes of brilliant geometers, including É. Cartan, C. Ehresmann, I. M. Singer, and W. Ambrose. It is tightly organized, uniformly very precise, and amazingly comprehensive for its length.

Contents: Manifolds; Lie groups; Fibre bundles; Differential forms; Connexions; Affine connexions; Riemannian manifolds; Geodesics and complete Riemannian manifolds; Riemannian curvature; Immersions and the second fundamental form; Second variation of arc length; Appendix: Theorems on differential equations; Bibliography; Subject index.

AMS Chelsea Publishing

October 2001, 273 pages, Hardcover, ISBN 0-8218-2923-8, 2000 *Mathematics Subject Classification:* 53-01, **All AMS members \$35, List \$39, Order code CHEL/344.HN**



The Decomposition and Classification of Radiant Affine 3-Manifolds

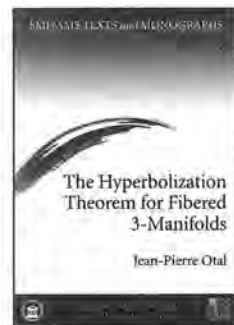
Suhyoung Choi, Seoul National University, Korea

Contents: Introduction; Acknowledgement; Preliminary; $(n - 1)$ -convexity; previous results; Radiant vector fields,

generalized affine suspensions, and the radial completeness; Three-dimensional radiant affine manifolds and concave affine manifolds; The decomposition along totally geodesic surfaces; 2-convex radiant affine manifolds; The claim and the rooms; The radiant tetrahedron case; The radiant trihedron case; Obtaining concave-cone affine manifolds; Concave-cone radiant affine 3-manifolds and radiant concave affine 3-manifolds; The nonexistence of pseudo-crescent-cones; Appendix A. Dipping intersections; Appendix B. Sequences of n -balls; Appendix C. Radiant affine 3-manifolds with boundary, and certain radiant affine 3-manifolds; Bibliography.

Memoirs of the American Mathematical Society, Volume 154, Number 730

October 2001, 122 pages, Softcover, ISBN 0-8218-2704-9, LC 2001034315, 2000 *Mathematics Subject Classification:* 57M50; 53A20, 53C15, 53C12, **Individual member \$28, List \$47, Institutional member \$38, Order code MEMO/154/730N**



The Hyperbolization Theorem for Fibered 3-Manifolds

Jean-Pierre Otal, ENS-Lyon, France

From a review of the French Edition:

The book is very well written ... completely self-contained ...

—*Mathematical Reviews*

A fundamental element of the study of 3-manifolds is Thurston's remarkable geometrization conjecture, which states that the interior of every compact 3-manifold has a canonical decomposition into pieces that have geometric structures. In most cases, these structures are complete metrics of constant negative curvature, that is to say, they are hyperbolic manifolds. The conjecture has been proved in some important cases, such as Haken manifolds and certain types of fibered manifolds. The influence of Thurston's hyperbolization

theorem on the geometry and topology of 3-manifolds has been tremendous. This book presents a complete proof of the hyperbolization theorem for 3-manifolds that fiber over the circle, following the plan of Thurston's original (unpublished) proof, though the double limit theorem is dealt with in a different way.

The book is suitable for graduate students with a background in modern techniques of low-dimensional topology and will also be of interest to researchers in geometry and topology.

This is the English translation of a volume originally published in 1996 by the Société Mathématique de France.

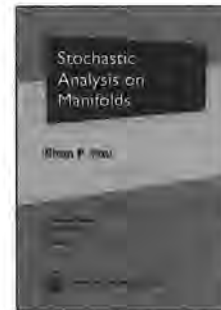
SMF members are entitled to AMS member discounts.

Contents: Teichmüller spaces and Kleinian groups; Real trees and degenerations of hyperbolic structures; Geodesic laminations and real trees; Geodesic laminations and the Gromov topology; The double limit theorem; The hyperbolization theorem for fibered manifolds; Sullivan's theorem; Actions of surface groups on real trees; Two examples of hyperbolic manifolds that fiber over the circle; Geodesic laminations; Bibliography; Index.

SMF/AMS Texts and Monographs, Volume 7

October 2001, approximately 133 pages, Softcover, ISBN 0-8218-2153-9, 2000 *Mathematics Subject Classification:* 57M07, 57M50, 20E08, 51M10, **All AMS members \$31, List \$39, Order code SMFAMS/7N**

Probability



Stochastic Analysis on Manifolds

Elton P. Hsu, Northwestern University, Evanston, IL

Probability theory has become a convenient language and a useful tool in many areas of modern analysis. The main purpose of this book is to explore part of this connection concerning the relations between

Brownian motion on a manifold and analytical aspects of differential geometry. A dominant theme of the book is the probabilistic interpretation of the curvature of a manifold.

The book begins with a brief review of stochastic differential equations on Euclidean space. After presenting the basics of stochastic analysis on manifolds, the author introduces Brownian motion on a Riemannian manifold and studies the effect of curvature on its behavior. He then applies Brownian motion to geometric problems and vice versa, using many well-known examples, e.g., short-time behavior of the heat kernel on a manifold and probabilistic proofs of the Gauss-Bonnet-Chern theorem and the Atiyah-Singer index theorem for Dirac operators. The book concludes with an introduction to stochastic analysis on the path space over a Riemannian manifold.

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

Contents: Stochastic differential equations and diffusions; Basic stochastic differential geometry; Brownian motion on manifolds; Brownian motion and heat kernel; Short-time

asymptotics; Further applications; Brownian motion and analytic index theorems; Analysis on path spaces; Notes and comments; General notations; Bibliography; Index.

Graduate Studies in Mathematics, Volume 38

November 2001, approximately 273 pages, Hardcover, ISBN 0-8218-0802-8, LC 2001046052, 2000 *Mathematics Subject Classification*: 58J65, 60J60, 60J65, All AMS members \$35, List \$44, Order code GSM/38N

Previously Announced Publications

Supplementary Reading

Recommended Text

Arithmetic Algebraic Geometry

Brian Conrad, *University of Michigan, Ann Arbor*, and Karl Rubin, *Stanford University, CA*, Editors

The articles in this volume are expanded versions of lectures delivered at the Graduate Summer School and at the Mentoring Program for Women in Mathematics held at the Institute for Advanced Study/Park City Mathematics Institute. The theme of the program was arithmetic algebraic geometry. The choice of lecture topics was heavily influenced by the recent spectacular work of Wiles on modular elliptic curves and Fermat's Last Theorem. The main emphasis of the articles in the volume is on elliptic curves, Galois representations, and modular forms. One lecture series offers an introduction to these objects. The others discuss selected recent results, current research, and open problems and conjectures. The book would be a suitable text for an advanced graduate topics course in arithmetic algebraic geometry.

IAS/Park City Mathematics Series, Volume 9

August 2001, 569 pages, Hardcover, ISBN 0-8218-2173-3, LC 2001035291, 2000 *Mathematics Subject Classification*: 11F11, 11F33, 11F70, 11F80, 11G07, 11G18, 11R23, 11S25, 11G05, All AMS members \$60, List \$75, Order code PCMS/9RT109

Recommended Text

Plane Algebraic Curves

Gerd Fischer, *Heinrich-Heine-Universität, Düsseldorf, Germany*

From a review for the German Edition:

The present book provides a completely self-contained introduction to complex plane curves from the traditional algebraic-analytic viewpoint. The arrangement of the material is of outstanding instructional skill, and the text is written in a very lucid, detailed and enlightening style ... Compared to the many other textbooks on (plane) algebraic curves, the present new one comes closest in spirit and content, to the work of E. Brieskorn and H. Knoerr ... One could say that the book under review is a beautiful, creative and justifiable abridged version of this work, which also stresses the analytic-topological point of view ... the present book is a beautiful invitation to algebraic geometry, encouraging for beginners, and a welcome

source for teachers of algebraic geometry, especially for those who want to give an introduction to the subject on the undergraduate-graduate level, to cover some not too difficult topics in substantial depth, but to do so in the shortest possible time.

—*Zentralblatt für Mathematik*

The study of the zeroes of polynomials, which for one variable is essentially algebraic, becomes a geometric theory for several variables. In this book, Fischer looks at the classic entry point to the subject: plane algebraic curves. Here one quickly sees the mix of algebra and geometry, as well as analysis and topology, that is typical of complex algebraic geometry, but without the need for advanced techniques from commutative algebra or the abstract machinery of sheaves and schemes.

In the first half of this book, Fischer introduces some elementary geometrical aspects, such as tangents, singularities, inflection points, and so on. The main technical tool is the concept of intersection multiplicity and Bézout's theorem. This part culminates in the beautiful Plücker formulas, which relate the various invariants introduced earlier.

The second part of the book is essentially a detailed outline of modern methods of local analytic geometry in the context of complex curves. This provides the stronger tools needed for a good understanding of duality and an efficient means of computing intersection multiplicities introduced earlier. Thus, we meet rings of power series, germs of curves, and formal parametrizations. Finally, through the patching of the local information, a Riemann surface is associated to an algebraic curve, thus linking the algebra and the analysis.

Concrete examples and figures are given throughout the text, and when possible, procedures are given for computing by using polynomials and power series. Several appendices gather supporting material from algebra and topology and expand on interesting geometric topics.

This is an excellent introduction to algebraic geometry, which assumes only standard undergraduate mathematical topics: complex analysis, rings and fields, and topology. Reading this book will help the student establish the appropriate geometric intuition that lies behind the more advanced ideas and techniques used in the study of higher dimensional varieties.

This is the English translation of a German work originally published by Vieweg Verlag (Wiesbaden, Germany).

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

Student Mathematical Library, Volume 15

August 2001, 231 pages, Softcover, ISBN 0-8218-2122-9, LC 2001031597, 2000 *Mathematics Subject Classification*: 14H50, 14Hxx, 14-01, All AMS members \$28, List \$35, Order code STML/15RT109

Independent Study

Recommended Text

Vertex Algebras and Algebraic Curves

Edward Frenkel, *University of California, Berkeley*, and David Ben-Zvi, *University of Chicago, IL*

Vertex algebras are algebraic objects that formalize the concepts of vertex operators and operator product expansion from two-dimensional conformal field theory. In the fifteen years since they were introduced by R. Borcherds, vertex algebras have turned out to be extremely useful in many areas of mathematics. They are by now ubiquitous in the representation theory of infinite-dimensional Lie algebras. They have also

found applications in such fields as algebraic geometry, theory of finite groups, modular functions, topology, integrable systems, and combinatorics. This book is an introduction to the theory of vertex algebras with a particular emphasis on the relationship between vertex algebras and the geometry of algebraic curves.

The notion of a vertex algebra is introduced in the book in coordinate-independent way, allowing the authors to give global geometric meaning to vertex operators on arbitrary smooth algebraic curves, possibly equipped with some additional data. To each vertex algebra and a smooth curve, they attach an invariant called the space of conformal blocks. When the complex structure of the curve and other geometric data vary, these spaces combine into a sheaf on the relevant moduli space. From this perspective, vertex algebras appear as algebraic objects that encode the geometric structure of various moduli spaces associated with algebraic curves.

Numerous examples and applications of vertex algebras are included, such as the Wakimoto realization of affine Kac-Moody algebras, integral solutions of the Knizhnik-Zamolodchikov equations, classical and quantum Drinfeld-Sokolov reductions, and the W -algebras. Among other topics discussed in the book are vertex Poisson algebras, Virasoro uniformization of the moduli spaces of curves, the geometric Langlands correspondence, and the chiral de Rham complex. The authors also establish a connection between vertex algebras and chiral algebras, recently introduced by A. Beilinson and V. Drinfeld.

This book may be used by the beginners as an entry point to the modern theory of vertex algebras, and by more experienced readers as a guide to advanced studies in this dynamic field.

Mathematical Surveys and Monographs, Volume 88

August 2001, 348 pages, Hardcover, ISBN 0-8218-2894-0, LC 2001032794, 2000 *Mathematics Subject Classification*: 17B69; 81R10, 81T40, 17B65, 17B67, 17B68, 14D20, 14D21, 14H10, 14H60, 14H81, All AMS members \$44, List \$55, Order code SURV/88RT109

Recommended Text

Algebraic Geometry for Beginners

C. Musili, *University of Hyderabad, India*

A publication of the *Hindustan Book Agency*.

This volume offers a nearly self-contained introduction to some of the basic concepts of algebraic geometry. Prerequisites have been kept to a minimum in order to examine the following areas and some of their standard applications: Bézout's Theorem, the Fundamental Theorem of Projective Geometry, and Zariski's Main Theorem. The exposition is modern, but in the language of "varieties", rather than that of "schemes", making it more accessible to the non-expert. There is extensive coverage of plane curves, including elliptic curves and complex tori, moduli questions, and applications to cryptography.

Distributed worldwide except in India by the American Mathematical Society.

Number 7

March 2001, 335 pages, Hardcover, ISBN 81-85931-27-5, 2000 *Mathematics Subject Classification*: 13-XX, 14-XX, All AMS members \$30, List \$38, Order code HIN/7RT109

Recommended Text

Principles of Functional Analysis Second Edition

Martin Schechter, *University of California, Irvine*

From a review for the First Edition:

'Charming' is a word that seldom comes to the mind of a science reviewer, but if he is charmed by a treatise, why not say so? I am charmed by this book.

Professor Schechter has written an elegant introduction to functional analysis including related parts of the theory of integral equations. It is easy to read and is full of important applications. He presupposes very little background beyond advanced calculus; in particular, the treatment is not burdened by topological 'refinements' which nowadays have a tendency of dominating the picture.

The book can be warmly recommended to any reader who wants to learn about this subject without being deterred by less relevant introductory matter or scared away by heavy prerequisites.

—The American Scientist

Functional analysis plays a crucial role in the applied sciences as well as in mathematics. It is a beautiful subject that can be motivated and studied for its own sake. In keeping with this basic philosophy, the author has made this introductory text accessible to a wide spectrum of students, including beginning-level graduates and advanced undergraduates.

The exposition is inviting, following threads of ideas, describing each as fully as possible, before moving on to a new topic. Supporting material is introduced as appropriate, and only to the degree needed. Some topics are treated more than once, according to the different contexts in which they arise.

The prerequisites are minimal, requiring little more than advanced calculus and no measure theory. The text focuses on normed vector spaces and their important examples, Banach spaces and Hilbert spaces. The author also includes topics not usually found in texts on the subject.

This Second Edition incorporates many new developments while not overshadowing the book's original flavor. Areas in the book that demonstrate its unique character have been strengthened. In particular, new material concerning Fredholm and semi-Fredholm operators is introduced, requiring minimal effort as the necessary machinery was already in place. Several new topics are presented, but relate to only those concepts and methods emanating from other parts of the book. These topics include perturbation classes, measures of noncompactness, strictly singular operators, and operator constants.

Overall, the presentation has been refined, clarified, and simplified, and many new problems have been added.

Graduate Studies in Mathematics, Volume 36

September 2001, 393 pages, Hardcover, ISBN 0-8218-2895-9, LC 2001031601, 2000 *Mathematics Subject Classification*: 46-01, 47-01, 46B20, 46B25, 46C05, 47A05, 47A07, 47A12, 47A53, 47A55, All AMS members \$47, List \$59, Order code GSM/36RT109

Recommended Text

Triangle of Thoughts

Alain Connes, André Lichnerowicz, and Marcel Paul Schützenberger

Our view of the world today is fundamentally influenced by twentieth century results in physics and mathematics. Here, three members of the French Academy of Sciences: Alain Connes, André Lichnerowicz, and Marcel Paul Schützenberger, discuss the relations among mathematics, physics and philosophy, and other sciences. Written in the form of conversations among three brilliant scientists and deep thinkers, the book touches on, among others, the following questions:

- Is there a "primordial truth" that exists beyond the realm of what is provable? More generally, is there a distinction between what is true in mathematics and what is provable?
- How is mathematics different from other sciences? How is it the same? Does mathematics have an "object" or an "object of study", the way physics, chemistry and biology do?
- Mathematics is a lens, through which we view the world. Connes, Lichnerowicz, and Schützenberger examine that lens, to understand how it affects what we do see, but also to understand how it limits what we can see.
- How does a well-informed mathematician view fundamental topics of physics, such as: quantum mechanics, general relativity, quantum gravity, grand unification, and string theory?
- What are the relations between computational complexity and the laws of physics?
- Can pure thought alone lead physicists to the right theories, or must experimental data be the driving force? How should we compare Heisenberg's arrival at matrix mechanics from spectral data to Einstein's arrival at general relativity through his thought experiments?

The conversations are sprinkled with stories and quotes from outstanding scientists, which enliven the discourse. The book will make you think again about things that you once thought were quite familiar.

Alain Connes is one of the founders of non-commutative geometry. He holds the Chair of Analysis and Geometry at the Collège de France. He was awarded the Fields Medal in 1982. In 2001, he was awarded the Crafoord Prize by The Royal Swedish Academy of Sciences.

André Lichnerowicz, mathematician, noted geometer, theoretical physicist, and specialist in general relativity, was a professor at the Collège de France.

Marcel Paul Schützenberger made brilliant contributions to combinatorics and graph theory. He was simultaneously a medical doctor, a biologist, a psychiatrist, a linguist, and an algebraist.

June 2001, 179 pages, Hardcover, ISBN 0-8218-2614-X, LC 00-065064, 2000 *Mathematics Subject Classification*: 00A30, All AMS members \$24, List \$30, Order code TOTRT109

Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom

Graduate Student Edition

Solomon Friedberg, *Boston College, Chestnut Hill, MA*, Avner Ash, *Elizabeth Brown, Deborah Hughes Hallet, Reva Kasman, Margaret Kenney, Lisa A. Mantini, William McCallum, Jerry Teitelbaum, and Lee Zia*

Progress in mathematics frequently occurs first by studying particular examples and then by generalizing the patterns that have been observed into far-reaching theorems. Similarly, in teaching mathematics one often employs examples to motivate a general principle or to illustrate its use. This volume uses the same idea in the context of learning *how* to teach: By analyzing particular teaching situations, one can develop broadly applicable teaching skills useful for the professional mathematician. These teaching situations are the Case Studies of the title.

Just as a good mathematician seeks both to understand the details of a particular problem and to put it in a broader context, the examples presented here are chosen to offer a serious set of detailed teaching issues and to afford analysis from a broad perspective.

Each case raises a variety of pedagogical and communication issues that may be explored either individually or in a group facilitated by a faculty member.

The methodology of Case Studies is widely used in areas such as business and law. The consideration of the mathematics cases presented here will help readers to develop teaching skills for their own classrooms.

This series is published in cooperation with the Mathematical Association of America.

CBMS Issues in Mathematics Education, Volume 10

June 2001, 67 pages, Softcover, ISBN 0-8218-2823-1, LC 2001022683, 2000 *Mathematics Subject Classification*: 00A35, 97D40; 00A05, 97C70, 97D30, 97D50, 97D60, 97D70, 97U70, All AMS members \$13, List \$16, Order code CBMATH/10RT109

Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom

Faculty Edition

Solomon Friedberg, *Boston College, Chestnut Hill, MA*, and members of the Boston College Mathematics Case Studies Project Development Team

This series is published in cooperation with the Mathematical Association of America.

CBMS Issues in Mathematics Education, Volume 10

June 2001, 158 pages, Softcover, ISBN 0-8218-2875-4, 2000 *Mathematics Subject Classification*: 00A35, 97D40; 00A05, 97C70, 97D30, 97D50, 97D60, 97D70, 97U70, All AMS members \$23, List \$29, Order code CBMATH/10.FRT109

Recommended Text

Geometry of Differential FormsShigeyuki Morita, *University of Tokyo, Japan*

Since the times of Gauss, Riemann, and Poincaré, one of the principal goals of the study of manifolds has been to relate local analytic properties of a manifold with its global topological properties. Among the high points on this route are the Gauss-Bonnet formula, the de Rham complex, and the Hodge theorem; these results show, in particular, that the central tool in reaching the main goal of global analysis is the theory of differential forms.

The book by Morita is a comprehensive introduction to differential forms. It begins with a quick introduction to the notion of differentiable manifolds and then develops basic properties of differential forms as well as fundamental results concerning them, such as the de Rham and Frobenius theorems. The second half of the book is devoted to more advanced material, including Laplacians and harmonic forms on manifolds, the concepts of vector bundles and fiber bundles, and the theory of characteristic classes. Among the less traditional topics treated is a detailed description of the Chern-Weil theory.

The book can serve as a textbook for undergraduate students and for graduate students in geometry.

Translations of Mathematical Monographs (*Iwanami Series in Modern Mathematics*), Volume 201

August 2001, approximately 352 pages, Softcover, ISBN 0-8218-1045-6, LC 2001022608, 2000 *Mathematics Subject Classification*: 57Rxx, 58Axx, **All AMS members \$42**, List \$53, Order code MMONO/201RT109

Advances in Algebraic Geometry Motivated by PhysicsEmma Previato, *Boston University, MA*, Editor

Our knowledge of objects of algebraic geometry such as moduli of curves, (real) Schubert classes, fundamental groups of complements of hyperplane arrangements, toric varieties, and variation of Hodge structures, has been enhanced recently by ideas and constructions of quantum field theory, such as mirror symmetry, Gromov-Witten invariants, quantum cohomology, and gravitational descendants.

These are some of the themes of this refereed collection of papers, which grew out of the special session, "Enumerative Geometry in Physics," held at the AMS meeting in Lowell, MA, April 2000. This session brought together mathematicians and physicists who reported on the latest results and open questions; all the abstracts are included as an Appendix, and also included are papers by some who could not attend.

The collection provides an overview of state-of-the-art tools, links that connect classical and modern problems, and the latest knowledge available.

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

Contributors include: A. I. Suciú, S. J. Kovács, F. Sottile, D. Abramovich, A. Bertram, F. Oort, I. Caporaso, E. Cattani, J. Fernandez, H. Clemens, R. Vakil, D. A. Cox, S. Katz, Y.-P. Lee, T. J. Jarvis, T. Kimura, A. Vaintrob, B. Kreuzler, A. R. Mavlyutov, A. Polishchuk, A. Postnikov, S. Rosenberg, M. Vajiac, C. Woodward, and E. Previato.

Contemporary Mathematics, Volume 276

July 2001, 294 pages, Softcover, ISBN 0-8218-2810-X, LC 2001022549, 2000 *Mathematics Subject Classification*: 13P10, 14-XX, 32G20, 32S22, 53Cxx, 53D45; 20Fxx, 57M05, 65H20, 93B55, **Individual member \$45**, List \$75, Institutional member \$60, Order code CONM/276RT109

Topics in Probability and Lie Groups: Boundary TheoryJ. C. Taylor, *McGill University, Montreal, PQ, Canada*, Editor

This volume is comprised of two parts: the first contains articles by S. N. Evans, F. Ledrappier, and Figà-Talamanca. These articles arose from a Centre de Recherches de Mathématiques (CRM) seminar entitled, "Topics in Probability on Lie Groups: Boundary Theory".

Evans gives a synthesis of his pre-1992 work on Gaussian measures on vector spaces over a local field. Ledrappier uses the free group on d generators as a paradigm for results on the asymptotic properties of random walks and harmonic measures on the Martin boundary. These articles are followed by a case study by Figà-Talamanca using Gelfand pairs to study a diffusion on a compact ultrametric space.

The second part of the book is an appendix to the book *Compactifications of Symmetric Spaces* (Birkhäuser) by Y. Guivarc'h and J. C. Taylor. This appendix consists of an article by each author and presents the contents of this book in a more algebraic way. L. Ji and J.-P. Anker simplifies some of their results on the asymptotics of the Green function that were used to compute Martin boundaries. And Taylor gives a self-contained account of Martin boundary theory for manifolds using the theory of second order strictly elliptic partial differential operators.

Contributors include: J.-P. Anker, L. Ji, S. N. Evans, A. Figà-Talamanca, Y. Guivarc'h, J. C. Taylor, and F. Ledrappier.

CRM Proceedings & Lecture Notes, Volume 28

July 2001, 202 pages, Softcover, ISBN 0-8218-0275-5, LC 2001032073, 2000 *Mathematics Subject Classification*: 60B99; 31C35, 22E30, 22E46, 60J50, **Individual member \$35**, List \$59, Institutional member \$47, Order code CRMP/28RT109

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—*Mathematical Gazette*

After completing his famous *Foundations of Analysis* (See AMS Chelsea Publishing, Volume 79.H for the English Edition and AMS Chelsea Publishing, Volume 141 for the German Edition,

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Grundlagen der Analysis), Landau turned his attention to this book on calculus. The approach is that of an unrepentant analyst, with an emphasis on functions rather than on geometric or physical applications. The book is another example of Landau's formidable skill as an expositor. It is a masterpiece of rigor and clarity.

AMS Chelsea Publishing

January 1965, 372 pages, Hardcover, ISBN 0-8218-2830-4, LC 60-8966, 2000 *Mathematics Subject Classification*: 26-01, 01A75, All AMS members \$33, List \$37, Order code CHEL/78.HRT109

Graduate Studies in Mathematics

These are recent publications in the AMS series, Graduate Studies in Mathematics. Designed for graduate study, these books are regularly adopted as course texts or used for independent study or supplemental reading. Their broad subject range and in-depth coverage make them invaluable resources for both mathematics professors and their students. For more books in this and other AMS series, go to the AMS Bookstore at www.ams.org/bookstore.

Recommended text

A Course in Metric Geometry

Dmitri Burago, Pennsylvania State University, University Park, and Yuri Burago and Sergei Ivanov, Steklov Institute of Mathematics, St. Petersburg, Russia

Graduate Studies in Mathematics, Volume 33; 2001; 415 pages; Hardcover; ISBN 0-8218-2129-6; List \$44; All AMS members \$35; Order code GSM/33CT109

Differential Geometry, Lie Groups, and Symmetric Spaces

Sigurdur Helgason, Massachusetts Institute of Technology, Cambridge

From reviews for the First Edition:

A great book ... a necessary item in any mathematical library.

—S. S. Chern, University of California

Written with unmatched lucidity, systematically, carefully, beautifully.

—S. Bochner, Princeton University

Helgason's monograph is a beautifully done piece of work and should be extremely useful for several years to come, both in teaching and in research.

—D. Spencer, Princeton University

Renders a great service in permitting the non-specialist, with a minimum knowledge of differential geometry and Lie groups, an initiation to the theory of symmetrical spaces.

—H. Cartan, Secretariat Mathématique, Paris

The mathematical community has long been in need of a book on symmetric spaces. S. Helgason has admirably satisfied this need with his book, Differential Geometry and Symmetric Spaces. It is a remarkably well-written book ... a masterpiece of concise, lucid mathematical exposition ... it might be used as a textbook for "how to write mathematics".

—Louis Auslander

Graduate Studies in Mathematics, Volume 34; 2001; ISBN 0-8218-2848-7; 641 pages; Hardcover; All AMS members \$55, List \$69, Order Code GSM/34CT109

Recommended Text

Lecture Notes in Algebraic Topology

James F. Davis and Paul Kirk, Indiana University, Bloomington

Graduate Studies in Mathematics, Volume 35; 2001; 367 pages; Hardcover; ISBN 0-8218-2160-1; List \$55; All AMS members \$44; Order code GSM/35CT109

A Modern Theory of Integration

Robert G. Bartle, Eastern Michigan University, Ypsilanti, and University of Illinois, Urbana

Graduate Studies in Mathematics, Volume 32; 2001; ISBN 0-8218-0845-1; 458 pages; Hardcover; All AMS members \$47, List \$59, Order Code GSM/32CT109

Solutions Manual to A Modern Theory of Integration

Graduate Studies in Mathematics, Volume 32; 2001; ISBN 0-8218-2821-5; 72 pages; Softcover; All AMS members \$11, List \$14, Order Code GSM/32.MCT109

Recommended Text

Principles of Functional Analysis

Second Edition

Martin Schechter, University of California, Irvine

From a review for the First Edition:

"Charming" is a word that seldom comes to the mind of a science reviewer, but if he is charmed by a treatise, why not say so? I am charmed by this book.

Professor Schechter has written an elegant introduction to functional analysis including related parts of the theory of integral equations. It is easy to read and is full of important applications. He presupposes very little background beyond advanced calculus; in particular, the treatment is not burdened by topological "refinements" which nowadays have a tendency of dominating the picture.

The book can be warmly recommended to any reader who wants to learn about this subject without being deterred by less relevant introductory matter or scared away by heavy prerequisites."

—The American Scientist

Graduate Studies in Mathematics, Volume 36; 2001; ISBN 0-8218-2895-9; 393 pages; Hardcover; All AMS members \$47, List \$59, Order Code GSM/36CT109

Recommended Text

Theta Constants, Riemann Surfaces and the Modular Group

An Introduction with Applications to Uniformization Theorems, Partition Identities and Combinatorial Number Theory

Hershel M. Farkas, The Hebrew University, Jerusalem, Israel, and Irwin Kra, State University of New York, Stony Brook

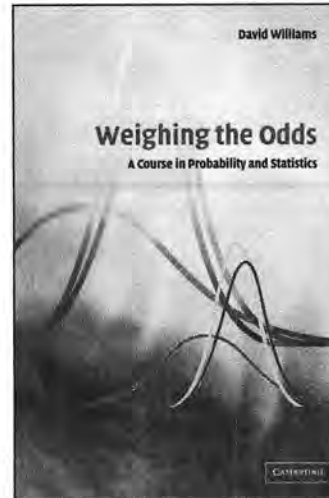
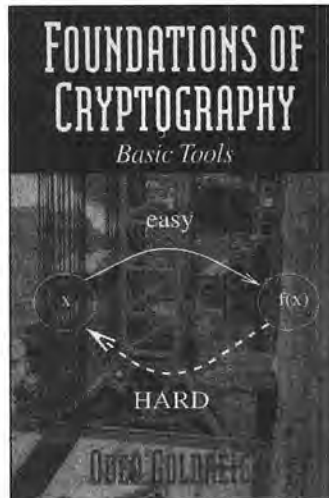
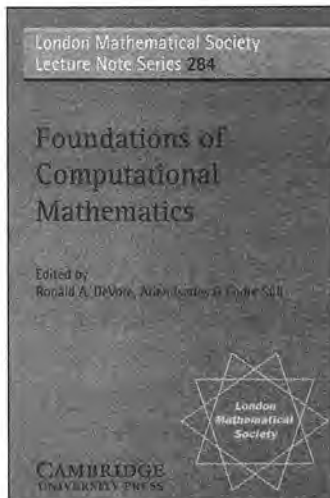
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Yibin B. Fu and Raymond W. Ogden, Editors

Describes the behavior of objects that deform when external forces or temperature gradients are applied. The authors discuss the use of symbolic manipulation software as well as computer algorithm issues.

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0-521-79695-4 538 pp. Paperback \$49.95

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—*Bulletin of the American Mathematical Society*

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Department of Mathematics
Berkeley, CA 94720

Several temporary positions beginning in fall 2002 are anticipated for new and recent Ph.D.'s of any age in any area of pure or applied mathematics. The terms of these appointments may range from one to three years. Applicants for NSF or other postdoctoral fellowships are encouraged to apply for these positions. Mathematicians whose research interests are close to those of regular department members will be given some preference. Applicants should send a résumé and reprints, preprints, and/or dissertation abstract, and ask three people to send letters of evaluation to the Vice Chair for Faculty Affairs at the above address. All letters of evaluation are subject to Berkeley campus policies on confidentiality of letters of evaluation, a summary of which can be found on our home page (<http://math.berkeley.edu>) by clicking on available teaching position and then confidentiality policy. We request that applicants use the AMS standardized application form and indicate their subject area using the AMS subject classification numbers. The form is the Academic Employment in Mathematics, Application

Cover Sheet, available courtesy of the American Mathematical Society.

Applications must be postmarked by December 1, 2001. Applications postmarked after the deadline will not be considered. The University of California is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF CALIFORNIA, IRVINE
Department of Mathematics
Irvine, CA 92697-3875

Applications are invited for several one- or three-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 \$46,100. Teaching load: 5 to 6 quarter-courses per year. Applicants should send résumé, preprints, dissertation abstract and ask three people to send letters of recommendation to: Visiting Assistant Professor Search Committee at the above address. Electronic submission not accepted.

The deadline for applications is November 30, 2001, or until the positions are filled. The University of California, Irvine, is an Equal Opportunity Employer committed to excellence through diversity.

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 2001 rate is \$100 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional text 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.

Upcoming deadlines for classified advertising are as follows: October 2001 issue–July 26, 2001; November 2001 issue–August 27, 2001; Decem-

ber 2001 issue–September 27, 2001; January 2002 issue–October 24, 2001; February 2002 issue–November 20, 2001; March 2002 issue–December 28, 2001.

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 (vol. 44).

Situations wanted advertisements from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. and Canada or 401-455-4084 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 classads@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.

UNIVERSITY OF CALIFORNIA, IRVINE
Department of Mathematics
Irvine, CA 92697-3875

Applications are invited for tenure-track or tenured positions. Priorities will be placed on the following areas: (A) applied and computational mathematics, (B) analysis and PDE (includes mathematical physics), (C) geometry and topology (includes geometric analysis), (D) logic and set theory, (E) probability, (F) algebra and number theory (includes algebraic and arithmetic geometry). Candidates must possess a Ph.D. Strong record and potential in research and teaching are required for the positions. Send curriculum vitae (include e-mail address), list of publications, preprints, reprints, and research plan to the Recruiting Committee at the above address. Designate area by letter A-F. Applicants should also arrange for four letters of recommendation to be sent. If possible, use the AMS cover sheet. Electronic submission not accepted.

The deadline for applications is November 30, 2001, or until the positions are filled. The University of California, Irvine, is an Equal Opportunity Employer committed to excellence through diversity.

UNIVERSITY OF CALIFORNIA,
LOS ANGELES
Department of Mathematics

Subject to availability of resources and administrative approval, the following positions are available:

- 1) Several tenure-track and senior positions in all areas of mathematics.
- 2) Several E. R. Hedrick Assistant Professorships. Salary is \$52,900. Three-year appointment. Teaching load: four quarter-courses per year, which may include one advanced course in the candidate's field.
- 3) Several Research Assistant Professorships in Computational and Applied Mathematics (CAM). Salary is \$52,900. Three-year appointment. Teaching load: normally reduced to two or three quarter-courses per year by research funding as available; may include one advanced course in the candidate's field.
- 4) Several Adjunct Assistant Professorships or Lectureships 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 one-quarter programming courses each year and one seminar every two years. One-year initial appointment, with the option of applying for renewal for a second year and possibly longer, up to a maximum service of four years. Salary is \$56,600. 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 one-quarter programming courses per year. One-year

appointment, probably renewable one or more times, depending on the needs of the program. Salary is \$43,152 or more, depending on experience.

5) Several VIGRE Assistant Professorships, Hedrick, CAM, or PIC applicants who are U.S. citizens or permanent residents may also apply for a VIGRE Assistant Professor position. Three-year appointment. Salary is \$52,900. The successful recipient will receive a summer stipend of \$6,500 for two summers and \$2,500 per year for travel, equipment, and supplies for three years. Teaching load: 3 courses per year.

6) Several Adjunct Assistant Professorships and Research Postdocs. Up to one-year appointment, with the possibility of renewal. Strong research and teaching background required. Salary \$48,700-\$52,900. Teaching load for Adjuncts: five quarter-courses per year.

7) Several visiting instructorships.

For more details, see <http://www.math.ucla.edu/~search/>. To apply, complete the application on the website, or send e-mail to search@math.ucla.edu, or write to: Staff Search, Department of Mathematics, University of California, Los Angeles, CA 90095-1555. Preference will be given to applications completed by January 7, 2002.

UCLA is an Equal Opportunity/Affirmative Action Employer. Under federal law, the University of California may employ only individuals who are legally authorized to work in the United States as established by providing documents specified in the Immigration Reform and Control Act of 1986.

GEORGIA

GEORGIA INSTITUTE OF TECHNOLOGY
School of Mathematics

The School of Mathematics at Georgia Tech expects to have several visiting, tenure-track and senior positions available beginning fall 2002 and will consider applications in pure and applied mathematics and statistics. The school is interested in adding new areas of expertise to complement its existing strengths. Candidates with strong research and teaching records or potential should arrange for a résumé, at least three letters of reference, and a summary of future research plans to be sent to the Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332-0160. Review of applications will begin in September 2001 and will continue until all positions have been filled. Georgia Tech, an institution of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

ILLINOIS

ILLINOIS WESLEYAN UNIVERSITY
Department of Mathematics and
Computer Science
Bloomington, IL

The Department of Mathematics and Computer Science at Illinois Wesleyan University invites applications for a tenure-track assistant professor in mathematics. Employment would begin in August 2002, and the teaching load would be six courses per year. All candidates should possess a Ph.D. in mathematics and a dedication to excellent teaching in a liberal arts environment where undergraduate research is encouraged. We are primarily interested in candidates with expertise in number theory, graph theory, or combinatorics. Candidates in other fields which do not seriously overlap the interests of existing faculty will also be considered. The opportunity to participate in university-wide general education programs is available for interested faculty.

Illinois Wesleyan University is a highly selective undergraduate university of approximately 2,000 students located in Bloomington, Illinois, a community of about 120,000. This year the average ACT for Illinois Wesleyan's entering class of freshmen was 28. In recent years as many as 4% of the undergraduate population at Illinois Wesleyan University have declared majors in mathematics. The department maintains a healthy balance between applied mathematics and pure mathematics. Faculty areas of professional expertise include algebra, approximation theory, differential equations, dynamical systems, electrical engineering, linear algebra, logic, operations research, probability, topology, topos theory, numerical analysis and wavelet analysis. The Department of Mathematics and Computer Science is located in the Center for Natural Science Learning and Research, a \$25 million facility opened in 1995. The department operates five computer labs for students which have around 80 SunSparc and iMac computers. For additional information on the mathematics curriculum, facilities, and faculty interests, see <http://titan.iwu.edu/~math/>.

Candidates for the position should submit a letter of application, a vita, an AMS Standard Cover Sheet, a teaching statement, a research statement, and three letters of recommendation to: Melvyn Jeter, Department of Mathematics and Computer Science, Illinois Wesleyan University, P.O. Box 2900, Bloomington, IL 61702-2900. Preliminary interviews for this position will be held at the Joint Mathematics Meetings in San Diego, CA (January 2002). Applications received after December 15, 2001, may not receive full consideration. Women and minorities are encouraged to apply. Illinois Wesleyan is an Equal Oppor-

tunity Employer. For further information see our jobs web page at: <http://www.iwu.edu/~iwujobs/>.

ILLINOIS WESLEYAN UNIVERSITY
Department of Mathematics and
Computer Science
Bloomington, IL

The Department of Mathematics and Computer Science at Illinois Wesleyan University invites applications for a full-time tenure-track assistant professor in computer science to begin in August 2002. Candidates should have a Ph.D. in computer science or a Ph.D. in a closely related field with significant computing experience or significant graduate work in computer science. Candidates must be able to teach in the core CS curriculum. Preference may be given to candidates who can teach upper-level courses in any of the following areas: networking, computer architecture, human-computer interaction, software engineering, operating systems.

Illinois Wesleyan University is a highly selective undergraduate university of approximately 2,000 students located in Bloomington, Illinois, a community of about 120,000. The Department of Mathematics and Computer Science is located in the Center for Natural Science Learning and Research, a \$25 million facility opened in 1995.

Candidates for the position should submit a letter of application and résumé, and have three letters of recommendation sent separately to: Melvyn Jeter, Department of Mathematics and Computer Science, Illinois Wesleyan University, P.O. Box 2900, Bloomington, IL 61702-2900. Applications received after November 16, 2001, may not receive full consideration. Women and minorities are encouraged to apply. Illinois Wesleyan is an Equal Opportunity Employer. For further information see our jobs web page at: <http://www.iwu.edu/~iwujobs/>.

MARYLAND

UNIVERSITY OF MARYLAND,
COLLEGE PARK
Computational Nonlinear Dynamics
Faculty Position

A nonlinear dynamicist with strong interest in computation is sought for a tenured or tenure-track appointment in the Department of Mathematics, possibly joint with the Institute for Physical Science and Technology. An outstanding record of research accomplishments and a proven ability to attract research support are important for a senior position. Good teaching is a priority of the university.

Applications should be sent to: Chair's Office, Computational Nonlinear Dynamics, Department of Mathematics, University of Maryland, College Park, MD 20742-4015. Priority will be given to applications

received by December 1, 2001. Appointments will commence in fall 2002. The University of Maryland is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF MARYLAND,
COLLEGE PARK
Department of Mathematics

Applications are invited for tenured and tenure-track positions in the Department of Mathematics. Strong preference will be given to candidates in (1) applied statistics, (2) algebraic geometry, (3) dynamics, and (4) geometry, but candidates from all areas will be considered.

Priority will be given to applications received by December 1, 2001. Appointments will commence in fall 2002.

The University of Maryland is an Equal Opportunity/Affirmative Action Employer that strongly encourages applications from female and minority candidates.

Please send a curriculum vitae and AMS Standard Cover Sheet, and three letters of recommendation to:

The Hiring Committee
 Department of Mathematics
 University of Maryland
 College Park, MD 20742

UNIVERSITY OF MARYLAND,
COLLEGE PARK
Lectureships in the Department of
Mathematics

Applications are invited for Avron Douglis Lectureships, starting in fall 2002. These positions are for recent Ph.D. recipients, with a preference for those not more than one year past the Ph.D. degree. The lectureship is for two years and is nonrenewable. Candidates must have superior research potential and a strong commitment to teaching. The Department of Mathematics provides an excellent scientific environment to foster the professional development of junior mathematicians. The teaching duties consist of three courses per year. The salary is \$47,000 per academic year, supplemented by a \$1,000 research stipend. Priority will be given to applications completed by December 15, 2001.

The University of Maryland is an Equal Opportunity/Affirmative Action Employer that strongly encourages applications from female and minority candidates.

Please send a curriculum vitae and AMS Standard Cover Sheet, and three or more letters of recommendation, at least one of which speaks to the applicant's teaching credentials, to:

Douglis Lectureship Committee
 Department of Mathematics
 University of Maryland
 College Park, MD 20742

MICHIGAN

UNIVERSITY OF MICHIGAN
Department of Mathematics

The department has several openings at the tenure-track or tenured level. Candidates should hold the Ph.D. in mathematics or a related field and should show outstanding promise and/or accomplishments in both research and teaching. Areas of special interest are: analysis; geometry/topology; applied and interdisciplinary mathematics, including mathematical biology, computational science, probability, and actuarial or financial mathematics. However, we encourage applications from any area of pure or applied mathematics. Salaries are competitive, based on credentials. Applicants should send a C.V.; bibliography; descriptions of research and teaching experience; and three or four letters of recommendation, at least one of which addresses the candidate's teaching experience and capabilities, to: Personnel Committee, University of Michigan, Department of Mathematics, 2074 East Hall, Ann Arbor, MI 48109-1109. Applications are considered on a continuing basis, but candidates are urged to apply by November 1, 2001. More detailed information regarding available positions may be found on our web page, <http://www.math.lsa.umich.edu/>. Inquiries may be made by e-mail to math.chair@math.lsa.umich.edu. The University of Michigan is an Equal Opportunity/Affirmative Action Employer.

NEW YORK

UNIVERSITY OF BUFFALO, SUNY
Department of Mathematics

The Department of Mathematics anticipates the appointment of several tenure-track assistant professors, effective August 2002. Salary will be competitive. We seek candidates from all fields, particularly applied mathematics and geometry/topology. Applicants should have excellent research accomplishments and potential, a Ph.D. in the mathematical sciences, and a strong commitment to teaching.

A complete application consists of a curriculum vitae, a statement of research interests, and four letters of recommendation. These materials should be sent to:

Search Committee
 Department of Mathematics
 University of Buffalo, SUNY
 Mathematics Building 244
 Buffalo, NY 14260-2900

The deadline for applications is November 1, 2001. Late applications will be considered until positions are filled. No electronic applications will be accepted.

The University of Buffalo is an Equal Opportunity/Affirmative Action Employer/

Recruiter. We are interested in identifying prospective minority and women candidates. No person, in whatever relationship with the University of Buffalo, shall be subject to discrimination on the basis of age, color, creed, handicap, marital status, national origin, race, religion, sex, sexual orientation, or veteran status.

NORTH CAROLINA

**EAST CAROLINA UNIVERSITY
Department of Mathematics
Chair and Professor of Mathematics**

Applications and nominations are invited for chair of the Department of Mathematics, College of Arts and Sciences, East Carolina University. Appointment will be at the level of professor with permanent tenure, beginning on or before August 1, 2002. Qualifications for the position include an earned Ph.D. in the mathematical sciences, administrative experience, a distinguished record of research, and a demonstrated commitment to excellence in teaching and service. Preference will be given to candidates from doctoral-granting institutions.

The department offers a Master of Arts in Mathematics, a Master of Arts in Mathematics Education, a Bachelor of Arts in Mathematics, and a Bachelor of Science in Mathematics Education. The areas of the department are mathematics, mathematics education, and statistics.

The mathematics department at ECU has 26 tenured or tenure-track faculty. The recent increase in our department's research productivity and external funding reflects the reclassification of East Carolina as a Doctoral/Research-Intensive University. Further information is available at the department website, <http://www.math.ecu.edu/>.

ECU enrolls more than 18,000 students and is the third largest institution in the University of North Carolina system. Located in the eastern region of the state, Greenville is a city of about 60,000, 91 miles east of Raleigh and a short distance to the Atlantic coast.

Salary and resources will be highly competitive. Screening will begin September 15, 2001, and applications will be accepted until the position is filled. Please send letter of application, CV, and a statement of administrative philosophy with details about personal administrative experience. Three current letters of recommendation or the names of 3 references should also be forwarded. Official graduate transcripts are required upon employment. Send all materials to:

Dr. Richard C. Kearney, Chair
Mathematics Search Committee
Department of Political Science
College of Arts and Science
East Carolina University
Greenville, NC 27858-4353

tel: 252-328-1066
fax: 252-328-4134
e-mail: kearneyr@mail.ecu.edu

East Carolina University is a constituent institution of the University of North Carolina University System, an Equal Opportunity/Affirmative Action University, and accommodates individuals with disabilities. Applicants must comply with the Immigration Reform and Control Act.

**NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics**

The Department of Mathematics invites applications for a tenure-track appointment at the assistant professor level in financial mathematics, beginning in the fall of 2002. Candidates should have a strong ongoing research program and a demonstrated skill in teaching. The candidate's areas of interest should complement the current research activities within the department in the broad areas of stochastic processes, partial differential equations, and scientific computation. The successful candidate will participate in the creation and development of a multidisciplinary master's program in financial mathematics. Applicants should send a vita and three letters of reference to: Financial Mathematics Search Committee, NC State University, Mathematics Department, Box 8205, Raleigh, NC 27695-8205. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, veteran status, or disability. Complete applications received before November 30, 2001, will receive full consideration.

**NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics**

The Department of Mathematics invites applications for a tenure-track appointment at the assistant professor level in computer algebra and symbolic computation, beginning in the fall of 2002. Candidates should have a strong ongoing research program and a demonstrated skill in teaching. We are primarily interested in researchers with an orientation to the following subareas of computer algebra and symbolic computation: computational algebraic geometry (and applications to computer-aided design and engineering) and computational number theory (and applications to cryptography and computer science). Applicants should send a vita and three letters of reference to: Symbolic Computation Search Committee, NC State University, Mathematics Department, Box 8205, Raleigh, NC 27695-8205. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, veteran status, or disability. Complete applications received before November 30, 2001, will receive full consideration.

**NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics**

The Department of Mathematics invites applications for a tenure-track position at the assistant professor level in representation theory and combinatorics, beginning in the fall of 2002. Candidates must have a doctoral degree in mathematics, a strong ongoing research program in representation theory and/or 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 three letters of recommendation to: Algebra Search Committee, NC State University, Department of Mathematics, Box 8205, Raleigh, NC 27695-8205. Review of completed applications will begin immediately. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, veteran status, or disability. Complete applications received before November 30, 2001, will receive full consideration.

UTAH

**UNIVERSITY OF UTAH
Department of Mathematics**

Applications are invited for the following positions. Availability of positions is contingent upon funding. The hiring committee will select candidates based on excellence in research and teaching.

1. Up to three full-time tenure-track or tenured appointments at the level of assistant, associate, or full professor. The department is primarily interested in applicants who work in the research areas represented in the department and who received their Ph.D. degrees prior to 2001.

2. One or more nonrenewable three-year Scott Assistant Professorships. Persons of any age receiving Ph.D. degrees in 1999 or later are eligible. Starting salary will be at least \$43,000. Increases are given annually, but amounts vary from year to year. Teaching duties for the entire three-year instructorship are 9 one-semester courses.

3. One or more Visiting Faculty positions of one year or less in any of the professorial ranks, depending upon availability.

Completed applications for faculty positions will be considered starting October 1, 2001, and positions may be offered from that date on. However, applications will be accepted up to May 1, 2002, or until positions are filled. Scott Assistant Professorship applications should be completed by December 1, 2001. Review of applications will begin on December 8, 2001.

To apply for any of these positions, you are strongly encouraged to fill out an application at <http://www.math.utah.edu/>

pos/ or at <http://www.mathjobs.org/>. Alternatively, you may send the AMS cover sheet. To complete your application, send a curriculum vitae, bibliography, and three letters of recommendation. Visiting professor applicants should indicate the part of the year they wish to visit. Incomplete files will not be considered.

Please send this information to: Committee on Staffing, Department of Mathematics, University of Utah, 155 S. 1400 E., JWB 233, Salt Lake City, UT 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.

WISCONSIN

UNIVERSITY OF WISCONSIN-MADISON Mathematical Physics/String Theory Cluster Hiring

The Departments of Mathematics and Physics anticipate openings for three positions to begin August 26, 2002, at either the tenure-track (assistant professor) or tenured (associate/full professor) level. This cluster hiring is a part of the Madison Initiative and is intended to establish a prominent research group connecting the existing groups in particle physics phenomenology in the physics department and topology/geometry in the mathematics department. Applications are especially encouraged from theorists pursuing innovative research in string theory, quantum gravity, physics with extra dimensions, quantum field theory, supersymmetry, and unification theories, as well as from mathematicians working on aspects of string theory or related topics. Successful candidates will be encouraged to participate in interdisciplinary research which will strengthen ties between the two departments. Joint appointments in the mathematics and physics departments are contemplated.

Candidates should exhibit evidence of outstanding research records, normally including achievements significantly beyond the doctoral dissertation. A strong commitment to excellence in instruction at both undergraduate and graduate levels is also expected. Applicants should send a curriculum vitae which includes a publication list, and brief descriptions of research and teaching accomplishments and goals to:

Math/Physics Cluster Hiring
Committee

Dept. of Mathematics, Van Vleck Hall
University of Wisconsin-Madison
480 Lincoln Drive
Madison, WI 53706-1388

Applicants should also arrange to have sent to the above address three letters

of recommendation which address the applicant's research potential and teaching experiences. Review of applications will begin on November 1, 2001. Applications will be accepted until the positions are filled. Additional letters will be solicited by the hiring committee for senior appointments.

The Departments of Mathematics and Physics are committed to increasing the number of women and minority faculty. The University of Wisconsin is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities. Unless confidentiality is requested in writing, information regarding the applicants must be released upon request. Finalists cannot be guaranteed confidentiality.

Additional departmental information is available on the websites <http://www.math.wisc.edu/> or <http://www.physics.wisc.edu/>. Information about the cluster hiring initiative is available at <http://wiscinfo.doit.wisc.edu/cluster/>.

CANADA

UNIVERSITY OF OTTAWA Department of Mathematics and Statistics

The University of Ottawa invites applications for two tenure-track positions starting July 1, 2002. One position will be for a recent Ph.D. at the assistant professor level. For the second position, the rank and salary will be commensurate with qualifications and experience. Applications in all areas of mathematics and statistics will be considered.

Applicants should send a curriculum vitae; a research plan; and arrange to have sent four confidential letters of recommendation, with one addressing teaching, to: Erhard Neher, Chairman, Department of Mathematics and Statistics, University of Ottawa, Ottawa, ON, Canada K1N 6N5. Applicants are also encouraged to include up to three copies of their most significant publications. The evaluation of files will start October 15, 2001, but applications will be accepted until the positions have been filled.

Conditions of employment are set by a collective agreement. Employment equity is university policy, and the university strongly encourages applications from women. Canadian citizens and permanent residents will be considered first for these positions.

Information about the department can be found at <http://www.science.uottawa.ca/mathstat/>.

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THE UNIVERSITY OF FLORIDA

is pleased to announce the creation of

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First appointment: Fall 2002

Terms of appointment: Three year terminal position with salary of \$50,000 for the academic year 2002-03, and \$5,000 summer research supplement for each of the three years. Reduced teaching load of one course per semester, during each academic year.

Eligibility: Mathematics Ph.Ds who have received degrees in the year 2000 or later.

Outstanding candidates in all areas of mathematics are encouraged to apply. Candidates must send vita and papers to:

Chair: Search Committee
Department of Mathematics
University of Florida
Gainesville, FL 32611

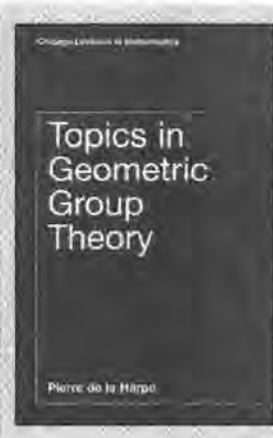
by December 15, 2001, and arrange for three letters of recommendation to be sent directly to the above address.

The department welcomes applications from women and minority candidates. The University of Florida is an EEO/AA institution. For more information about the position or institution: <http://www.math.ufl.edu>

*1970 Fields medallist John Griggs Thompson is Graduate Research Professor in the Department of Mathematics, University of Florida, since 1993. Professor Thompson who received the National Medal of Science in December 2000, will be turning 70 in November 2002. This research assistant professorship is being launched in Fall 2002 to coincide with his seventieth birthday year.

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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 visit the AMS web site for a choice of electronic versions at www.ams.org/coversheet/), 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 purpose of the cover form is to aid department staff in tracking and responding to each application for employment. Mathematics departments in Bachelor's-, Master's-, and Doctorate-granting institutions are expecting to receive the form from each applicant, along with the other application materials they require.

The AMS suggests that applicants and employers visit the Job Application Database for Mathematicians (www.mathjobs.com), a new electronic resource being offered by the AMS (in partnership with Duke University) for the first time in 2001-02. The system provides a way for applicants to produce printed coversheet forms, apply for jobs, or publicize themselves in the "Job Wanted" list. Employers can post a job listing, and once applications are made, search and sort among their applicants. Note-taking, rating, e-mail, data downloading and customizable EOE functions are available to employers. Also, reference writers can submit

their letters online. A paperless application process is possible with this system, however; employers can choose to use any portion of the service. It is hoped that departments hiring for postdoc positions, especially, will utilize the system this year. There will be no fees for any services this year. This system was developed at the Duke University Department of Mathematics, and was tested by a group of departments in 2000-01.

Please direct all questions and comments to: emp-info@ams.org.

AMS STANDARD COVER SHEET

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Middle Names _____

Address through next June _____ Home Phone _____

_____ e-mail Address _____

Current Institutional Affiliation _____ Work Phone _____

Highest Degree Held or Expected _____

Granting Institution _____ Date (optional) _____

Ph.D. Advisor _____

Ph.D. Thesis Title (optional) _____

Indicate the mathematical subject area(s) in which you have done research using, if applicable, the Mathematics Subject Classification printed on the back of this form or on e-MATH. 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 _____

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.

- _____
- _____
- _____
- _____

This form is provided courtesy of the American Mathematical Society.

This cover sheet is provided as an aid to departments in processing job applications. It should be included with your application material.

Please print or type. Do not send this form to the AMS.



2000 Mathematics Subject Classification

- 00 General
- 01 History and biography
- 03 Mathematical logic and foundations
- 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
- 19 K -theory
- 20 Group theory and generalizations
- 22 Topological groups, Lie groups
- 26 Real functions
- 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
- 37 Dynamical systems and ergodic theory
- 39 Difference and functional equations
- 40 Sequences, series, summability
- 41 Approximations and expansions
- 42 Fourier analysis
- 43 Abstract harmonic analysis
- 44 Integral transforms, operational calculus
- 45 Integral equations
- 46 Functional analysis
- 47 Operator theory
- 49 Calculus of variations and optimal control, optimization
- 51 Geometry
- 52 Convex and discrete geometry
- 53 Differential geometry
- 54 General topology
- 55 Algebraic topology
- 57 Manifolds and cell complexes
- 58 Global analysis, analysis on manifolds
- 60 Probability theory and stochastic processes
- 62 Statistics
- 65 Numerical analysis
- 68 Computer science
- 70 Mechanics of particles and systems
- 74 Mechanics of deformable solids
- 76 Fluid mechanics
- 78 Optics, electromagnetic theory
- 80 Classical thermodynamics, heat transfer
- 81 Quantum theory
- 82 Statistical mechanics, structure of matter
- 83 Relativity and gravitational theory
- 85 Astronomy and astrophysics
- 86 Geophysics
- 90 Operations research, mathematical programming
- 91 Game theory, economics, social and behavioral sciences
- 92 Biology and other natural sciences
- 93 Systems theory, control
- 94 Information and communication, circuits
- 97 Mathematics education

Mathematical Sciences Employment Center

*San Diego Convention Center, San Diego, California
January 6, 7, 8, and 9, 2002*

2002 Employment Center Schedule

Sunday, January 6

7:30 a.m.–4:00 p.m. Registration and materials pick-up.

9:00 a.m.–9:30 a.m. Short (optional) orientation session.

9:30–4:00 p.m. Submission of Scheduled Employment Register interview request forms for both Monday and Tuesday interviews. No request forms can be accepted after 4:00 p.m. Sunday.

9:30 a.m.–6 p.m. Interview Center open.

No Scheduled Employment Register interviews are held on Sunday.

Monday, January 7

7:00 a.m.–8:15 a.m. Distribution of interview schedules for both Monday and Tuesday, for those participating in the Scheduled Employment Register.

8:15 a.m.–4:40 p.m. Scheduled Employment Register interviews in 4 sessions: *Session 1:* 8:15 a.m.–9:50 a.m., *Session 2:* 10:00 a.m.–11:35 a.m., *Session 3:* 1:00 p.m.–2:35 p.m., *Session 4:* 3:00 p.m.–4:35 p.m.

8:00 a.m.–7:30 p.m. Interview Center open (doors open at 7:30 a.m.; do not schedule before 8:00 a.m.).

Tuesday, January 8

8:15 a.m.–4:40 p.m. Scheduled Employment Register interviews in 4 sessions: *Session 5:* 8:15 a.m.–9:50 a.m., *Session 6:* 10:00 a.m.–11:35 a.m., *Session 7:* 1:00 p.m.–2:35 p.m., *Session 8:* 3:00 p.m.–4:35 p.m.

8:00 a.m.–7:30 p.m. Interview Center open.

Wednesday, January 9

9:00 a.m.–1 p.m. Interview Center open.

Note: Any participant who plans to use the Scheduled Employment Register must appear at the Employment Center on Sunday by 4:00 p.m. to turn in the Interview Request/Availability Form. If unexpected delays occur while travelling, contact the Employment Center staff by telephone in the Convention Center. The phone number will be sent to registered participants by e-mail when it is available in December.

Overview of the Employment Center

The Employment Center (formerly the Employment Register) serves as a meeting place and information center for employers and Ph.D.-level jobseekers attending the Joint Mathematics Meetings. Most applicants and employers began the search process in the fall, and are looking for an opportunity to meet in person with those with whom they've already had communication. Some, however, use the Employment Center as a way to make some initial contacts, gather information, and distribute their own information. This is a less effective, but common, use of the program. The Employment Center allows everyone to choose a comfortable level of participation, by seeking interviews for any of the open hours, or by limiting schedules to certain days or hours.

The Employment Center is a three-day program which takes place on the Sunday, Monday, Tuesday, and Wednesday (morning only) of the Joint Meetings. Most participants register in advance (by the October 26 deadline) and their brief résumé or job description is printed in a booklet which is mailed to participants in advance.

The Employment Center houses two services: the computer-scheduled interview tables (the Scheduled Employment Register), and the employer-scheduled interview tables (the Interview Center). Use of the Center overall by employers has gone up in recent years. At the 2001 Employment Center, 347 candidates and 139 employers participated, giving an overall applicant-to-employer ratio of 2.5:1 (compared with 390 applicants and 152 employers in 2000, a ratio of 2.6:1). Each applicant ends up with roughly 5 to 15 interviews of various types. Those with the most interviews are those requested most by employers, usually as a result of a careful application process during the months before the Employment Center takes place.

At the January 2002 Employment Center, job candidates will be able to choose how to participate. Two forms of participation will be available:

All Employment Center services (computer-scheduling system, form posted in *Winter List of Applicants*, *Winter List of Employers* received by mail, use of Employment Message Center,

availability for employer-scheduled Interview Center).

Message Center and *Winter Lists* only (form posted in *Winter List of Applicants*, *Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center, BUT NOT use of the computer-scheduling system).

No matter which option is chosen, advance registration works best so that the Applicant Form (received by October 26, 2001) can be printed in the *Winter List* which will be distributed to employers.

Employer forms submitted by registered employers have no connection with the AMS on-line job ads (EIMS). Submitted forms are not available for browsing on the Web. They are reproduced in the *Winter List* booklet for use by Employment Center participants.

The Mathematical Sciences Employment Center is sponsored by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics; it is managed by members of the AMS staff, with the general guidance of the AMS-MAA-SIAM Committee on Employment Opportunities.

Employers: Choose one or both of these tables:

- Computer-scheduled Employment Register table
- Employer-scheduled Interview Center table

The Employment Register Computer-Scheduling System

Employers register in advance by the October 26 deadline, and their job listings ("Employer Forms") are printed and distributed in mid-December to applicants. Employers receive the book of brief, numbered applicant résumés in mid-December. Participants decide on Sunday, January 6, which of the eight sessions (of five interviews each) they will participate in and submit their Availability/Interview Request Forms by 4:00 p.m. Sunday. Employers can reserve time for other Joint Meetings events by marking "unavailable" for one or more of the eight sessions. Employers can request ten specific applicants per day, assuming they are available for all four sessions that day. Usually those requests will be filled by the scheduling algorithm, provided the applicants are present, except in the case of the few most-requested applicants. The rest of their interviews will be with applicants who ask to see them. Employers should be specific about their requirements on the Employer Form to avoid interviews with inappropriate candidates.

Schedules are distributed for all Monday and Tuesday interviews on Monday morning. The schedule allows 15-minute interviews, with 5 minutes between for note taking. One or more interviewers for the same position(s) may interview at the table separately, together, or in shifts.

For follow-up interviews, the scheduled tables will also be available for use until 7:30 p.m. on Monday and Tuesday and on Wednesday morning from 9:00 a.m.-1:00 p.m.

Participation in the scheduling program has become optional for applicants, so employers will notice some applicant résumés in the *Winter List of Applicants* with no applicant number. An employer can arrange to interview such an applicant outside of the scheduled interview sessions—for instance, between 4:40 p.m. and 7:30 p.m. Monday or Tuesday, or on Wednesday morning—or during sessions which they left unscheduled.

Employers who are interviewing for two distinct positions may wish to pay for two tables. See the instructions under "How to Register". Employers should bring school catalogs, corporate reports, or more lengthy job descriptions to the Employment Center early on Sunday for perusal by applicants prior to interviews.

The Employer-Scheduled Interview Center

The Interview Center allows any employer to reserve a table in an area adjacent to the Employment Center. Employers will arrange their own schedule of interviews, either in advance or on site, by using the Employment Message Center. Employers who have never used the Employment Center before might want to try conducting interviews at this convenient location. Since they will be setting their own schedules, employers will have complete control over whom they'll see, for how long, and when they'll be interviewing. This allows employers to pursue other activities at the Joint Meetings.

The Center will be open only during the following hours:

- Sunday, January 6,, 2002, 9:30 a.m.-6:00 p.m.
- Monday, January 7, 2002, 8:00 a.m.-7:30 p.m.
- Tuesday, January 8, 2002, 8:00 a.m.-7:30 p.m.
- Wednesday, January 9, 2002, 9:00 a.m.-1:00 p.m.

The fee for use of this area is the same as the normal employer fee. It is requested that all employers fill out an Employer Form for inclusion in the *Winter List*. This should clarify to Employment Center applicants what type of position is being filled. If an employer is unable to accept new applicants because the deadline has passed, that should be stated on the form.

The *Winter List of Applicants*, containing information about the candidates present at the Employment Center, will be mailed to all employers in advance of the meeting.

Employers scheduling interviews in advance should tell applicants to find the table with the institution's name in the Interview Center (not the numbered-table area). Employers can schedule any time during the open hours listed above. To schedule interviews after arriving in San Diego, leave messages for Employment Center applicants in the Employment Message Center. Paper forms will be provided to help speed the invitation process. Each employer will be provided with a box in the Message Center where applicants can leave items.

Employers should have at most two interviewers per table at any time due to space limitations. There will be no outlets or electricity available at the interviewing tables.

About the *Winter List of Applicants*

This booklet contains hundreds of résumés of applicants registered by October 26 for the Employment Center. It will be mailed to all employers who register by October 26 who indicate on their Joint Meetings registration form that they would like their materials mailed. Employers should be aware that there will be hundreds of brief résumés to look through and should be sure to obtain the *Winter List of Applicants* as early as possible.

Employers Not Planning to Interview

Employers who do not plan to participate in the Employment Center at all may display a job description. This description must be submitted on the Employer Form, which appears in the back of this issue, with the appropriate box checked indicating that no interviews will take place. A fee of \$50 is charged for this service (paid through the Joint Meetings registration form). The form must be received in the Providence office (with payment or purchase order) by the October 26 deadline, to appear in the *Winter List of Employers*. Forms received in the Providence office after that deadline will be displayed at the meeting. Those wishing to bring a one-page job description to the Employment Center desk for display during the Meetings may do so at no charge.

Employers: How to Register

The interviewer should register and pay for the Joint Mathematics Meetings by:

Indicating on the Joint Meetings registration form (available electronically at www.ams.org/amsmtgs/2049_intro.html, or in the back of the October issue of the *Notices*) that you are also paying the Employment Center employer fee. Indicate your choice of tables. Mark all that apply.

Submitting an Employer (job listing) Form electronically at www.ams.org/emp-reg/, or using the print version in the back of this issue. Be sure the form indicates which type or types of tables will be used. This form will be printed in the *Winter List of Employers*.

It's important to register by the October 26 deadline, in order for your form to be included in the *Winter List of Employers*. However, registration will be accepted up to December 10 for the normal fees or on site in San Diego at the on-site rates. Call 800-321-4267, ext. 4105, with any questions or deadline problems.

Any number of interviewers can sit at a table together or in shifts, and their names should be listed on the Employer Form as a reference point for the applicants. However, Employment Center fees should be paid only for each table required.

In a few unusual cases an institution will be conducting interviews in the Employment Center for two or more distinct positions and will not want to conduct these interviews at one table. In that case two or more Employer

Forms should be submitted, and separate tables and employer numbers will be provided. Applicants will then be able to request interviews for the appropriate job by employer number. First and second table fees should be paid.

The fee for all employers to register in advance is \$210 for the first table and \$60 for each additional table. On-site registration fees (any registrations after 12/10/01) are \$300 for the first table and \$100 for each additional table. Employers must also register for the Joint Meetings and pay the appropriate Joint Meetings fee.

Employers: Registration on Site

Employers who do not register for the Joint Mathematics Meetings and the Employment Center by December 10 may register on site in San Diego at the Joint Meetings Registration Desk. They must bring their receipt to the Employment Center desk between 7:30 a.m. and 4:00 p.m. on Sunday, January 6, to receive their materials. A typed copy of the Employer Form (found in the back of this issue) can be brought to the Employment Center for posting on site (or the form can be handwritten on site). If registering for the employer-scheduled Interview Center only, registration on Monday is possible.

Applicants: Use of the Computer-Scheduled Program Is Now Optional

In 2002, applicants will be given flexibility in deciding how to participate in the Employment Center. There are two options:

All Employment Center services (computer-scheduling system, form posted in *Winter List of Applicants*, *Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center).

Message Center and *Winter Lists* only (form posted in *Winter List of Applicants*, *Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center, BUT NOT use of the computer-scheduling system). This option is available at a slightly lower price.

Applicants who participate in the 2002 Employment Center will find themselves talking with employers in two different settings:

1. A computer-scheduling program sets 15-minute interviews in the Employment Register numbered tables. This is the choice that has now become optional for applicants. Applicants do not have to hand in a computer-scheduling form at all.

2. There is also an Interview Center, where employers set their own schedules. These employers do not participate in the scheduling program, so applicants have no automatic access to interviews with them. They determine their own schedules and make their own appointments privately, either in advance or on site using the Employment

Message Center. These interviews have always been "optional" for applicants since they may turn down any written invitation they receive. Applicants are reminded to respond to all invitations promptly.

The Schedule

For applicants using all services, there is a certain scheduling burden placed on them to juggle these simultaneous services. However, computer-scheduled sessions are in small blocks, for a total of eight sessions over the two days of interviews (Monday and Tuesday). This allows applicants, once they receive invitations to interview in the Interview Center, to accept, knowing that when they submit the computer schedule request on Sunday, they can mark that they are unavailable for one or more of these sessions without seriously jeopardizing their chances of obtaining scheduled interviews. Likewise, applicants who are scheduled to give a talk can avoid interviews for that time. Applicants are encouraged to schedule their time in advance in this manner and not wait for the computer schedule to be distributed Monday morning.

Interviews

Applicants should understand that the Employment Center provides no guarantees of interviews or jobs. It is simply a convenient meeting place for candidates and employers who are attending the Joint Meetings. Those who have not yet begun their job search efforts may go unnoticed at the Employment Center (although applicants will likely receive a minimum of between one and three interviews in the scheduled program). Attention generally goes to candidates who already have applied for open positions or to those who are well suited for teaching positions at liberal arts colleges.

Data from recent Employment Centers show that women represent about half of the most sought-after applicants, although they make up less than half of the total Employment Center applicant pool. Those without permanent authorization to work in the United States will find themselves far less requested than U.S. citizens or permanent residents. Newer Ph.D.'s tend to be invited for more interviews than those who have been working longer. Most jobs listed require a doctorate.

Preparations

Candidates just beginning a job search should realize that employers have no method to judge their credentials other than the brief résumé form, and they should make an effort to make it distinct and interesting.

Applicants who register in advance will receive the *Winter List of Employers* in mid-December. If time permits, they should apply for suitable open positions they notice in the *Winter List of Employers* after they receive it. Applicants are advised to bring a number of copies of their vita or résumé so that they may leave them with prospective employers. It is a good idea in the fall for applicants to alert any employer to whom applications are made that they plan to be present at the Joint Meetings. Also, they should bring enough materials with them to accompany requests for

interviews they may want to leave in the Message Center boxes of the Interview Center employers.

Applicants are also encouraged to leave some extra copies of their résumés in their own message folders, so that interested employers may find them there. Photocopying costs at a convention are high, so applicants should come prepared with a reasonably large number of copies. A brightly colored form in each folder gives applicants an opportunity to present some information about their availability during the Meetings, for public perusal.

The *Winter List of Applicants* is mailed to all employers in advance, so it is vital that the Joint Meetings registration form, applicant résumé form, and payments be received by the October 26 deadline so the Applicant Form can be printed in the book. This greatly increases an applicant's chances of being invited to the Interview Center.

Applicants should keep in mind that interviews arranged by the Employment Center represent only an initial contact with the employers and that hiring decisions are not ordinarily made during or immediately following such interviews.

Applicants: Register Early

Applicants need to complete the following steps by the advance deadline of October 26, 2001.

1. Pay fees

Register for the Joint Mathematics Meetings (see form in the back of the October issue of the *Notices* or the electronic information at www.ams.org/amsmtgs/2049_intro.html). You cannot participate in the Employment Center unless you are a Meetings participant. Mark one of the two "Employment Center Applicant Fee" boxes on the Joint Meetings registration form and make payments. The fee in advance for applicants is \$40, or "Message Center and *Winter List ONLY*" registration is \$20.

2. Send form

Submit the Applicant Form (a brief résumé form) electronically at www.ams.org/emp-reg/ or use the print version in the back of this issue.

After Registration

Submission of the Applicant Form electronically will result in an e-mail acknowledgement almost immediately. For registration and payments, the Meetings Service Bureau acknowledges all payment. When payments AND the Applicant Form have been received, another acknowledgement will go out by e-mail, if possible, or by mail. Please allow a week or so for processing, but after that contact staff (AMS 800-321-4267, ext. 4105) if you do not receive acknowledgement from the Employment Center.

Around December 10, the *Winter List of Employers* will be mailed to all registered applicants, unless they request otherwise.

Registering After the Deadline

After October 26, applicants can still register for the Employment Center, at the same prices, until the final

deadline of December 10. However, the Applicant Form will NOT be included in the *Winter List of Applicants*, but will be posted on site at the Employment Center (a serious disadvantage). Those who do not register by December 10 must register on site at the Joint Meetings registration desk and pay higher fees (\$75 Employment Center fee; however, the "Message Center and *Winter List ONLY*" fee is always just \$20.

It is worthwhile to submit the applicant form even if you miss the October 26 deadline. An unexpected delay in publishing may allow your late form to get into the book. At the very least, your printed-out form will be brought to the Meeting by staff and displayed there (after all the fees have been paid.)

When to Arrive

All participants in the scheduled section of the Employment Center must submit their Interview Request/Availability forms in person between 9:30 a.m. and 4:00 p.m. on Sunday, January 6, 2002, or they will not be included when the interview-scheduling program runs Sunday night. Should unexpected delays occur while travelling, contact the Employment Center staff by telephone at the Employment Center desk in the Convention Center. The phone number will be sent to registered participants by e-mail when it is available in December. Be sure to keep Employment Center materials with you because in an emergency, you can report your interview requests over the phone.

Applicants: Registering on Site

Feel free to enter the Employment Center area first to consult staff about the decision to register on site and to check on which employers are participating. Full registration on site early Sunday is allowed for a higher fee but is severely discouraged. Most employers will not notice an Applicant Form which arrives on Sunday. Therefore, these individuals will receive only a couple of computer-scheduled interviews. Registration on site is advisable only for those who know they will be interviewed in the Interview Center and would like a Message Center folder for employers to leave messages in. This year registering on site for a mailbox only is possible, at the \$20 rate, on Sunday and Monday.

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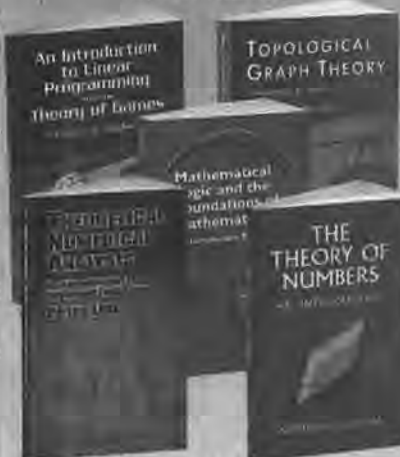


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Instructions for Applicant and Employer Forms

Applicant forms submitted for the Employment Center by the October 26 deadline will be reproduced in a booklet titled *Winter List of Applicants*. Employer forms submitted by the October 26 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 the AMS website.

- 00 General
- 01 History and biography
- 03 Mathematical logic and foundations
- 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
- 19 K-theory
- 20 Group theory and generalizations
- 22 Topological groups, Lie groups
- 26 Real functions
- 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
- 37 Dynamical systems and ergodic theory
- 39 Difference and functional equations
- 40 Sequences, series, summability
- 41 Approximations and expansions
- 42 Fourier analysis
- 43 Abstract harmonic analysis
- 44 Integral transforms, operational calculus
- 45 Integral equations

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 **October 26, 2001**, in order to appear in the *Winter List*. However, meeting registration (and payment of fees) is required before the forms can be processed.

- 46 Functional analysis
- 47 Operator theory
- 49 Calculus of variations and optimal control; optimization
- 51 Geometry
- 52 Convex and discrete geometry
- 53 Differential geometry
- 54 General topology
- 55 Algebraic topology
- 57 Manifolds and cell complexes
- 58 Global analysis, analysis on manifolds
- 60 Probability theory and stochastic processes
- 62 Statistics
- 65 Numerical analysis
- 68 Computer science
- 70 Mechanics of particles and systems
- 74 Mechanics of deformable solids
- 76 Fluid mechanics
- 78 Optics, electromagnetic theory
- 80 Classical thermodynamics, heat transfer
- 81 Quantum theory
- 82 Statistical mechanics, structure of matter
- 83 Relativity and gravitational theory
- 85 Astronomy and astrophysics
- 86 Geophysics
- 90 Operations research, mathematical programming
- 91 Game theory, economics, social and behavioral sciences
- 92 Biology and other natural sciences
- 93 Systems theory; control
- 94 Information and communication, circuits
- 97 Mathematics education

Electronic
Research Announcements
OF THE
AMERICAN MATHEMATICAL SOCIETY

Volume 7, 2001 (Most Recent Articles)

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Hans Ulrich Besche, Bettina Eick, and E. A. O'Brien,
The groups of order at most 2000

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AMERICAN MATHEMATICAL SOCIETY

APPLICANT RÉSUMÉ FORM
MATHEMATICAL SCIENCES EMPLOYMENT CENTER
JANUARY 6-9, 2002
SAN DIEGO, CALIFORNIA

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Center information and forms is <http://www.ams.org/emp-reg/>.
2. Paper or electronic forms are due, along with payment and your Advance Registration/Housing Form, by October 26 (to AMS, P. O. Box 6887, Providence, RI 02940) in order to be included in the *Winter List of Applicants*.
3. Forms will not be processed until registration and payment of fees have been received.

APPLICANT	Last name _____ First name _____		
CODE:	Mailing address (include zip code) _____		
	E-mail address (one only) _____		
	URL (or other contact info) _____		
	Specialties _____		
	<small>(use MR classification codes plus text if possible; applicants will be indexed by first number only)</small>		
DESIRED POSITION:			
Academic:	<input type="checkbox"/> Research <input type="checkbox"/> University Teaching	College Teaching: <input type="checkbox"/> 4-year <input type="checkbox"/> 2-year	
	Would you be interested in nonacademic employment? <input type="checkbox"/> Yes <input type="checkbox"/> No Available mo. _____ /yr. _____		
	Computer skills _____		
	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 _____		

Degree	Year (expected)	Institution	
_____	_____	_____	
_____	_____	_____	
_____	_____	Number of refereed papers accepted/published _____	
PROFESSIONAL EMPLOYMENT HISTORY:			
	Employer	Position	Years
1.	_____	_____	_____ to _____
2.	_____	_____	_____ to _____
3.	_____	_____	_____ to _____
	References (Name and Institution only)		

Work authorization status: (check one)			
	<input type="checkbox"/> U.S. Citizen	<input type="checkbox"/> Non-U.S. Citizen, authorized to work permanently in U.S.	
		<input type="checkbox"/> Other	
This applicant will be using: <input type="checkbox"/> ALL Employment Center services <input type="checkbox"/> Message Center and Winter List ONLY			

MATHEMATICAL MOMENTS

The *Mathematical Moments* program is a series of illustrated “snapshots” designed to promote appreciation and understanding of the role mathematics plays in science, nature, technology, and human culture.

Download these and other *Mathematical Moments* pdf files at www.ams.org/mathmoments.

MATHEMATICAL MOMENTS

Securing Internet Communication

No one could shop, pay bills, or conduct business securely on the Internet without the mathematics of encryption. Although based on algebraic facts proved centuries ago, today's sophisticated encryption techniques were formulated within the past twenty-five years.

Public key encryption allows a user to publish the encryption key for all to use, while keeping the decryption key secret. One such algorithm, called RSA, is behind the encryption in modern browsers. The National Institute of Standards and Technology recently adopted an Advanced Encryption Standard that will be used for electronic communication in the years to come. This new standard uses permutations, modular arithmetic, polynomials, matrices, and finite fields to transmit information freely but securely.

For More Information:

“Communications Security for the Twenty-first Century,” Susan Landau, *Notices of the American Mathematical Society*, April 2000.



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1. Fill in pages 1 & 2 of this form neatly

2. Print

3. Send 8 copies by U.S. mail to AMS (Invited Speakers may send only one)
(copies should be stapled, single-sided)

4. Include one copy of page 3

Return on or before **October 31, 2001** to:

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American Mathematical Society

201 Charles Street, Providence, RI 02904

e-mail (for inquiries only): icm02@ams.org

Or, you may type in the answers for printing and mailing at www.ams.org/careers-edulicmapp.html

ICM2002 TRAVEL GRANT APPLICATION

for U.S. mathematicians attending the
International Congress of Mathematicians, Beijing, China, 2002

U.S. mathematicians are those affiliated with a U.S. institution or organization. Funding by NSF for this program has been requested. An award to attend the Congress in Beijing under this program may NOT be supplemented by other NSF funds. Persons traveling under NSF grants must travel by U.S. flag carriers, if available.

All applicants fill in this section.

last name _____ first and/or middle names _____

Full mailing address (usable from now until Spring, 2002):

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Are you an INVITED SPEAKER at the Congress? Yes No If yes, send one copy of invitation letter.

Present rank or position: _____

Current institution or organization: _____

Highest earned degree: _____ Institution: _____ Year _____

Have you requested or been granted funds which might be used for travel to this Congress? If so, give details:

(Please notify the American Mathematical Society if this information changes)

Mathematics specialties (ICM2002 sections):

1. Logic

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3. Number Theory

4. Differential Geometry

5. Topology

6. Algebraic and Complex Geometry

7. Lie Groups and Representation Theory

8. Real and Complex Analysis

9. Operator Algebras and Functional Analysis

10. Probability and Statistics

11. Partial Differential Equations

12. Ordinary Differential Equations and Dynamical Systems

13. Mathematical Physics

14. Combinatorics

15. Mathematical Aspects of Computer Science

16. Numerical Analysis and Scientific Computing

17. Applications of Mathematics in the Sciences

18. Mathematical Education and Popularization of Mathematics

19. History of Mathematics

Invited Speakers may skip to page 3. All others fill in this section.

Other positions held (professional, scientific, teaching, administrative): [For each give Institution or Organization, Position, and Dates]

1. _____

2. _____

3. _____

List up to five significant publications, with title/journal/page/date references. These may include recent accepted papers (give journals).

1. _____

2. _____

3. _____

4. _____

5. _____

Scholarships, fellowships, etc. Specify institution, dates held, and field of study:

List research support from all sources in the last five years, including any current support: specify sponsor, title or identification of award, and amount and duration (dates):

List research proposals which have been submitted and/or are pending at this time; specify sponsor:

Further comments in support of your application, or other relevant professional contributions not already listed:

This section should be filled out by early career mathematicians only.
Thesis title and advisor:

Early career mathematicians only (those within 6 years of their doctorate) are urged to have senior professional mathematicians (no more than 2) write on their behalf concerning their ability, and the value of attendance at this Congress to the research and professional interests of such early career mathematicians. Submission of these letters is strongly encouraged but not required. Letters should be sent to Professional Services, AMS, 201 Charles Street, Providence, RI 02904. **LETTERS ONLY** (not applications) may be sent via e-mail to icm02@ams.org. Name of applicant and "ICM02" should appear on the first line of the message. Deadline for receipt of letters is October 31, 2001.

All applicants should submit ONE copy only of this page.

You may optionally provide the following. Your application will not be adversely affected if you choose not to provide this information.

Gender:

- Female
- Male

Citizenship:

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- Other non-U.S. citizen

Ethnicity:

- Hispanic or Latino
- Not Hispanic or Latino

Race (select one or more):

- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian or other Pacific Islander
- White
- Other

I do not wish to provide any of the above information on this page.

Meetings & Conferences of the AMS

IMPORTANT INFORMATION REGARDING MEETINGS PROGRAMS: AMS Sectional Meeting programs do not appear in the print version of the *Notices*. However, comprehensive and continually updated meeting and program information with links to the abstract for each talk can be found on the AMS website. See <http://www.ams.org/meetings/>. Programs and abstracts will continue to be displayed on the AMS website in the Meetings and Conferences section until about three weeks after the meeting is over. Final programs for Sectional Meetings will be archived on the AMS website in an electronic issue of the *Notices* as noted below for each meeting.

Columbus, Ohio

Ohio State University

September 21–23, 2001

Meeting #969

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: June 2001

Program first available on AMS website: August 9, 2001

Program issue of electronic *Notices*: October 2001

Issue of *Abstracts*: Volume 22, Issue 3

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: Expired

Invited Addresses

Alex Eskin, University of Chicago, *Title to be announced.*

Dennis Gaitsgory, University of Chicago, *Title to be announced.*

Yakov B. Pesin, Pennsylvania State University, *Title to be announced.*

Thaleia Zariphopoulou, University of Texas at Austin, *Title to be announced.*

Special Sessions

L² Methods in Algebraic and Geometric Topology, **Dan Burghelea** and **Michael Davis**, Ohio State University.

Algebraic Cycles, Algebraic Geometry, **Roy Joshua**, Ohio State University.

Coding Theory and Designs, **Tom Dowling**, Ohio State University, and **Dijen Ray-Chaudhuri**.

Commutative Algebra, **Evan Houston**, University of North Carolina, Charlotte, and **Alan Loper**, Ohio State University.

Complex Approximation Theory via Potential Theory, **V. V. Andrievskii** and **Richard S. Varga**, Kent State University.

Cryptography and Computational and Algorithmic Number Theory, **Eric Bach**, University of Wisconsin-Madison, and **Jonathan Sorenson**, Butler University.

Differential Geometry and Applications, **Andrzej Derdzinski** and **Fangyang Zheng**, Ohio State University.

Fractals, **Gerald Edgar**, Ohio State University.

Group Theory, **Koichiro Harada**, **Surinder Seghal**, and **Ronald Solomon**, Ohio State University.

Multivariate Generating Functions and Automatic Computation, **Robin Pemantle**, Ohio State University.

Proof Theory and the Foundations of Mathematics, **Timothy Carlson**, Ohio State University.

Quantum Topology, **Thomas Kerler**, Ohio State University.

Rings and Modules, **S. K. Jain**, Ohio University, and **Tariq Rizvi**, Ohio State University.

Spectral Theory of Schrödinger Operators, **Boris Mityagin**, Ohio State University, and **Sergei Novikov**, University of Maryland.

Stochastic Modeling in Financial Mathematics, **Ronnie Sircar**, Princeton University.

Chattanooga, Tennessee

University of Tennessee, Chattanooga

October 5–6, 2001

Meeting #970

Southeastern Section

Associate secretary: John L. Bryant

Announcement issue of *Notices*: August 2001

Program first available on AMS website: August 23, 2001

Program issue of electronic *Notices*: November 2001

Issue of *Abstracts*: Volume 22, Issue 3

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: August 14, 2001

Invited Addresses

Susanne C. Brenner, University of South Carolina, Columbia, *Additive multigrid theory*.

Edward B. Saff, University of South Florida, *Title to be announced*.

Joel H. Spencer, New York University, *Erdős magic*.

Roberto Triggiani, University of Virginia, *Differential geometric methods in the control of partial differential equations*.

Special Sessions

Applications of Partial Differential Equations in Geometric Analysis (Code: AMS SS N1), **Bo Guan** and **Changyou Wang**, University of Tennessee, Knoxville.

Asymptotic Behavior of Solutions of Differential and Difference Equations (Code: AMS SS B1), **John R. Graef**, University of Tennessee, Chattanooga, and **Chuanxi Qian**, Mississippi State University.

Commutative Ring Theory (Code: AMS SS A1), **David F. Anderson** and **David E. Dobbs**, University of Tennessee, Knoxville.

Differential Geometric Methods in the Control of Partial Differential Equations (Code: AMS SS L1), **Walter Littman**, University of Minnesota, and **Roberto Triggiani**, University of Virginia.

Mathematical and Numerical Aspects of Wave Propagation (Code: AMS SS F1), **Boris P. Belinskiy** and **Yongzhi Xu**, University of Tennessee, Chattanooga.

New Directions in Combinatorics and Graph Theory (Code: AMS SS C1), **Teresa Haynes** and **Debra J. Knisley**, East Tennessee State University.

Numerical Analysis and Approximation Theory (Code: AMS SS G1), **Tian-Xiao He**, Illinois Wesleyan University, and **Don Hong**, Eastern Tennessee State University.

Numerical Methods for PDEs (Code: AMS SS J1), **Susanne C. Brenner**, University of South Carolina, and **Craig C. Douglas**, University of Kentucky.

Real Analysis (Code: AMS SS D1), **Paul D. Humke**, Saint Olaf College, **Harry I. Miller**, University of Tennessee, Chattanooga, and **Clifford E. Weil**, Michigan State University.

Recent Advances in Optimization Methods (Code: AMS SS H1), **Jerald P. Dauer** and **Aniekan Ebiefung**, University of Tennessee, Chattanooga.

Sphere-Related Approximation and Applications (Code: AMS SS M1), **Edward B. Saff**, University of South Florida, and **Larry L. Schumaker**, Vanderbilt University.

Topics in Geometric Function Theory (Code: AMS SS E1), **Lelia Miller-Van Wieren**, Penn State Berks Campus, and **Bruce P. Palka**, University of Texas at Austin.

Variational Problems for Free Surface Interfaces (Code: AMS SS K1), **John E. McCuan**, Georgia Institute of Technology, **Thomas I. Vogel**, Texas A&M University, and **Henry C. Wente**, University of Toledo.

Williamstown, Massachusetts

Williams College

October 13–14, 2001

Meeting #971

Eastern Section

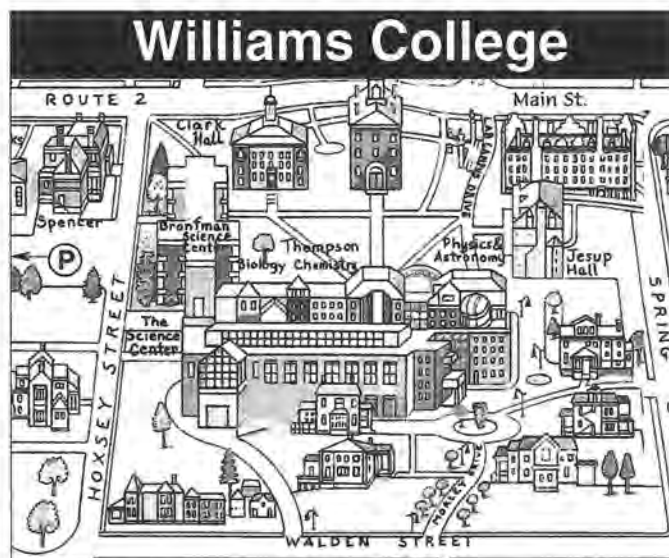
Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: August 2001

Program first available on AMS website: August 30, 2001

Program issue of electronic *Notices*: November 2001

Issue of *Abstracts*: Volume 22, Issue 4



Deadlines

For organizers: Expired
 For consideration of contributed papers in Special Sessions: Expired
 For abstracts: August 21, 2001

Invited Addresses

Hubert Bray, Massachusetts Institute of Technology, *Title to be announced.*
Robin Forman, Rice University, *Title to be announced.*
Emma Previato, Boston University, *Theta functions, old and new.*
Yisong Yang, Polytechnic University, *Harmonic maps, gauge fields, and magnetic vortices.*

Special Sessions

Abelian Varieties (Code: AMS SS K1), **Alexander Polishchuk** and **Emma Previato**, Boston University.
Algebraic and Topological Combinatorics (Code: AMS SS D1), **Eva Maria Feichtner**, ETH, Zürich, Switzerland, and **Dmitry N. Kozlov**, KTH, Stockholm, Sweden.
Commutative Algebra (Code: AMS SS C1), **Susan R. Loepp**, Williams College, and **Graham J. Leuschke**, University of Kansas.
Diophantine Problems (Code: AMS SS F1), **Edward B. Burger**, Williams College, and **Jeffrey D. Vaaler**, University of Texas at Austin.
Ergodic Theory (Code: AMS SS H1), **Cesar Silva**, Williams College.
Geometry and Topology of the Universe (Code: AMS SS E1), **Colin C. Adams**, Williams College, **Glenn Starkmann**, Case Western Reserve University, and **Jeffrey R. Weeks**, Canton, New York.
Harmonic Analysis since the Williamstown Conference of 1978 (Code: AMS SS G1), **Janine E. Wittwer**, Williams College, and **David Cruz-Uribe**, Trinity College.
History of Mathematics (Code: AMS SS A1), **Glen R. Van Brummelen**, Bennington College, **Della D. Fenster**, Richmond University, **James J. Tattersall**, Providence College, and **Shawnee L. McMurrin**, California State University, San Bernardino.
Integrable Systems and Quantum Groups (Code: AMS SS L1), **Pavel I. Etingof**, Massachusetts Institute of Technology, and **Emma Previato**, Boston University.
Nonlinear PDEs and Calculus of Variations (Code: AMS SS J1), **Yisong Yang**, Polytechnic University, **Fanghua Lin**, Courant Institute, New York University, and **Nader Masmoudi**, Courant Institute, New York University.
Number Theory, Holomorphic Dynamics, and Algebraic Dynamics (Code: AMS SS B1), **Robert L. Benedetto**, University of Rochester, **John W. Milnor**, IMS and SUNY at Stony Brook, and **Kevin M. Pilgrim**, University of Missouri at Rolla.

Irvine, California

University of California Irvine

November 10–11, 2001

Meeting #972

Western Section
 Associate secretary: Bernard Russo
 Announcement issue of *Notices*: September 2001
 Program first available on AMS website: September 27, 2001
 Program issue of electronic *Notices*: December 2001
 Issue of *Abstracts*: Volume 22, Issue 4

Deadlines

For organizers: Expired
 For consideration of contributed papers in Special Sessions: Expired
 For abstracts: September 18, 2001

Invited Addresses

William Duke, University of California Los Angeles, *Title to be announced.*
Grigory Mikhalkin, University of Utah, *Title to be announced.*
Gigliola Staffilani, Stanford University, *Title to be announced.*
Jonathan Weitsman, University of California Santa Cruz, *Title to be announced.*

Special Sessions

Extremal Metrics and Moduli Spaces (Code: AMS SS F1), **Steven Bradlow**, University of Illinois, Urbana-Champaign, **Claude LeBrun**, State University of New York, Stony Brook, and **Yat Sun Poon**, University of California Riverside.
Groups and Covering Spaces in Algebraic Geometry (Code: AMS SS D1), **Michael Fried**, University of California Irvine, and **Helmut Voelklein**, University of Florida.
Harmonic Analyses and Partial Differential Equations (Code: AMS SS H1), **Gustavo Ponce**, University of California Santa Barbara, and **Gigliola Staffilani**, Stanford University.
Harmonic Analysis and Complex Analysis (Code: AMS SS G1), **Xiaojun Huang**, Rutgers University, and **Song-Ying Li**, University of California Irvine.
Operator Spaces, Operator Algebras, and Applications (Code: AMS SS J1), **Marius Junge**, University of Illinois, Urbana-Champaign, and **Timur Oikhberg**, University of Texas and University of California Irvine.
Partial Differential Equations and Applications (Code: AMS SS C1), **Edriss S. Titi**, University of California Irvine.
Quantum Topology (Code: AMS SS A1), **Louis Kauffman**, University of Illinois at Chicago, **Jozef Przytycki**, George Washington University, and **Fernando Souza**, University of Waterloo.

Random and Deterministic Schrödinger Operators (Code: AMS SS E1), **Svetlana Jitomirskaya** and **Abel Klein**, University of California Irvine.

Topology of Algebraic Varieties (Code: AMS SS B1), **Eriko Hironaka**, Florida State University, and **Grigory Mikhalkin**, University of Utah.

Accommodations

Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the AMS "math" meeting. **All rooms will be on a space available basis after the deadline given.** The AMS is not responsible for rate changes or for the quality of the accommodations. Price does not include tax.

Atrium Hotel at Orange County Airport (John Wayne), 18700 MacArthur Boulevard, Irvine, CA; 949-428-3793; \$129/single or double; approximately 5 miles to campus. Call the Atrium from the telephones located in the baggage claim for complimentary Orange County Airport Shuttle. **Deadline for reservations is October 18.**

Travelodge Orange County Airport (John Wayne), 1400 SE Bristol Street, Santa Ana Heights, Costa Mesa, CA; 714-557-8700; \$54/single and \$59/double; one half mile to campus. **Deadline for reservations is October 1.**

Food Service

There are a number of restaurants located off-campus, as well as the Cornerstone Café on campus. The Café will be open from 9:00 a.m. to 11:00 p.m. on Saturday and from noon to 11:00 p.m. on Sunday. A list of restaurants will be available at the registration desk.

Local Information

Please visit the website maintained by the UC Davis Department of Mathematics at <http://www.math.uci.edu/sub6.html>.

Other Activities

AMS Book Sale: Examine the newest titles from the AMS! Most books will be available at a special 50% discount offered only at meetings. Complimentary coffee will be served, courtesy of AMS Membership Services.

Parking

Parking is located off Bison Avenue in Lot 12A. Daily parking passes will be available from attendant for \$5.

Registration and Meeting Information

Registration will take place in the lobby of Rowland Hall from 7:30 a.m. to 4:30 p.m., Saturday, November 10, and from 8:00 a.m. to noon on Sunday, November 11. Lectures will take place in the Physical Sciences and Technology Building and Rowland Hall.

Registration fees: (payable on-site only) \$40/AMS members; \$60/nonmembers; \$5/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express.

Travel

By air: The John Wayne Orange County Airport, MacArthur Blvd., Santa Ana, CA, is located 10 minutes from the UCI campus. No public transportation is available; however, taxis and shuttles are available.

The following specially negotiated rates on **USAirways** are available exclusively to mathematicians and their families for the period November 7–November 14, 2001. Discounts apply only to travel within the continental U.S. Other restrictions may apply and seats are limited. Receive a 5% discount off First or Envoy Class and any published USAirways promotional round-trip fare. By purchasing your ticket 60 days or more prior to departure, you can receive an additional bonus discount. Or you may receive a 10% discount off unrestricted coach fares with seven-day advance purchase. For reservations call (or have your travel agent call) USAirways Group and Meeting Reservation Office toll-free at 877-874-7687 between 8:00 a.m. and 9:30 p.m. Eastern Time. Refer to **Gold File number 88111579.**

Driving: From the north on 405 (San Diego Freeway): Take 405 South to 73 South and exit on Bison Ave. From Bison Ave. turn left and continue until you reach parking lots 12A and 16. Turn right into these lots.

From the south on 5 (Santa Ana Freeway): Take 5 North, and if coming from south of San Juan Capistrano, take 73 North. Exit on Bison Ave. From Bison Ave. turn left and continue until you reach parking lots 12A and 16. Turn right into these lots.

Car rental: Special rates have been negotiated with Avis Rent A Car for the period November 3–November 18, 2001. All rates include unlimited free mileage; the weekend rates quoted are available from noon Thursday until Monday at 11:59 p.m. Rates do not include state or local surcharges, tax, optional coverages, or gas refueling charges. Renter must meet Avis's age, driver, and credit requirements. Make reservations by calling 800-331-1600 or online at <http://www.avis.com/>. Nonweekend and weekly rates are also available. Please quote **Avis Discount Number J098887** when making reservations.

Daily weekend rates are Subcompact, \$34.99; Compact, \$37.99; Intermediate, \$40.99; Full size (2-door), \$47.99; Full size (4-door), \$49.99; Premium, \$53.99; Luxury, \$63.99; Minivan, \$68.99; and Sport Utility, \$66.99.

Weather

The daytime temperatures typically range from 70° to 80° F.

San Diego, California

San Diego Convention Center

January 6–9, 2002

Meeting #973

Joint Mathematics Meetings, including the 108th Annual Meeting of the AMS, 85th Meeting of the Mathematical Association of America (MAA), with minisymposia and other

special events contributed by the Society for Industrial and Applied Mathematics (SIAM), the 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: John L. Bryant
Announcement issue of *Notices*: October 2001
Program first available on AMS website: November 1, 2001
Program issue of electronic *Notices*: January 2002
Issue of *Abstracts*: Volume 23, Issue 1

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: October 2, 2001
For summaries of papers to MAA organizers: To be announced

Joint Invited Addresses

Dennis DeTurck, University of Pennsylvania, *Title to be announced* (AMS-MAA), Sunday, 11:10 a.m.

Hendrik W. Lenstra Jr., University of California Berkeley, *Harmonic numbers and the ABC-conjecture* (AMS-MAA), Tuesday, 11:10 a.m.

Joint Special Sessions

History of Mathematics (Code: AMS SS A1), **Thomas Archibald**, Acadia University, and **David E. Zitarelli**, Temple University.

Mathematics and Education Reform (Code: AMS SS Q1), **William H. Barker**, Bowdoin College, **Jerry L. Bona**, University of Texas at Austin, **Naomi D. Fisher**, University of Illinois at Chicago, and **Kenneth C. Millett**, University of California Santa Barbara.

Set Theory and Classification Problems (Code: AMS SS DD1), **Simon R. Thomas**, Rutgers University.

AMS Invited Addresses

Michael V. Berry, Bristol University, *Title to be announced* (Josiah Willard Gibbs Lecture), Sunday, 8:30 p.m.

Felix E. Browder, Rutgers University, *Reflections on the future of mathematics* (Retiring Presidential Address), Sunday, 10:05 a.m.

L. Craig Evans, University of California Berkeley, *Titles to be announced* (Colloquium Lectures), Sunday, Monday, and Tuesday, 1:00 p.m.

John M. Franks, Northwestern University, *The role of rotation numbers in dynamical systems*, Tuesday, 9:00 a.m.

Jeffrey C. Lagarias, AT&T Laboratories Research, *Computational problems in topology: The complexity of unknotting*, Monday, 3:20 p.m.

Fanghua Lin, Courant Institute, New York University, *Analytical and topological issues concerning Sobolev mappings*, Wednesday, 2:15 p.m.

John Preskill, California Institute of Technology, *Putting weirdness to work: Quantum information and quantum computation*, Monday, 2:15 p.m.

Richard L. Taylor, Harvard University, *Meromorphic continuation of L-functions*, Tuesday, 10:05 a.m.

AMS Special Sessions

Algebraic Coding Theory (Code: AMS SS D1), **Marcus Grefrath**, **Michael E. O'Sullivan**, and **Roxana N. Smarandache**, San Diego State University.

Algebraic Combinatorics (Code: AMS SS E1), **Rosa C. Orellana**, Dartmouth College, and **Michael Zabrocki**, York University.

Algebras, Forms, and Algebraic Groups (Code: AMS SS F1), **R. Skip Garibaldi**, University of California Los Angeles, **David J. Saltman**, University of Texas at Austin, and **Adrian R. Wadsworth**, University of California San Diego.

Analysis and Application of Quasilinear Partial Differential Equations (Code: AMS SS G1), **Sunčica Čanić** and **Eun Heui Kim**, University of Houston.

Chaos, Stability, and Asymptotics in Difference Equations (Code: AMS SS H1), **Saber N. Elaydi**, Trinity University, **Gerasimos Ladas**, University of Rhode Island, and **Donald A. Lutz**, San Diego State University.

Commutative Algebra and Algebraic Geometry (Code: AMS SS BB1), **Paul C. Roberts** and **Anurag K. Singh**, University of Utah.

Computability Theory with Applications (Code: AMS SS J1), **Douglas Cenzer**, University of Florida, and **Jeffrey B. Remmel**, University of California San Diego.

Computational Commutative Algebra and Algebraic Geometry (Code: AMS SS CC1), **Elizabeth Arnold**, Texas A&M University, and **Amelia Taylor**, Rutgers University.

Computational Topology (Code: AMS SS EE1), **Jeffrey C. Lagarias**, AT&T Research Laboratories, and **William H. Jaco**, Oklahoma State University.

Dynamic Equations on Time Scales (Code: AMS SS B1), **Martin J. Bohner**, University of Missouri at Rolla, and **Billur Kaymakçalan**, Georgia Southern University.

Fractal Geometry and Applications: A Jubilee of Benoit Mandelbrot (Code: AMS SS L1), **Michel L. Lapidus**, University of California Riverside, and **Machiel van Frankenhuysen**, Rutgers University.

Graph Theory (Code: AMS SS M1), **Andre Kundgen** and **K. Brooks Reid**, California State University, San Marcos.

Hybrid Systems (Code: AMS SS N1), **Elena Litsyn**, Ben-Gurion University, and **A. S. Vatsala**, University of Louisiana at Lafayette.

Low Dimensional Topology (Code: AMS SS Z1), **Tim D. Cochran**, Rice University.

Nonlinear Elliptic Partial Differential Equations (Code: AMS SS R1), **Maya Chhetri**, University of North Carolina at Greensboro, and **Jon T. Jacobsen**, Pennsylvania State University.

Partial Differential Equations and Their Applications (Code: AMS SS S1), **Reza Malek-Madani** and **Peter A. McCoy**, United States Naval Academy, and **John W. Neuberger**, University of North Texas.

Probabilistic Methods in Combinatorics and the Internet (Code: AMS SS C1), **Fan Chung Graham** and **Van Vu**, University of California San Diego.

Quantum Computation and Information (Code: AMS SS T1), **Philip L. Bowers** and **Washington Mio**, Florida State University, and **John Preskill**, California Institute of Technology.

Recent Developments in Analysis and Numerics of Fluid Problems (Code: AMS SS K1), **Jie Shen**, Pennsylvania State University and University of Central Florida, **Shouhong Wang**, Indiana University, and **Xiaoming Wang**, Iowa State University.

Research in Mathematics by Undergraduates (Code: AMS SS U1), **Carl V. Lutzer** and **Darren A. Narayan**, Rochester Institute of Technology.

Stochastic Processes and Functional Analysis (in honor of M. M. Rao) (Code: AMS SS V1), **Alan C. Krinik**, California State Polytechnic University, Pomona, and **Randall J. Swift**, Western Kentucky University.

Symbolic Dynamics (Code: AMS SS AA1), **Aimee S. A. Johnson**, Swarthmore College, and **Kathleen M. Madden**, Drew University.

The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics (Code: AMS SS P1), **Jonathan D. Farley**, University of Oxford and Vanderbilt University.

The Theory and Applications of Symmetric Functions (Code: AMS SS W1), **Adriano Garsia** and **Jeffrey B. Remmel**, University of California San Diego.

Topology and Its Applications (Code: AMS SS X1), **Alexander Arhangelskii**, Ohio University, **Melvin Henriksen**, Harvey Mudd College, **James E. Keesling**, University of Florida, **Ralph D. Kopperman**, City College of CUNY, and **John C. Mayer**, University of Alabama at Birmingham.

Wavelets for Undergraduates (Code: AMS SS Y1), **Edward F. Aboufadel** and **Steven J. Schlicker**, Grand Valley State University.

Ann Arbor, Michigan

University of Michigan

March 1–3, 2002

Meeting #974

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: January 2002

Program first available on AMS website: January 17, 2002

Program issue of electronic *Notices*: May 2002

Issue of *Abstracts*: To be announced

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: November 13, 2001

For abstracts: January 9, 2002

Invited Addresses

Lazlo Babai, University of Chicago, *Title to be announced.*

Netts Katz, Washington University, *Title to be announced.*

Alan Reid, University of Texas at Austin, *Title to be announced.*

Lihe Wang, University of Iowa, *Title to be announced.*

Special Sessions

Quantum Topology in Dimension Three (Code: AMS SS A1), **Charles Frohman**, University of Iowa, and **Joanna Kania-Bartoszyńska**, Boise State University.

Atlanta, Georgia

Georgia Institute of Technology

March 8–10, 2002

Meeting #975

Southeastern Section

Associate secretary: John L. Bryant

Announcement issue of *Notices*: January 2002

Program first available on AMS website: January 31, 2002

Program issue of electronic *Notices*: May 2002

Issue of *Abstracts*: To be announced

Deadlines

For organizers: October 8, 2001

For consideration of contributed papers in Special Sessions: November 27, 2001

For abstracts: January 22, 2002

For summaries of papers to MAA organizers: To be announced

AMS Invited Addresses

Nigel J. Kalton, University of Missouri, Columbia, *Title to be announced.*

James G. Oxley, Louisiana State University, *Title to be announced.*

Montréal, Quebec, Canada

*Centre de Recherches Mathématiques,
Université de Montréal*

May 3-5, 2002

Meeting #976

Eastern Section

Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: March 2002

Program first available on AMS website: March 21, 2002

Program issue of electronic *Notices*: July 2002

Issue of *Abstracts*: To be announced

Deadlines

For organizers: October 3, 2001

For consideration of contributed papers in Special Sessions: January 15, 2002

For abstracts: March 12, 2002

Invited Addresses

Nicholas M. Ercolani, University of Arizona, *Title to be announced.*

Lars Hesselholt, Massachusetts Institute of Technology, *Title to be announced.*

Niky Kamran, McGill University, *Title to be announced.*

Rafael de la Llave, University of Texas at Austin, *Title to be announced.*

Special Sessions

Combinatorial and Geometric Group Theory (Code: AMS SS A1), **Olga G. Kharlampovich**, McGill University, **Alexei Myasnikov** and **Vladimir Shpilrain**, City College, New York, and **Daniel Wise**, McGill University.

Potential Theory (Code: AMS SS B1), **Paul M. Gauthier**, Université de Montréal, **K. Gowri Sankaran**, McGill University, and **David H. Singman**, George Mason University.

Pisa, Italy

June 12-16, 2002

Meeting #977

First Joint International Meeting between the AMS and the Unione Matematica Italiana.

Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Invited Addresses

Luigi Ambrosio, Scuola Normale Superiore, *Title to be announced.*

Luis A. Caffarelli, University of Texas at Austin, *Title to be announced.*

Claudio Canuto, University of Torino, *Title to be announced.*

L. Craig Evans, University of California Berkeley, *Title to be announced.*

Giovanni Gallavotti, University of Rome I, *Title to be announced.*

Sergio Klainerman, Princeton University, *Title to be announced.*

Rahul V. Pandharipande, California Institute of Technology, *Title to be announced.*

Claudio Procesi, University of Roma, *Title to be announced.*

Portland, Oregon

Portland State University

June 20-22, 2002

Meeting #978

Western Section

Associate secretary: Bernard Russo

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: November 20, 2001

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Boston, Massachusetts

Northeastern University

October 5-6, 2002

Meeting #979

Eastern Section

Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: August 2002

Program first available on AMS website: August 22, 2002

Program issue of electronic *Notices*: December 2002

Issue of *Abstracts*: To be announced

Deadlines

For organizers: March 6, 2002

For consideration of contributed papers in Special Sessions: June 18, 2002

For abstracts: August 13, 2002

Invited Addresses

Lou P. van den Dries, University of Illinois, Urbana-Champaign, *Title to be announced.*

Diane Henderson, Pennsylvania State University, *Title to be announced.*

Christopher K. King, Northeastern University, *Title to be announced.*

Xiaobo Liu, University of Notre Dame, *Title to be announced.*

Madison, Wisconsin

University of Wisconsin-Madison

October 12–13, 2002

Meeting #980

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: August 2002

Program first available on AMS website: August 29, 2002

Program issue of electronic *Notices*: December 2002

Issue of *Abstracts*: To be announced

Deadlines

For organizers: March 12, 2002

For consideration of contributed papers in Special Sessions: June 25, 2002

For abstracts: August 20, 2002

Invited Addresses

Lawrence Ein, University of Illinois at Chicago, *Title to be announced.*

Eleny Ionel, University of Wisconsin, *Title to be announced.*

Mikhail Safonov, University of Minnesota, *Title to be announced.*

John Sullivan, University of Illinois, Urbana-Champaign, *Title to be announced.*

Special Sessions

Arithmetic Algebraic Geometry (Code: AMS SS A1), **Ken Ono** and **Tonghai Yang**, University of Wisconsin-Madison.

Arrangements of Hyperplanes (Code: AMS SS E1), **Daniel C. Cohen**, Louisiana State University, **Peter Orlik**, University of Wisconsin-Madison, and **Anne Shepler**, University of California Santa Cruz.

Biological Computation and Learning in Intelligent Systems (Code: AMS SS S1), **Shun-ichi Amari**, RIKEN, **Amir Assadi**,

University of Wisconsin-Madison, and **Tomaso Poggio**, MIT.

Combinatorics and Special Functions (Code: AMS SS T1), **Richard Askey** and **Paul Terwilliger**, University of Wisconsin-Madison.

Dynamical Systems (Code: AMS SS P1), **Sergey Bolotin** and **Paul Rabinowitz**, University of Wisconsin-Madison.

Effectiveness Questions in Model Theory (Code: AMS SS J1), **Charles McCoy**, **Reed Solomon**, and **Patrick Speissegger**, University of Wisconsin-Madison.

Geometric Methods in Differential Equations (Code: AMS SS H1), **Gloria Mari Beffa**, University of Wisconsin-Madison, and **Peter Olver**, University of Minnesota.

Geophysical Waves and Turbulence (Code: AMS SS M1), **Paul Milewski**, **Leslie Smith**, and **Fabian Waleffe**, University of Wisconsin-Madison.

Group Cohomology and Homotopy Theory (Code: AMS SS G1), **Alejandro Adem**, University of Wisconsin-Madison, and **Jesper Grodal**, Institute for Advanced Study.

Harmonic Analysis (Code: AMS SS C1), **Alex Ionescu** and **Andreas Seeger**, University of Wisconsin-Madison.

Hyperbolic Differential Equations and Kinetic Theory (Code: AMS SS K1), **Shi Jin**, **Marshall Slemrod**, and **Athanasios Tzavaras**, University of Wisconsin-Madison.

Lie Algebras and Related Topics (Code: AMS SS N1), **Georgia Benkart** and **Arun Ram**, University of Wisconsin-Madison.

Multiresolution Analysis and Data Presentation (Code: AMS SS F1), **Amos Ron**, University of Wisconsin-Madison.

Partial Differential Equations and Geometry (Code: AMS SS D1), **Sigurd Angenent** and **Mikhail Feldman**, University of Wisconsin-Madison.

Probability (Code: AMS SS R1), **David Griffeath**, University of Wisconsin-Madison, and **Timo Seppalainen**, Iowa State University.

Ring Theory and Related Topics (Code: AMS SS L1), **Don Passman**, University of Wisconsin-Madison.

Several Complex Variables (Code: AMS SS B1), **Pat Ahern**, **Xianghong Gong**, **Alex Nagel**, and **Jean-Pierre Rosay**, University of Wisconsin-Madison.

Orlando, Florida

University of Central Florida

November 9–10, 2002

Meeting #982

Southeastern Section

Associate secretary: John L. Bryant

Announcement issue of *Notices*: September 2002

Program first available on AMS website: September 26, 2002

Program issue of electronic *Notices*: January 2003

Issue of *Abstracts*: Volume 23, Issue 4

Deadlines

For organizers: April 10, 2002

For consideration of contributed papers in Special Sessions: July 23, 2002

For abstracts: September 17, 2002

Baltimore, Maryland

Baltimore Convention Center

January 15–18, 2003

Joint Mathematics Meetings, including the 109th Annual Meeting of the AMS, 86th 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: Susan J. Friedlander

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 15, 2002

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

Baton Rouge, Louisiana

Louisiana State University

March 14–16, 2003

Southeastern Section

Associate secretary: John L. Bryant

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 14, 2002

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Bloomington, Indiana

Indiana University

April 4–6, 2003

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: To be announced

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Seville, Spain

June 25–28, 2003

First Joint International Meeting between the AMS and the Real Sociedad Matematica Española (RSME).

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: To be announced

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Binghamton, New York

SUNY-Binghamton

October 10–12, 2003

Eastern Section

Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: March 10, 2003

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

Phoenix, Arizona

Phoenix Civic Plaza

January 7-10, 2004

Associate secretary: Bernard Russo

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: April 2, 2003

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

Athens, Ohio

Ohio University

March 26-27, 2004

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced

Program issue of electronic *Notices*: To be announced

Issue of *Abstracts*: To be announced

Deadlines

For organizers: August 26, 2003

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

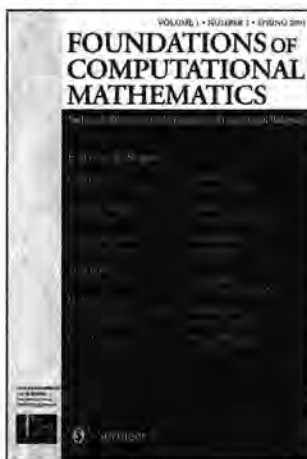
FOUNDATIONS OF COMPUTATIONAL MATHEMATICS

The Journal of the Society for the Foundations of Computational Mathematics

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Foundations of Computational Mathematics (FoCM) publishes research and survey papers of the highest quality which further the understanding of the connections between mathematics and computation. The journal aims to promote the exploration of all fundamental issues underlying the creative tension among mathematics, computer science and application areas unencumbered by an external criteria such as the pressure for applications. The journal will thus serve an increasingly important and applicable area of mathematics. The journal hopes to further the understanding of the

deep relationships between mathematical theory: analysis, topology, geometry and algebra, and the computational processes as they are evolving in tandem with the modern computer.

With its distinguished editorial board selecting papers of the highest quality and interest from the international community, *FoCM* hopes to influence both mathematics and computation. *FoCM* will be published four times a year starting in 2001. The journal accepts ancillary materials such as animations, data sets, and computer code which will be maintained on the journal web site. Abstracts and tables of contents for the journal will be available to all readers in electronic form. The full text of *FoCM* is available to subscribers via the LINK Online Information Service. Papers accepted in the journal will also be accessible online in advance of the print issue via Online First. Please visit LINK at <http://link.springer-ny.com> or <http://link.springer.de> for more information.

The Society for the Foundations of Computational Mathematics (SFoCM) is an international nonprofit organization which promotes research on the foundations of computational mathematics. More information on the activities of the Society, including how to become a member, can be found on its web site at <http://www.focm.net>

ISSN 1615-3375, ELECTRONIC ISSN 1615-3383, TITLE NO. 10208, 2002, VOL. 2, 4 ISSUES
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Meetings and Conferences of the AMS

Associate Secretaries of the AMS

Western Section: Bernard Russo, Department of Mathematics, University of California Irvine, CA 92697; e-mail: brusso@math.uci.edu; telephone: 949-824-5505.

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@duke.poly.edu; telephone: 718-260-3505.

Southeastern Section: John L. Bryant, Department of Mathematics, Florida State University, Tallahassee, FL 32306-4510; e-mail: bryant@math.fsu.edu; telephone: 850-644-5805.

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. **Information in this issue may be dated. Up-to-date meeting and conference information at www.ams.org/meetings/.**

Meetings:

2001

September 21-23	Columbus, Ohio	p. 950
October 5-6	Chattanooga, Tennessee	p. 951
October 13-14	Williamstown, MA	p. 951
November 10-11	Irvine, California	p. 952

2002

January 6-9	San Diego, California Annual Meeting	p. 953
March 1-3	Ann Arbor, Michigan	p. 955
March 8-10	Atlanta, Georgia	p. 955
May 3-5	Montréal, Québec, Canada	p. 956
June 12-16	Pisa, Italy	p. 956
June 20-22	Portland, Oregon	p. 956
October 5-6	Boston, Massachusetts	p. 956
October 12-13	Madison, Wisconsin	p. 957
November 9-10	Orlando, Florida	p. 957

2003

January 15-18	Baltimore, Maryland Annual Meeting	p. 958
March 14-16	Baton Rouge, Louisiana	p. 958

April 4-6	Bloomington, Indiana	p. 958
June 25-28	Seville, Spain	p. 958
October 10-12	Binghamton, New York	p. 958

2004

January 7-10	Phoenix, Arizona Annual Meeting	p. 959
March 26-27	Athens, Ohio	p. 959

Important Information regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 87 in the January 2001 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 \LaTeX is necessary to submit an electronic form, although those who use \LaTeX or \AMS-\LaTeX may submit abstracts with such 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; 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.

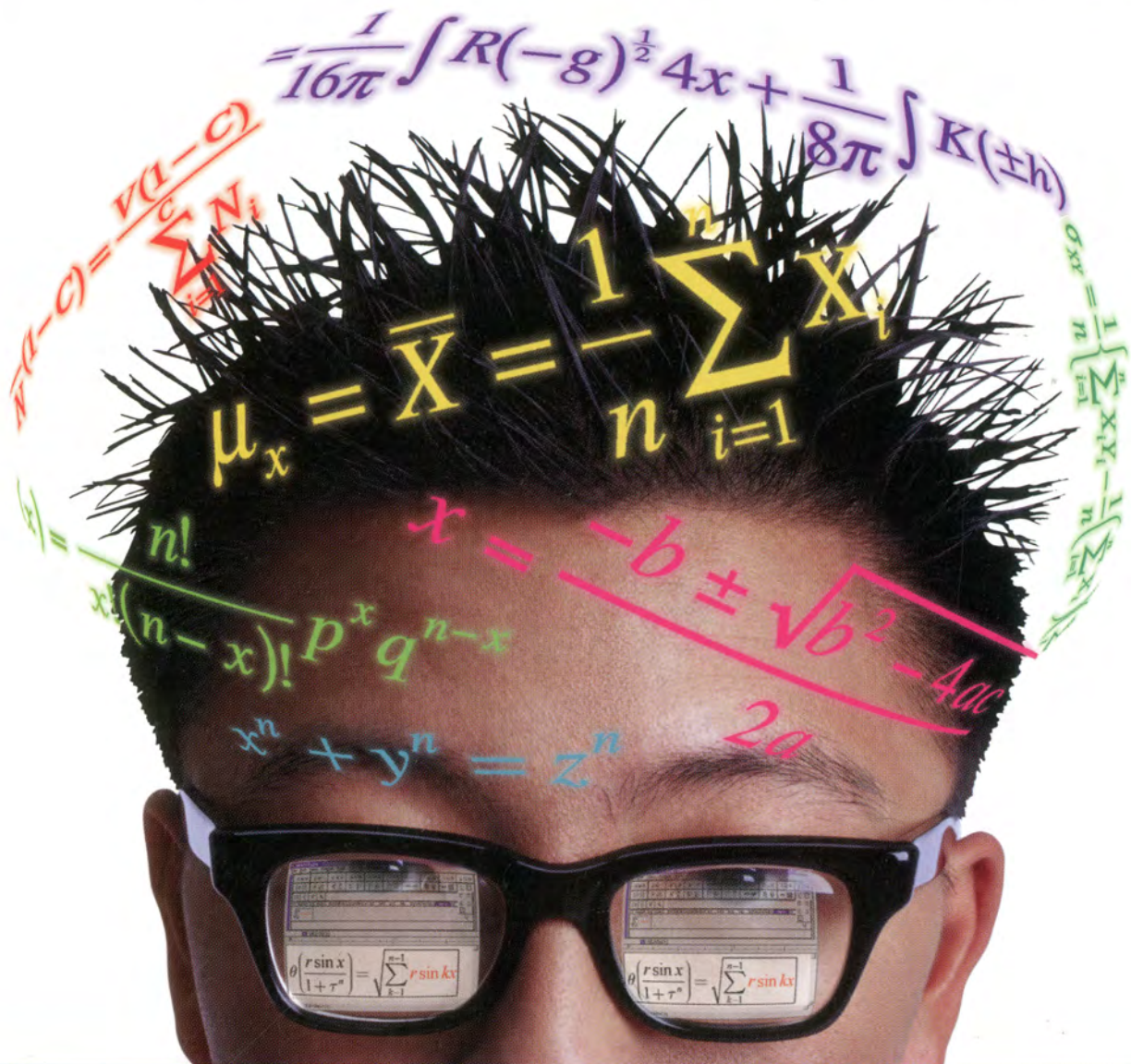
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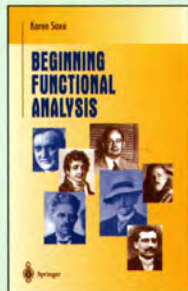


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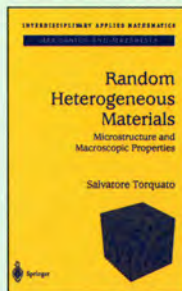
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