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Notices

of the American Mathematical Society

September 2005 Volume 52, Number 8

The Poincaré disk and the Poincaré chocolate disk (see page 840)

Clay Mathematics Institute at Oxford

October 7-8: Euclid and His Heritage

St. Catherine's College

October 11: Annual Meeting

Said Business School

Presentation of the Clay Research Awards
Award Lectures: *to be announced*
Public Lecture by Andrew Wiles: *Solving Equations*

Euclid and His Heritage

Clay Mathematics Institute Conference
hosted by Oxford University

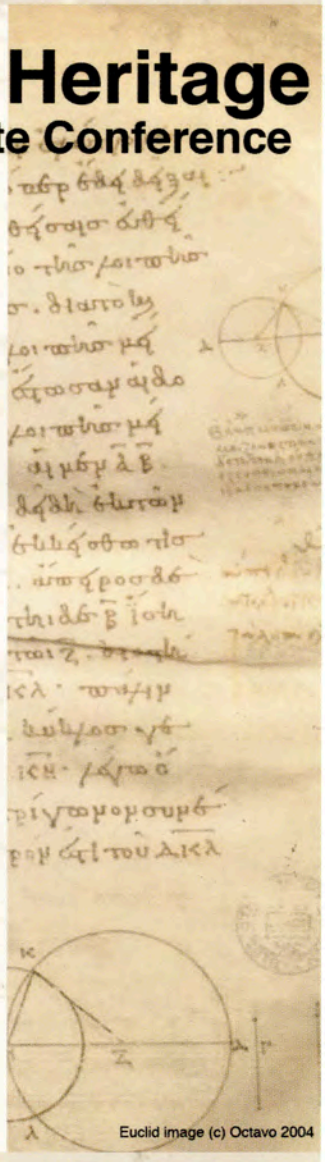
October 7 and 8, 2005
St. Catherine's College
Oxford University

In September of 888 AD, Stephen the Clerk, working in Constantinople, penned the last stroke of what became the oldest surviving manuscript of Euclid's Elements. Composed in Alexandria a millennium earlier, this remarkable book stands as the founding document of mathematics. Now, thanks to the work of Octavo.com, the 888 manuscript, in the collection of the Bodleian library since 1804, is available to scholars and the public in high-quality, easily disseminated digital form.

The Clay Mathematics Institute celebrates this moment by convening classicists, historians, mathematicians and philosophers for a fresh look at Euclid's work, its history, and its influence on our intellectual life over a period of twenty-three hundred years.

For more information, including a list of speakers and an online registration form, see

www.claymath.org/euclid



Euclid image (c) Octavo 2004

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NEW & NOTEWORTHY *from Birkhäuser*

Marked Point Processes and Piecewise Deterministic Processes

Theory and Applications

MARTIN JACOBSEN, *University of Copenhagen, Denmark*

This text examines the basic theory of marked point processes, developing randomly over time, and shows how this theory may be used to treat piecewise deterministic stochastic processes in continuous time. It details point processes that generate only finitely many points in finite time intervals, resulting, in particular, in piecewise deterministic processes with "few jumps."

The second part of the book shows how the theory developed earlier is used to analyze various models in statistics and applied probability with examples from survival analysis, branching processes, risk theory, finance, queueing theory, and sports (soccer).

2005/APPROX. 350 PP./HARDCOVER/$59.95 (TENT.)
ISBN 0-8176-4215-3
PROBABILITY AND ITS APPLICATIONS

Differential Geometry and Analysis on CR Manifolds

SORIN DRAGOMIR, *Università della Basilicata, Romana, Potenza, Italy;* **GIUSEPPE TOMASSINI,** *Scuola Normale Superiore, Pisa, Italy*

This monograph is a unified presentation of several differential geometric aspects in the theory of CR manifolds and tangential Cauchy-Riemann equations. It presents topics from the Tanaka-Webster connection, a key contributor to the birth of pseudohermitian geometry, to the major differential geometric achievements in the theory of CR manifolds, such as Fefferman's metric, pseudo-Einstein structures and the Lee conjecture, CR immersions, subelliptic harmonic maps as a local manifestation of pseudoharmonic maps from a CR manifold, Yang-Mills fields on CR manifolds, to name several. It also aims at explaining how certain results from analysis are employed in CR geometry.

2005/APPROX. 530 PP./HARDCOVER/$125.00 (TENT.)
ISBN 0-8176-4388-5
PROGRESS IN MATHEMATICS

Determining Spectra in Quantum Theory

MICHAEL DEMUTH, *Technische Universität Clausthal, Germany;* **MADDALY KRISHNA,** *Institute of Mathematical Sciences, Chennai, India*

This work focuses on various known criteria in the spectral theory of selfadjoint operators in order to identify the spectrum and its components a la Lebesgue decomposition.

2005/228 PP., 20 ILLUS./HARDCOVER/$119.00
ISBN 0-8176-4366-4
PROGRESS IN MATHEMATICAL PHYSICS, VOL. 44

Geometric Problems on Maxima and Minima

TITU ANDREESCU, *University of Texas, Dallas, TX;* **OLEG MUSKAROV,** *Institute for Mathematics, Bulgarian Academy of Sciences, Sofia; and* **LUCHEZAR STOYANOV,** *University of Western Australia, Crawley*

Questions of maxima and minima have great practical significance, with applications to physics, engineering, and economics; they have also given rise to theoretical advances, notably in calculus and optimization. This carefully constructed problem presents hundreds of extreme value problems, examples, and solutions primarily through Euclidean geometry. Written by a team of established mathematicians and teachers, this work draws on the authors' experience in the classroom and as Olympiad coaches. By exposing readers to a wealth of creative problem-solving approaches, the text communicates not only geometry but also algebra, calculus, and topology.

2005/APPROX. 320 PP., 160 ILLUS./SOFTCOVER/$79.95
ISBN 0-8176-3517-3

The Unity of Mathematics

In Honor of the Ninetieth Birthday of I.M. Gelfand

PAVEL ETINGOF, *Massachusetts Institute of Technology, Cambridge, MA;* **VLADIMIR S RETAKH,** *Rutgers University, Piscataway, NJ; and* **I.M. SINGER,** *Massachusetts Institute of Technology, Cambridge, MA (Eds.)*

A tribute to the vision and legacy of Israel Gelfand, the invited papers in this volume reflect the unity of mathematics as a whole, with particular emphasis on the many connections among the fields of geometry, physics, and representation theory. Written by leading mathematicians, the text is broadly divided into two sections: the first is devoted to developments at the intersection of geometry and physics, and the second to representation theory and algebraic geometry.

2005/APPROX. 464 PP., 20 ILLUS./HARDCOVER/$89.95 (TENT.)
ISBN 0-8176-4076-2
PROGRESS IN MATHEMATICS

Recently Released

Variational Methods in Shape Optimization Problems

DORIN BUCUR, *Université de Metz, France and* **GIUSEPPE BUTTAZZO,** *Università di Pisa, Italy*

The study of shape optimization problems involves a wide area of academic research and applications to the real world. Such problems are treated here from both classical and modern perspectives and aimed at graduate students in pure and applied mathematics as well as engineers. Only standard knowledge of the calculus of variations and functional analysis is required.

2005/224 PP., 19 ILLUS./HARDCOVER/$69.95
ISBN 0-8176-4359-1
PROGRESS IN NONLINEAR DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS, VOL. 65

Studies in Lie Theory

A. Joseph Festschrift

JOSEPH BERNSTEIN, *Tel Aviv University, Israel;* **VLADIMIR HINICH,** *University of Haifa, Israel;* **ANNA MELNIKOV,** *University of Haifa, Israel (Eds.)*

Dedicated to Anthony Joseph in honor of his 60th birthday, this volume contains new results on different aspects of Lie theory, including Lie superalgebras, quantum groups, crystal bases, representations of reductive groups in finite characteristic, and the geometric Langlands program.

Contributors: J. Alev, A. Beilinson, A. Braverman, I. Cherednik, J. Dixmier, F. Dumas, P. Etingof, D. Farkas, D. Gaitsgory, F. Ivorra, D. Joseph, M. Kashiwara, D. Kazhdan, A. Kirillov, B. Kostant, S. Kumar, G. Letzter, T. Levasseur, G. Lusztig, L. Makar-Limanov, W. McGovern, M. Nazarov, K.-H. Neeb, L. Rybnikov, A. Sergeev, V. Schechtman, T. Stafford, Ya. Varshavsky, N. Wallach, I. Waschkies.

2005/APPROX. 400 PP., 10 ILLUS./HARDCOVER/$99.00 (TENT.)
ISBN 0-8176-4342-7
PROGRESS IN MATHEMATICS

Differential Geometry of Curves and Surfaces

A Concise Guide

VICTOR A. TOPONOGOV, *Sobolev Institute of Mathematics, Novosibirsk, Russia*

With the editorial assistance of **VLADIMIR Y. ROVENSKI,** *University of Haifa, Israel*

This book presents traditional material of curves and surfaces related to differential geometry along with important ideas of Riemannian geometry. The author introduces the reader to curves, then progresses to surfaces, and finally to more complex topics in the concluding section. The book weaves together standard theoretical material with more difficult theorems and complex problems while maintaining an easy separation between the two. One of the striking features of this presentation is the large number of nontrivial and original problems, some with useful hints and solutions, which introduce a motivated student into the real world of geometry.

2005/APPROX. 200 PP., 40 ILLUS./SOFTCOVER/$59.95
ISBN 0-8176-4384-2

Recently Released

Harmonic Analysis, Signal Processing, and Complexity

Festschrift in Honor of the 60th Birthday of Carlos A. Berenstein

IRENE SABADINI, *Politecnico di Milano, Italy; and* **DANIELE C. STRUPPA** *and* **DAVID F. WALNUT,** *both, George Mason University, Fairfax, VA (Eds.)*

2005/176 PP., 15 ILLUS./HARDCOVER/$69.95
ISBN 0-8176-4358-3
PROGRESS IN MATHEMATICS, VOL. 238

Notices

September 2005

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Communications

Commentary

Notices

of the American Mathematical Society

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Departments

From the AMS Secretary

What Mathematics Is Required to Make Use of Genomic Data?

Since genetic information has become available for many organisms across the biological spectrum, scientists are now seeking to understand how that information is manifested in the behaviors of cells, organs, organisms, and even communities of organisms.

Below we highlight some mathematical techniques, including statistics, algorithm development and refinement, and modeling of spatial and time-dependent phenomena, required to discover useful information in genomic data and to use that information to enhance biological understanding. The article stems from a report released this spring, *Mathematics and 21st Century Biology*, by a committee of the National Academies Board on Mathematical Sciences and Their Applications. That report, sponsored by the U.S. Department of Energy, gives an overview of the many past and current important interactions between the mathematical sciences and investigations at all biological scales, from genomes up to ecosystems. It makes a number of recommendations for increasing the rate of advance in computational biology.

Genomic data have embedded uncertainties stemming from the laboratory technologies used to obtain them. These variations in the data may or may not be of biological significance. Different sets of data obtained from monitoring a biological process need not be identical, even though they represent the same function. This kind of robustness provides a level of fault tolerance that living organisms need to survive. Given these characteristics, it is not feasible to talk clearly about genomics without the language of statistics.

In addition to providing the concepts and tools for modeling and manipulating information with uncertainties, mathematical techniques have proved invaluable for making genomic research more efficient. For example, it is often desirable to find a short DNA pattern within a longer DNA string. Algorithms have been created to find approximate locations of patterns in texts, to find the best relationship between two or more sequences, and to find the best overlap between two sequences. To try to find patterns in large sets of gene or protein expression data, scientists and mathematicians use machine learning algorithms—both supervised, where some initial structure is imposed on the data, and unsupervised, where no a priori structure is imposed.

Of course, investigations of genomic patterns are meant to inform and to be guided by the observable features of an organism. The traditional method is to estimate whether or not a given genomic region or gene has a causal influence on the appearance of a trait of interest, using a likelihood ratio statistic that expresses the odds of the observed data under the competing hypotheses. Nested models of this fashion can accommodate the evaluation of one genomic site while controlling for the effect of another site or an environmental factor to gain additional power. However, as a result of correlation among nearby variable sites in the human genome, test statistics of this nature are frequently conducted across numerous genes or large regions without a clear picture of what defines a statistically significant finding. As a result, permutation testing has become a critical and highly recommended component of evaluating the significance of these individual single-factor analyses.

More generally, mathematical models serve many key roles in our study of complex biological systems: they capture complex correlations among, and serve as a means to integrate the information in, diverse types of data. They encode substantive biological knowledge and represent our mechanistic and quantitative understanding of systems. In addition, they provide the analytical framework for estimation and inference of unknown parameters and for quantitative prediction.

Consider the modeling of a cell as a system of time-varying variables interacting with each other. A typical goal of the modeler is to reveal a functional structure, representative of what is known or reasonable about the evolution of these variables. Traditionally, these are assumed to evolve according to a set of ordinary differential equations. In the simplest treatment, this dependency is linear and the linear coefficients essentially capture how the various species of molecules affect each other. The analysis quickly becomes challenging when nonlinearity is introduced. The analysis of such coupled nonlinear ordinary differential equations to obtain qualitative understanding of their solution and the ability to make quantitative predictions will likely push the frontier of the theory of differential equations or will certainly require researchers with solid grounding in that theory. A more realistic model of cell processes would take into account the discrete nature of the system, thus involving Markov processes instead of continuous equations. Moreover, the structure of such models should also somehow capture the surprising robustness of many biological systems.

While the previous example illustrates the use of differential equations to construct models of time-dependent behaviors, modeling across the dimensions of both time and space is an important tool that is helpful in many scenarios. However, as spatial structure is taken into account, spatial complexity demands more complicated descriptions that include partial differential and integro-differential equations to account for chemical diffusion, active transport, and other means of communication between neighboring regions. While a large array of analytical tools has been developed to understand the behavior of spatially continuous systems, the understanding of these systems from a mathematical perspective is far from complete.

—Jennifer Slimowitz
—Scott Weidman
Board on Mathematical Sciences and Their Applications
National Research Council

Copies of the report Mathematics for 21st Century Biology *are available from the National Academies Press at 888-624-8373 or online at* `http://www.nap.edu`.

Letters to the Editor

Gender Studies

I read Roitman and Wood's letter "Gender and Mathematics—Again" in the May 2005 *Notices* with interest.

They refer to a "basic study replicated often" which sends the same vita or the same academic paper to some people under a male name and to other people under a female name. The "woman" is ranked lower whether men or women do the ranking.

If this "study" can indeed be replicated over time, its validity becomes very questionable because the respondents seem to represent a bad sample tested by questionable methods.

Where do you find people who consider themselves able to judge an academic paper and who are yet so naive as to not suspect some sort of scam when they recieve a "paper" from an unfamiliar source? Who, after two years in college, does not know of the existence of "bogus" set-ups for psychological studies?

Naive or not, they should have been protected by ethical constraints, in particular a requirement that prospective subjects in a study be made aware of factors that could influence their decision to participate. It is hard to believe that in study after study a reasonable sample would go knowingly through a charade of judging in order that they themselves could be judged.

I hope no AMS members were involved in this "basic study". Refereeing both papers and credentials is an onerous professional responsibility. Refereeing papers at the academic level, especially, is time consuming and is undertaken as a service to the community. Referees are not lab rats.

It seems to me that further attempts to replicate this study would require acceptance of a yet more credulous body of responders or yet more unpleasant schemes of deception and so should be abandoned. Furthermore, recent replications should be reexamined with a critical eye.

—I. David Berg
University of Illinois (retired)

(Received May 16, 2005)

Origins of Grothendieck's Pursuing Stacks

Allyn Jackson's excellent articles on Alexander Grothendieck (October and November 2004) seem to me slightly misleading on the 600-page 1983 manuscript "Pursuing stacks", which has become influential over the years, so I would like to point out that it was written in English in response to a correspondence in English, namely with myself and Tim Porter from Bangor. He sent copies to me and Larry Breen, and with his permission, I sent copies to a few people. So it began its circulation.

—Ronald Brown
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(Received May 27, 2005)

A Textbook Editions Policy

We have become increasingly concerned about a fairly common practice in the textbook publishing business. New editions are published on a regular cycle, with a period as short as four years, with little if any consideration of whether these new editions are justified on academic grounds. We understand that new book sales decrease in years following publication of new editions, as used copies become more available. Given the very high prices of new mathematics texts, it is not surprising that students often choose to buy used copies. To fight the reduction of income to publishers and authors, new editions appear for no apparent reason. This practice costs students money and forces often trivial but irritating changes in course outlines. This letter is prompted by the announcement that a particular text we have been using for a number of years is now going into the seventh edition. Successive editions of this text have appeared every four years for some time. In our view, they have gotten worse rather than better, because of the inclusion of more examples and verbiage that apparently are only intended to justify each new edition.

We have no problem with books that go into second and third editions because of the desire to correct errors, improve presentation, or change topics covered, based on the experience of users of the original version. But if the author can't get it right by the third edition, he/she should give up. The decision to publish a new edition should be based on pedagogy, not money.

To put some pressure on publishers to adopt what we consider a more responsible approach to this issue, the undergraduate studies committee of the UCLA mathematics department, at its meeting of June 7, 2005, adopted the following resolution: "Whenever one of our textbooks appears in a new edition beyond the third, if there is no evidence that it represents a significant pedagogical improvement over the previous edition, the mathematics department will immediately start a search for a replacement text."

At the same meeting, we decided to change the text mentioned in the first paragraph above. This text has also been used by the UCLA statistics department. Robert Gould, who is my counterpart in that department, has endorsed this letter.

—Thomas M. Liggett
Undergraduate Vice Chair of Mathematics
UCLA
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(Received June 10, 2005)

Correction

A photo caption on page 777 of the August 2005 issue incorrectly identified Congressman Vernon Ehlers (R-MI) as a senator, when he is, in fact, a member of the House of Representatives.

In celebration of the one-hundredth anniversary of Einstein's annus mirabilis, the American Mathematical Society presents...

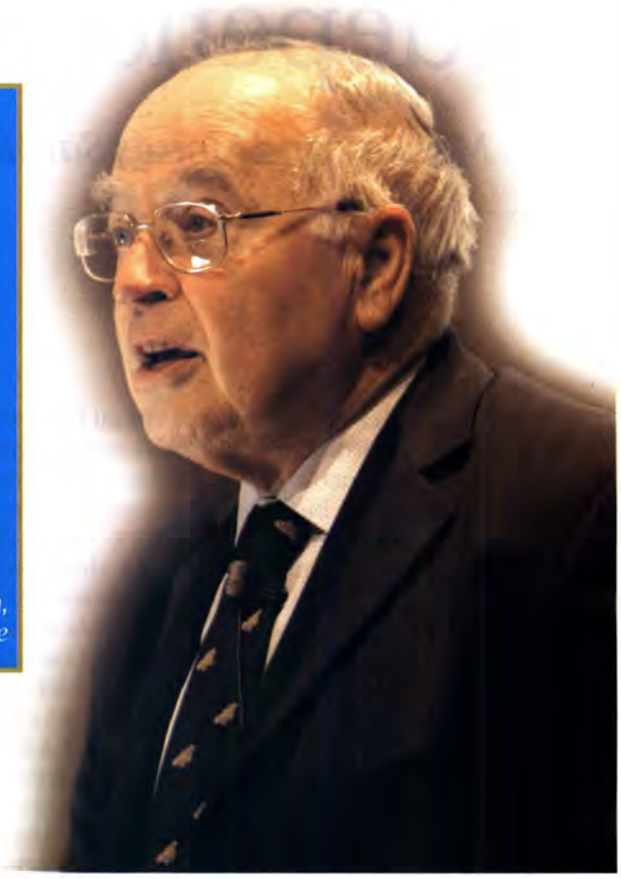
The Einstein Public Lecture in Mathematics

A lecture given by Sir Michael Atiyah

The Nature of Space

For more than two thousand years philosophers, mathematicians, and physicists have struggled to understand the nature of space. Kant studied the role of the human mind, mathematicians examined the logical ramifications of space, and physicists investigated experimental phenomena. The story continues to the present day, with increasingly exotic scenarios of vibrating strings in ten dimensional space-time. I shall review the history and present the status of the great philosophical controversies in the light of modern developments.

—Sir Michael Atiyah, in his abstract for the lecture



The American Mathematical Society is sponsoring a public lecture in mathematics in celebration of the one-hundredth anniversary of Einstein's *annus mirabilis*. The year 1905 marked the publication by Albert Einstein in Germany of three fundamental papers that changed the course of twentieth-century physics. Einstein later moved to the United States, where he became a founding member of the School of Mathematics at the Institute for Advanced Study in Princeton.

The lecture will take place on Friday, October 21, 2005, at the AMS Sectional Meeting in Lincoln, Nebraska. The lecture is aimed at members of the general public, but will also be of interest to professional mathematicians.

The work of Atiyah in topology and geometry has had a profound influence on these areas over the past fifty years. It has also been a major factor in the new relations that have grown up between geometry and physics. Atiyah has in fact been a leader in developing these relations and in encouraging both mathematicians and physicists to see their subjects as part of a common enterprise.

Sir Michael Atiyah has won numerous awards and honors. He was awarded a Fields Medal in 1966. He has served as director of the Newton Institute, Master of Trinity College at Cambridge, and president of the Royal Society of London. In May 2004 he was presented the Abel Prize in Mathematics with I. M. Singer for the "discovery and proof of the Index Theorem connecting geometry and analysis in a surprising way" and an "outstanding role in building new bridges between mathematics and theoretical physics."

—James Arthur, President

For more information see `www.math.unl.edu/pi/events/ams2005`.

Mathematics, Biology, and Physics: Interactions and Interdependence

Michael C. Mackey and Moisés Santillán

Introduction

Modern science has a solid conceptual framework and considers experimental results as the ultimate litmus test against which to validate any theoretical construct. Its birth can be traced back to the sixteenth and seventeenth centuries. The work of people like Nicholaus Copernicus, Galileo Galilei, Isaac Newton, Johannes Kepler, William Harvey, Vesalius, and others was seminal to this development. Before the so-called scientific revolution, natural philosophers (the forefathers of scientists as we know them today) did not perform experiments, as manual labor was considered a lower-class activity. This attitude, inherited from the Greeks, changed between the sixteenth and the eighteenth centuries, as merchants and craftsmen gained economic and political power. As a result, economics, politics, and science went through significant changes. In that period, democracy, capitalism, and modern science were founded and emerged as the cornerstones of a new era.

During the Enlightenment, in the latter part of the eighteenth and early part of the nineteenth centuries, scientific disciplines started to be hierarchically classified. This classification works well in some instances, and without it, dealing with the rapidly growing body of knowledge of the past two hundred years would have been difficult. However, it fails to fairly represent the interdisciplinary work which has been, and continues to be, highly important. In this paper we give a taste of the rich historical relation between physics, mathematics, and the biological sciences. We argue that this will continue to play a very important role in the future, based on historical examples and on a brief review of the current situation.

Michael C. Mackey is professor and director at the Centre for Nonlinear Dynamics, Department of Physiology, McGill University. His email address is mackey@cnd.mcgill.ca.

Moisés Santillán is professor in the Depto. de Física, Esc. Sup. de Física y Matemáticas, Inst. Politécnico Nal., D.F., México. His email address is moyo@esfm.ipn.mx.

The 18th and 19th Centuries

Electrophysiology is the science that studies the interaction between electromagnetic fields and biological tissues. This includes the generation of electric or magnetic fields and electric currents in some specialized organs, the intrinsic electric and magnetic properties of tissue, the response of specialized cells (like neurons and muscle cells) to stimulation, etc. Up to the middle of the nineteenth century, the historical development of electrophysiology paralleled that of electromagnetism. The first electric generating machines and the Leyden jar were constructed to produce static electricity for a specific purpose: to "electrify" and stimulate humans. The Voltaic pile was developed with the idea of galvanic (i.e. direct current, as opposed to faradic or alternating current) stimulation. Bioelectric and biomagnetic measurements were the incentive for the development of sensitive measurement instruments, like the galvanometer and the capillary electrometer. Thus, it is no surprise that some scientists of the time made important contributions to the development of both the biological and the physical sciences. In the following paragraphs we present a brief review of the contributions of some of these interdisciplinary workers. We do not attempt to present a detailed review of the history of electrophysiology, as our purpose is only to exemplify the rich interdisciplinary interactions of the eighteenth and nineteenth centuries.

The essential invention necessary for the application of a stimulating electric current was the Leyden jar (a capacitor formed by a glass bottle covered with metal foil on the inner and outer surfaces), independently invented in Germany (1745) and The Netherlands (1746). With it, Benjamin Franklin's experiments allowed him to deduce the concept of positive and negative electricity in 1747. Franklin also studied atmospheric electricity with his famous kite experiment in 1752. Many American school children have heard the apocryphal stories of Franklin flying kites during thunderstorms with strings soaked in salt water.

Franklin

The most famous experiments in neuromuscular stimulation of the time were performed by Luigi Galvani, professor of anatomy at the University of Bologna. His first important finding is dated January 26, 1781. A dissected and prepared frog was lying on the same table as an electric machine. When his assistant touched the femoral nerve of the frog with a scalpel, sparks were simultaneously discharged in the nearby electric machine, and violent muscular contractions occurred. (It has been suggested that the assistant was Galvani's wife, Lucia, who is known to have helped him with his experiments). This is cited as the first documented experiment in neuromuscular electric stimulation.

Galvani

Galvani continued the stimulation studies with atmospheric electricity on a prepared frog leg. He connected an electric conductor between the side of the house and the nerve innervating the frog leg. Then he grounded the muscle with another conductor in an adjacent well. Contractions were obtained simultaneously with the occurrence of lightning flashes. In September 1786, Galvani was trying to obtain contractions from atmospheric electricity during calm weather. He suspended frog preparations from an iron railing in his garden by brass hooks inserted through the spinal cord. Galvani happened to press the hook against the railing when the leg was also in contact with it. Observing frequent contractions, he repeated the experiment in a closed room. He placed the frog leg on an iron plate and pressed the brass hook against the plate, and muscular contractions occurred. Systematically continuing these experiments, Galvani found that when the nerve and the muscle of a frog were simultaneously touched with a bimetallic strip of copper and zinc, a contraction of the muscle was produced. This experiment is often cited as the classic study to demonstrate the existence of animal electricity. Galvani did not understand the mechanism of the stimulation with the bimetallic strip. His explanation for this phenomenon was that the bimetallic strip was discharging the animal electricity existing in the body.

Galvani's investigations intrigued his friend and colleague Alessandro Volta (professor of physics in Pavia), who eventually came up with a totally different (and correct) explanation for the phenomena that Galvani was trying to explain. In the process, Galvani and Volta maintained their friendship (in spite of their differences of scientific opinion), and Volta developed the ideas that eventually led to the invention of the Voltaic pile in 1800 (forerunner of the modern battery), a battery that could produce continuous electric current. Incidentally, Volta completed the equivalent of his doctoral dissertation when he was fifty years old!

Volta

All of these contributions to electrophysiology were experimental. The first significant theoretical contributions were made by the German scientist and philosopher Hermann Ludwig Ferdinand von Helmholtz. A physician by education and appointed professor of physiology at Königsberg in 1849, he moved to the chair of physiology at Bonn in 1855. In 1871 he was awarded the chair of physics at the University of Berlin. Helmholtz's fundamental experimental and theoretical scientific contributions in the field of electrophysiology included the demonstration that axons are extensions of the nerve cell body, the establishment of the law of conservation of energy (the First Law of Thermodynamics), the invention of the myograph, and the first measurement of the action potential conduction velocity in a motor nerve axon. Besides these, the contributions of Helmholtz to other fields of science include fundamental work in physiology, acoustics, optics, electrodynamics, thermodynamics, and meteorology. He invented the ophthalmoscope and was the author of the theory of hearing from which all modern theories of resonance are derived. Another important contribution to the development of biophysics was Helmholtz's philosophical position in favor of founding physiology completely on the principles of physics and chemistry at a time when physiological explanations were based on vital forces that were not physical in nature.

von Helmholtz

The 20th Century

In the eighteenth and nineteenth centuries interdisciplinary research bridging physics, mathematics, and biology was carried out by scientists educated as physicians. The twentieth century witnessed a reversal of this trend, with major contributions to

biology from people with solid backgrounds in physics and mathematics. There are two of these disciplines in which the contributions by physicists and mathematicians were particularly important: electrophysiology (following the tradition of Galvani, Volta, Helmholtz, etc.) and molecular biology.

Electrophysiology

The growth of biophysics owes much to A. V. Hill, whose work on muscle calorimetry was essential to our understanding of the physiology of muscle contraction. Hill received an undergraduate degree in physics and mathematics and a doctorate in physiology, all from Cambridge. Besides his work on muscle contraction, Hill also addressed problems related to the propagation of the nervous impulse, the binding of oxygen by hemoglobin, and calorimetry of animals. He discovered that heat is produced during the nerve impulse. Hill's original papers reveal an elegant mixture of biological concepts and experiments, together with physical and mathematical theory and insight. His discoveries concerning the production of heat in muscle earned him the Nobel Prize in 1922, and his research gave rise to an enthusiastic following in the field of biophysics. He was instrumental in establishing an extremely successful interdisciplinary school in Cambridge, whose investigators received a number of Nobel Prizes.

Hill

A few years later, Bernard Katz, working at University College London with his student Paul Fatt, made a major advance in our understanding of the chemical and quantal nature of synaptic transmission. The papers "An analysis of the end-plate potential recorded with an intra-cellular electrode" and "Spontaneous subthreshold activity at motor nerve endings" were marvels of experimental investigation combined with mathematical modelling of stochastic processes. Katz was one of the recipients of the 1970 Nobel Prize for "discoveries concerning the humoral transmitters in the nerve terminals and the mechanism for their storage, release and inactivation."

Katz

Jumping back a few decades, the German physical chemist Walter Nernst was interested in the transport of electrical charge in electrolyte solutions. His work intrigued another physicist, Max Planck, one of the fathers of modern quantum theory. He extended Nernst's experimental and theoretical work, writing down a transport equation (the Nernst-Planck equation) describing the current flow in an electrolyte under the combined action of an electric field and a concentration gradient.

This work lay largely forgotten until the 1930s, when it was picked up by the physicist Kenneth S. Cole at Columbia University and his graduate student David Goldman (originally trained in physics). They realized that the work of Nernst and Planck (in the form of the Nernst-Planck equation) could be used to describe ion transport through biological membranes and did so with great effect. Their work resulted in the development of the Goldman equation, which describes the membrane equilibrium potential in terms of intra- and extracellular ionic concentrations and ionic permeabilities. This background theoretical work of Nernst and Planck was also instrumental in helping Cole to experimentally demonstrate that there was a massive increase in membrane conductance during an action potential.

Nernst

Planck

Cole

Two of the most distinguished alumni of Hill's Cambridge interdisciplinary school were A. L. Hodgkin and A. F. Huxley. Both studied physics, mathematics, and physiology at Trinity College, Cambridge. At the time, high table included an astonishing array of scientific talent with people like J. J. Thomson, Lord Rutherford, F. W. Aston, A. S. Eddington, F. G. Hopkins, G. H. Hardy, F. J. W. Roughton, W. A. H. Rushton, A. V. Hill, and E. D. Adrian. Hodgkin and Huxley developed a long-lasting collaboration, interrupted only by the outbreak of World War II.

In 1938 Hodgkin spent the summer with Cole at Woods Hole, and they demonstrated the overshoot of the action potential, which had significant implications in terms of potential ionic mechanisms. It seems reasonable to suppose that Cole and Hodgkin discussed the possible meanings of these discoveries and what types of experiments were needed to determine exactly what was going on. Because of their training they would have seen that some means must be found to bring under experimental control the variable (either membrane current or membrane voltage) that is responsible for the all-or-nothing behavior of the action potential. Hence taming the action potential required controlling either the current or the voltage. They realized that space clamping was necessary for both current and voltage clamping. Since both knew cable theory, they knew that space clamping was best done by drastically reducing internal resistance (space clamping), so the

space constant was much longer than the length of the axon under study.

The Second World War interrupted these investigations, and Cole, like hundreds of other scientists, was caught up in the war effort. Cole moved from Columbia to the Manhattan Project in Chicago and worked on radiation dosimetry and radiation damage in tissues during the war. After the war he was at the University of Chicago for a few years. When the war was over, one of the positive outcomes was the existence of high transconductance vacuum tubes, which had been developed for the amplifiers in radar receivers. Cole, working with Marmont in Chicago, used these new electronic advances to build a feedback circuit that allowed them to space clamp axons. These axons developed an all-or-none action potential when sufficiently depolarized. The implication was that voltage clamping was necessary to tame the axon to measure the dependence of membrane current on membrane voltage.

Shortly after the war (1948), Hodgkin visited the United States and Cole's laboratory in Chicago and realized that the results of the space clamp experiments meant that voltage clamping was the way to go. On his return to England he teamed up with Huxley to really measure what was going on during the generation of an action potential in the squid giant axon. This work was published in a brilliant series of five papers in the *Journal of Physiology* in 1952. The final one is an intellectual tour de force combining both experimental data analysis and mathematical modelling (the Hodgkin-Huxley equations). This work won Hodgkin and Huxley the Nobel Prize in 1963, along with J. C. Eccles, "for their discoveries concerning the ionic mechanisms involved in excitation and inhibition in the peripheral and central portions of the nerve cell membrane."

Hodgkin

Huxley

Huxley, the mathematician/physiologist, was not content to stop there, however, and went on to publish in 1957 his celebrated review of muscle contraction data and its synthesis into the mathematically formulated cross bridge theory, a theory that still stands in its essential ingredients today.

The Hodgkin-Huxley model for excitability in the membrane of the squid giant axon is complicated and consists of one nonlinear partial differential equation coupled to three ordinary differential equations. In the early 1960s Richard FitzHugh applied some of the techniques that he had learned from the Russian applied mathematics literature to an analysis of the Hodgkin-Huxley equations. That reduction of the Hodgkin-Huxley equations later became known as the FitzHugh-Nagumo model and has given us great insight into the mathematical and physiological complexities of the excitability process. Another consequence of the Hodgkin-Huxley model, taken to its interpretational extreme, was the implication that there were microscopic "channels" in the membrane through which ions would flow and which were controlled by membrane potential. There were strong experimental data also leading to the same conclusion, including the binding of tetrodotoxin (TTX) to nerve membranes to block sodium currents, titration studies indicating that there were about 20 TTX binding sites per square micrometer, and membrane noise measurements.

However, it was left to the German physicist Erwin Neher, in conjunction with the physiologist Bert Sakmann, to develop the patch clamping technology and techniques that eventually allowed them to demonstrate the existence of these ion channels. They were awarded the Nobel Prize in 1991 for this work. Modifications of the Hodgkin-Huxley equations were soon proposed for cardiac tissue as well as a myriad of other excitable cells.

Neher

Extensions of the work of Hodgkin and Huxley soon followed. For example, J. W. Woodbury (a physicist turned physiologist) and his student W. E. Crill found that current injected into one cell in a sheet of heart muscle changed the membrane voltage in nearby cells in an anisotropic manner. This showed that there must be low resistance connections between abutting cells in heart tissue and paved the way for the discovery and characterization of gap junctions between the cells (in a variety of tissues such as epithelia). Woodbury also showed that Eyring reaction rate theory (learned from his famous foster thesis advisor, Henry Eyring) can be used to explain the linear current-voltage relationship of open sodium channels. This is done by choosing the appropriate electrochemical potential profile encountered by a sodium ion while traversing a Na ion channel. This, together with other lines of experimental evidence mentioned above, established the feasibility of the ion channel concept before single-channel conductances were directly measured by Neher.

Woodbury

One of the most remarkable individuals interested in the dynamic behavior of simple nervous systems was H. K. Hartline of the Johns Hopkins University. Hartline was trained as a physiologist, and following receipt of his M.D., he spent an

additional two years at Hopkins taking mathematics and physics courses. For some unaccountable reason he was still not satisfied with his training and obtained funding to study for a further year in Leipzig with the physicist Werner Heisenberg and a second year in Munich with Arthur Sommerfeld. Armed with this rather formidable training in the biological, mathematical, and physical sciences, he then devoted the majority of his professional life at Hopkins to the experimental study of the physiology of the retina of the horseshoe crab Limulus. His papers are a marvel of beautiful experimental work combined with mathematical modelling designed to explain and codify his findings. His life work justly earned him the Nobel Prize in 1967 (with George Wald) "for his discoveries concerning the primary physiological and chemical visual processes in the eye." As an aside, we should point out that FitzHugh (of the FitzHugh-Nagumo reduction of the Hodgkin-Huxley model) received his Ph.D. in biophysics (where he learned mathematics, physics, and chemistry) under Hartline after completing his biological studies at the University of Colorado.


Hartline

One can hardly underestimate the impact that this work in excitable cell physiology has had on the biological sciences, since the impact is so broad and pervasive. The *Notices of the American Mathematical Society* (December 1999) has a very nice article by Nancy Kopell with some of the mathematical side of the story, and *Nature Neuroscience* (November 2000) featured some of this from a biological perspective in an interesting and lively series of survey articles.

Molecular Biology

Genetics started in 1866, when Gregor Mendel first deduced the basic laws of inheritance. However, modern genetics, with its capacity to manipulate the very essence of living things, came into being only with the rise of molecular investigations, culminating in the breakthrough discovery of the structure of DNA, for which Francis Crick, James D. Watson, and Maurice Wilkins received the Nobel Prize in 1962. The contribution of physics and physicists to this—what Watson calls Act 1 of molecular biology's great drama—was seminal. Here we review the work of some of the physicists who helped shape molecular biology into the exciting science it currently is.

Max Delbrück received his doctorate in theoretical physics from the University of Göttingen and then spent three postdoctoral years in England, Switzerland, and Denmark. His interest in biology was aroused during his stay in Denmark by Niels Bohr's speculation that the complementarity principle of quantum mechanics might have wide applications to other scientific fields and especially to the relation between physics and biology. Back in Berlin, Delbrück initiated an interdisciplinary collaboration with Nikolai W. Timofeeff and Karl G. Zimmer on biologically inspired problems. Based on x-ray-induced mutagenesis experiments and applying concepts from quantum mechanics, they suggested that chromosomes are nothing more than large molecules and that mutations can be viewed as ionization processes. These results were published in 1935. Schrödinger's little book *What Is Life?* (1944) was in part inspired by this paper.


Delbrück

In 1937 Delbrück moved from Germany to the United States and decided to remain after the start of World War II. At that time he initiated a fruitful collaboration with Salvador Luria on the genetic structure of bacteriophage (bacteria-infecting viruses) and on the genetic mechanism of DNA replication. After the outbreak of the war, Delbrück and Luria were classified as "enemy aliens" by the American government despite their open opposition to the Nazi and Fascist regimes. This classification fortuitously allowed them to pursue their own investigations without having to join any military project. For "their discoveries concerning the replication mechanism and the genetic structure of viruses," Delbrück and Luria were awarded the Nobel Prize in 1969, along with Alfred D. Hershey. In the early 1950s Delbrück's research interests shifted from molecular genetics to sensory physiology, with the goal of clarifying the molecular nature of the primary transduction processes of sense organs. Delbrück was also involved in setting up an institute of molecular genetics at the University of Cologne. It was formally dedicated on June 22, 1962, with Niels Bohr as the principal speaker. His lecture, entitled "Light and life revisited", commented on his original lecture of 1933, which had been the starting point of Delbrück's interest in biology. It was to be Bohr's last formal lecture. He died before completing the manuscript of this lecture for publication.


Bohr


Schrödinger

Erwin Schrödinger is regarded as one of the fathers of quantum mechanics. However, his interests went far beyond physics. He was particularly interested in philosophy and biology. Early in his career, he made substantial contributions to the theory of color vision. Schrödinger's personal life was tumultuous. He

participated as an officer in World War I on the Italian front. For a variety of reasons, Schrödinger moved constantly, holding positions in Austria, Switzerland, Germany, England, and then Austria again. Soon after he took up this last position in Graz, Austria fell into the hands of the Nazis, and Schrödinger escaped to Ireland, since his initial departure from Berlin when the National Socialists took power was considered an unfriendly act.

In Ireland, Schrödinger joined the Institute for Advanced Studies in Dublin. His contract required him to give a yearly series of public lectures. In 1943 he elected to discuss whether the events in space and time which take place within the spatial boundary of a living organism can be accounted for by physics and chemistry in light of the most recent developments in quantum mechanics and its application to genetics. These lectures were published in book form in 1944 under the title *What Is Life?*

After discussing how thermodynamics plays a role in the processes of life and reviewing the not-so-recent results on mutagenesis by Delbrück et al., Schrödinger argued in *What Is Life?* that life could be thought of in terms of storing and transmitting information. Chromosomes were thus simply bearers of information. Because so much information had to be packed into every cell, Schrödinger argued it must be compressed into what he called a "hereditary code-script" embedded in the molecular fabric of chromosomes. To understand life, then, it was necessary to identify these molecules and crack their code. Schrödinger's book had the very positive effect of popularizing the Delbrück paper and of rephrasing some important questions derived from it in a language accessible to the nonexpert. The book's publication could not have been better timed, and it was tremendously influential. Many of those who would play major roles in the development of molecular biology were drawn to this field after reading *What Is Life?* Schrödinger's recruits included Francis Crick, James D. Watson, Maurice Wilkins, Seymour Benzer, and François Jacob.

Francis Crick studied physics at University College London. After graduating, he started research for a doctorate, but this was interrupted by the outbreak of World War II. During the war he worked as a scientist for the British Admiralty, mainly on magnetic and acoustic mines. When the war ended, Crick had planned to stay in military research, but, on reading Schrödinger's book, he joined the Medical Research Council Unit in Cambridge to study biology. In 1951 Crick started a collaboration with James D. Watson, who came to Cambridge as a postdoctoral fellow. Watson had originally considered being a naturalist, but he was also hooked on gene research by Schrödinger's book. Linus Pauling had discovered the alpha helix protein structure by making scale models of the different parts of the molecule and working out possible 3-dimensional schemes to infer which type of helical fold would be compatible with the underlying chemical features of the polypeptide (amino acid) chain. Following Pauling's approach, Watson and Crick started to look for the structure of DNA, which in 1944 had been discovered to be the substance making up the chromosomes. They finally succeeded in the spring of 1953. Not only did they determine the structure of DNA, they also proposed a scheme for its replication.


Crick

Essential for the work of Watson and Crick were the experimental results of Rosalind Franklin and Maurice Wilkins. Franklin had a background in chemistry, while Wilkins was a physicist. During World War II, Wilkins worked in the Manhattan Project. For him, as for many other of the scientists involved, the actual deployment of the bombs in Hiroshima and Nagasaki, the culmination of all their work, was profoundly disillusioning. He considered forsaking science altogether to become a painter in Paris. However, he too had read Schrödinger's book, and biology intervened. Franklin, working in Wilkins's lab, recorded the DNA x-ray diffraction patterns that allowed Watson and Crick to beat Pauling in the race to determine the structure of DNA. Crick, Watson, and Wilkins received the Nobel Prize in 1962 "for their discoveries concerning the molecular structure of nuclear acids and its significance for information transfer in living material." Rosalind Franklin had died at an early age a few years before and was not recognized for her essential contributions.


Wilkins

Knowing the structure of DNA was only the start. Next it was necessary to find the sequence of genes and chromosomes, to understand the molecular machinery used to read the messages in DNA, and to understand the regulatory mechanisms through which the genes are controlled. These questions were answered by a second generation of molecular biologists like Seymour Benzer, Sydney Brenner, François Jacob, Jacques Monod, and Walter Gilbert. Seymour Benzer and Walter Gilbert had both been educated as physicists but were attracted to the excitement of the new science. Seymour Benzer also heeded the


Benzer

clarion call of the Schrödinger book. He was a pioneer of gene sequencing. Among other things, Benzer was the first to produce a map of a single bacteriophage gene, rII, showing how a series of mutations (all errors in the gene script) were laid out linearly along the viral DNA.

Walter Gilbert received his doctorate in theoretical physics and after becoming a professor at Harvard, worked on particle physics and quantum field theory for a number of years. Then his interests shifted. In 1960 Gilbert joined James Watson and François Gros in a project to identify messenger RNA. After a year of work on this problem, Gilbert returned to physics only to re-return to molecular biology shortly afterwards. Some of the more important contributions of Gilbert and his collaborators to this field are: the discovery that a single messenger molecule can service many ribosomes at once and that the growing proteinic chain always remains attached to a transfer RNA molecule; the isolation of the lactose repressor, the first example of a genetic control element; the invention of the rolling circle model, which describes one of the two ways DNA molecules duplicate themselves; the isolation of the DNA fragment to which the lac repressor binds; and the development of rapid chemical DNA sequencing and of recombinant DNA techniques. Walter Gilbert and Frederick Sanger received the Nobel Prize in 1980 "for their contributions concerning the determination of base sequences in nucleic acids."

Gilbert

Present and Future Perspectives

What we have described so far have been a few of the significant advances made in the study of systems in which there was a certain clear and obvious physics and mathematics component to the research being carried out. The advances made in the biological understanding were often quite dependent on the application of physical and mathematical principles, or the development of the physics and the mathematics was clearly driven by observations in biology. This strong interdependence is mirrored in the highlighting of biologically oriented problems in the new millennium (January 2000) issues of *Physics Today* and the *Notices of the American Mathematical Society*, as well as the special November 2000 *Nature Neuroscience* issue "Computational Approaches to Brain Function". The *Notices of the American Mathematical Society* has on several occasions focussed on problems involving biomathematics (September 1995) or molecular biology (April and May 2002).

Many major universities in the world have at least one research group working in these fields. However, listing them all is beyond the scope or the intent of this article. Our purpose has been only to illustrate how widespread and important biophysics and biomathematics have been in the past few centuries and the increase in their importance in the past few decades.

Darwin's theory states that, given the environmental conditions, the fittest individuals are the ones that survive and reproduce. However, it is impossible to identify the current fittest individuals whose genes are going to pass to the next generation. They can be pinpointed only after they have survived. Thus, according to some, Darwinism is tautological, since it predicts only the survival of the survivors. In trying to foresee the future of science, we face the same problem. It is not possible to identify the current areas of scientific research that will play a relevant role in the development of science and technology. We acknowledge this problem. However, it is our belief that given the fruitful historical relation and the present blooming of biological, physical, and mathematical interdisciplinary sciences, they are going to be so important in the near future that the avant garde biological scientists will be those with a strong background in both the biological and the physical-mathematical sciences.

The mathematical and computational modelling of biological systems is a subject of increasingly intense interest. The accelerating growth of biological knowledge, in concert with a growing appreciation of the spatial and temporal complexity of events within cells, tissues, organs, and populations, threatens to overwhelm our capacity to integrate, understand, and reason about biology and biological function. The construction, analysis, and simulation of formal mathematical models is a useful way to manage such problems. Metabolism, signal transduction, genetic regulation, circadian rhythms, and various aspects of neurobiology are just a subset of the phenomena that have been successfully treated by mathematical modelling. What are the likely areas of advancement for the future? Predicting the future has fascinated and confounded man for centuries, probably for as long as he has been able to articulate the concept of the future. For example, some relatively recent predictions were:

> Physics is finished, young man. It's a dead-end street.
>
> —Unknown teacher of Max Planck, late nineteenth century

> I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks.
>
> —Thomas Edison, 1922

> It is probable that television drama of high caliber and produced by first-rate artists will materially raise the level of dramatic taste of the nation.
>
> —David Sarnoff, 1939

Being aware of the almost certain folly of trying to predict the future, as illustrated by these quotations, we nevertheless take the leap and mention several areas in which we feel that significant advances are likely to take place over the present century.

- The sequencing of human and other genomes has provided a spectacular amount of data which needs to be organized and analyzed before its significance becomes clear. The mathematical techniques necessary to do so are still to be developed. This has opened a whole new area of research known as bioinformatics, which is rapidly growing and presumably will keep on growing at an accelerated pace in the next few years. However, we are of the opinion that the sequence analysis component of bioinformatics will quickly evolve to become a mere tool widely and easily used by scientific practitioners (in analogy with the transition from scientific computing being done on large mainframe computers a few decades ago and now being almost exclusively carried out on inexpensive workstations).
- The classification aspects of bioinformatics will be rapidly replaced by efforts to understand the regulation of gene networks using established and new techniques from nonlinear dynamics. Mathematical modelling and analysis of the mechanisms of gene regulation will continue at an ever-accelerating pace. This, in conjunction with the already established ability to produce "designer" molecular circuits, will be instrumental in the targeted treatment of disease through gene therapy.
- Attempts to understand the noisy interactions in gene regulation and expression at the single-cell level will lead to the development of new mathematical techniques for dealing with chemical reactions in which the law of large numbers cannot be invoked.
- The Herculean efforts of countless neurobiologists over the past century have given us much insight into the functioning of single neurons as well as the behavior of simple neural circuits and some extremely simple sensory and motor systems. This progress will continue and lead to the efficient treatment of many neuron-related diseases, to a better design of prostheses, and perhaps to a deeper understanding of the relation between brain and mind. Shall we at some time be able to really understand phenomena like cognition and memory? Maybe, maybe not. Perhaps, as some philosophers maintain, the human mind is unable to understand itself. However, we firmly believe that the neurophysiological sciences will thrive in the near future, with physics and mathematics playing a central role in such progress. Examples are the use of vagal stimulation to abort epileptic seizures and deep brain stimulation to control the tremor of Parkinson's disease.
- Biophysical advances in determining the structure and dynamic properties of membrane channels and receptors have proceeded at a rapid pace over the past decade. There is every reason to anticipate that this will only accelerate in the future. The accumulated knowledge, in conjunction with modelling and production of designer molecules, will enable the efficient development and production of drugs specifically targeted to the elimination of disease symptoms, if not the disease itself.
- The accelerated rhythm at which technology is progressing makes us believe that in the near future it will be possible to combine knowledge and techniques from biology, chemistry, biochemistry, computer science, engineering, and physics to engineer designer molecules for specific medical and industrial purposes.
- Interdisciplinary work focussed on the development of biomaterials, bioelectronic devices, and biomechanical systems will improve the design of artificial organs, prostheses, and implants through the development of hybrid animate-inanimate devices.
- Epidemiological research aided by mathematical modelling and statistical analysis will help us understand the dynamics of disease transmission and design more efficacious treatment and vaccination strategies.
- The difficulty in collecting high-resolution temporal and spatial data from ecological and meteorological systems has limited the success of mathematical modelling approaches in these fields. The availability of more sophisticated geographic information systems and massive parallel computational power will alleviate these problems.

Summary

There has been a long and rich tradition of fruitful interdisciplinary interplay between the physical and biological sciences extending over several centuries, as we have illustrated with a few examples. Many other examples could have been offered to illustrate the point and would simply serve to highlight the rich interactions between apparently disparate branches of science. We expect that these interactions and interdependence will continue and become even stronger in the future.

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Bibliography

- Alessandro Volta webpage at University of Pavia, http://ppp.unipv.it/Volta.
- I. Asimov, *Asimov's Biographical Encyclopedia of Science and Technology: The Lives and Achievements of 1510 Great Scientists from Ancient Times to the Present Chronologically Arranged*, Doubleday, Garden City, NY, 1982.
- J. D. Bernal, *Science in History*, M.I.T. Press, Cambridge, MA, 1971.
- L. Koenigsberger, *Herman von Helmholtz*, Dover Publications, New York, NY, 1965.
- W. Moore, *Schrödinger, Life and Thought*, Cambridge University Press, Cambridge and New York, 1989.
- MacTutor History of Mathematics, http://www-gap.dcs.st-and.ac.uk/~history.
- J. Malmivuo and R. Plonsey, *Bioelectromagnetism*, Oxford University Press, New York and Oxford, 1995; http://butler.cc.tut.fi/~malmivuo/bem/bembook/index.htm.
- Nobel e-Museum, http://www.nobel.se.
- E. Schrödinger, What Is Life? *The Physical Aspects of the Living Cell*, Cambridge University Press, 1944.
- J. Watson, *DNA: The Secret of Life*, Alfred A. Knopf, New York, 2003.

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About the Cover

This month's cover accompanies the article by Mark Goresky and Susan Friedlander (pages 859–862). The logo for the 75th birthday of the School of Mathematics at the Institute for Advanced Study was based on a suggestion by Robert MacPherson. It was displayed in many, many places—conference invitations and parking direction signs, for example. Best of all, some genius in the kitchen thought of turning it into a dessert by means of Chocolography, a method of printing from a PDF file with something like an ink jet printer whose ink is dark chocolate spraying onto a white chocolate background. This technology comes from Chocolate Printing, Inc.

Mark Goresky saved the disk we photographed (about 3 inches across) from being eaten. Thomas Uphill and Charlotte Langlands also helped in producing this cover.

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Teaching Mathematics Graduate Students How to Teach

Solomon Friedberg

True or false: "The primary task of a mathematics graduate student is to learn, and ultimately to create, mathematics." Most graduate school faculty, including this author, would heartily agree. But such an individual, upon graduation, will be asked to teach his or her own course in the academy or to work as part of a group in industry. It is natural to expect such a student to develop the skills necessary to do so while in graduate school. In this article I focus on some novel ways for mathematics departments to promote the development of teaching (and communication) skills, consistent with the primary focus on subject matter mastery noted above.

Before discussing teaching, it seems appropriate to acknowledge that there was a time not long ago when teaching skills were of little importance to many institutions. (See for example the discussion of the Princeton math department in the 1950s in Sylvia Nasar's *A Beautiful Mind*.) Several factors are contributing to a change in this regard. The United States is a nation at risk in terms of precollegiate mathematics education, but if we do not succeed in teaching mathematics to the undergraduate students we get, even if these students are not all highly motivated and not all well prepared, then our nation will not be able to maintain the scientific work force it needs. At the same time, college tuition is large and growing, and consumers rightly expect that the product they purchase will be worth the cost. And it is not a given that as math faculty retire, they will be replaced by new faculty. If we cannot succeed at the teaching of mathematics to undergraduates, then the pressure to have others do so in our place will increase. In the long run, then, mathematics will do better if the next generation of mathematicians on university faculties are excellent teachers. The topic of this article should thus be of genuine importance to the entire math community.

Lofty principles and long-term perspectives are fine, but most of us live day to day. Graduate students serve as teaching assistants (TAs), getting exposure to teaching and helping us do the job of educating our students. TAs do different tasks at different institutions: some run recitation sections, some teach their own class under the supervision of a senior faculty member, some are handed the syllabus their first day on the job and told to go to it. In all cases, good TAs are a benefit to a mathematics department, both in the actual teaching of mathematics to undergraduates and in relations with other departments and the administration. Bad TAs, as measured by student complaints, are a liability. To address this, many institutions offer TA-training (a better phrase might be TA-development) programs. It might surprise some to learn not that this TA-training exists, but that it comes in a great variety of formats at different institutions. Formats include an intensive period during orientation week, a summer course, a required semester course, a voluntary semester course, a one-hour-per-week or per-month

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program during each year, a similar program but only during the first semester of TAing. Some programs involve only new TAs, some involve new and a few experienced TAs, some involve all TAs, some are only for experienced TAs. Besides the diversity in both TA duties and TA training, there is diversity in how these are coupled, with programs spanning the range from minimal supervision and no follow-up as regards TA training to carefully integrated and sustained mentoring.

What is in these TA-training programs? Certainly, to teach effectively one needs to be able to use a blackboard and to speak understandably (a foreign accent is fine; some of the best teachers I know speak heavily accented English). Accordingly, almost all programs include practice in explaining problems at the board, critiqued by the other participants or by the instructor. Some institutions videotape. But after developing teaching skills at this basic level, there is no uniform next topic, no canonical way to proceed.

This is not surprising. After all, there is no one right way of teaching and no one approach to the classroom that is guaranteed to work for all. Good teaching is far from well defined, and my idea of good pedagogy may be different from yours. So how can one possibly teach someone to teach well?

A crucial part of teaching, of course, is what you say and how you say it. In the rest of this article I would like to focus on two factors that contribute to what good teachers say and how they say it: *experience* and *good judgment*. It may seem surprising that one can speed the acquisition of the former and that one can teach the latter, but I will make the argument below that one can do so and that doing so is useful to developing strong teaching in mathematics graduate students.

The first of these factors, experience, is an obvious one. Those who have been in the classroom for a few years have seen the range of student responses to our efforts and have an idea of what works and what doesn't. Graduate students (and some beginning faculty), by contrast, frequently have limited access to experiences with students who are not like themselves—students who study mathematics for different reasons than they did or, even more strongly, students who find mathematics frightening or uninteresting. Experience in teaching such students will come in due time, but the parent paying an enormous tuition bill is no more likely to accept this as an excuse for ineffective teaching than the patient who finds out that his surgeon is doing the operation for the very first time but skipped the practice course.

The second factor, good judgment, is something we are well aware of in mathematics research but perhaps less so in the classroom. In the research setting, the student meets good judgment when the advisor's problem turns out to be solvable and interesting. In the classroom, it is an essential part of excellent teaching. Good judgment manifests itself in the way that the teacher answers for him- or herself and then for the class such questions as: Why is this mathematical concept important? What in the class material is fundamental and what is not? How do we balance conceptual understanding and an appreciation of the big picture with technical details and problem solving? How do we respond in lecture if students are unresponsive and possibly confused? What will motivate the students and engage them intellectually? What assignments will bring out their best? How do we respond to a diversity of levels of preparation? In these and many other questions that we face in the classroom, it is good judgment that makes some people successful and others less effective.[1]

The key point is that these two factors are coupled. *The analysis of experience can contribute to good judgment.* A driver who skids on a slippery road once and thinks about it will drive the road more slowly the next time it rains. In an academic context, in the early twentieth century business schools developed a method of teaching based on the analysis of experience, a method in which key business decisions were described and then analyzed: the case study method. As former Harvard president Lowell stated in the early 1920s, "The case method of business training is deemed the best preparation for business life, because the discussion of questions by the banker, the manufacturer, the merchant or the transporter consists of discerning the essential elements in a situation and applying to them the principles of organization and trade. His most important work consists of solving problems and for this he must have the faculty of rapid analysis and synthesis."[2] The analysis of cases promotes good business judgment.

The use of case studies to promote university teaching was developed extensively by Professor C. Roland Christensen of the Harvard Business School, beginning in the late 1960s and continuing into the 1990s. His cases describe in writing crises in a university classroom, and in Christensen's implementation each crisis is discussed in detail by a group with a discussion leader. The group members need not agree, but they are led to think deeply, in a Socratic-method approach. Christensen's seminar in the Boston area became renowned.[3] His book (joint with Barnes and Hanson) *Teaching and the Case Method* [1] is still

[1] *As these questions illustrate, good judgment has as a foundation a sophisticated understanding of the subject matter being taught.*

[2] *As quoted in [1], p. 41.*

[3] *A videotape giving the flavor of Christensen's seminar,* The Art of Discussion Leading: A Class with Chris Christensen, *is available through the Derek Bok Center for Teaching and Learning, Harvard University.*

a classic. But the issues and experiences in Christensen's cases are far from the ones of immediate concern to mathematics graduate students.

I first learned of case studies in the mid-1990s, when I was present at a case study discussion for middle and high school mathematics teachers led by Katherine Merseth of the Harvard Graduate School of Education. I still remember being deeply impressed by the way that the teachers responded to Merseth's case and the way that in the course of the discussion they visibly reevaluated their ideas about teaching and began to make new judgments about how to handle teaching issues. It seemed to me that this method had the potential to contribute to the preparation of mathematics graduate students in an important way.

During the period 1998–2002 the author led a major effort to develop case studies that would be relevant to mathematics graduate students. The project, dubbed the Boston College Mathematics Case Studies Project,[4] had as its goal the development of case studies—depictions of aspects of teaching math to undergraduates, typically involving a difficulty or an important decision—that would supplement mathematics graduate students' experiences and promote the development of good judgment concerning classroom issues. The resulting materials would be evaluated for their effectiveness.

With some relief, the author can report that the effort has been successful. The development team[5] wrote fourteen case studies, several with multiple parts or mathematical levels. (One of our case

[4] *The project was funded by a grant from the U.S. Department of Education's Fund for the Improvement of Postsecondary Education.*

[5] *Avner Ash, Elizabeth Brown, Solomon Friedberg, Deborah Hughes Hallett, Reva Kasman, Margaret Kenney, Lisa A. Mantini, William McCallum, Jeremy Teitelbaum, and Lee Zia.*

The following case study, Seeking Points, is reprinted from the book *Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom* by Solomon Friedberg, Avner Ash, Elizabeth Brown, Deborah Hughes Hallett, Reva Kasman, Margaret Kenney, Lisa A. Mantini, William McCallum, Jeremy Teitelbaum, and Lee Zia, Issues in Mathematics Education, vol. 10, American Mathematical Society, Providence, RI, 2001.

Seeking Points

Daniel sighed as he dumped his books on his office desk. He'd just handed back the first midterm exam from his Calculus I class, and he could tell as he left the classroom that there were a lot of unhappy students. Still, the exam had been just like the practice exam he'd given out, and he was sure it was pretty straightforward. As he sat down to take a look at the paper on duality for fppf sheaves he was supposed to read, he heard a knock on his office door.

"Come in," he called, and he saw Sam, one of his Calculus students, push open the door hesitantly.

"Can I talk to you about my exam?" Sam said.

"I guess this was inevitable," thought Daniel to himself. To Sam, he said "What's up?"

"It's this question number 2," said Sam. "I don't think my answer was graded properly."

"Let me take a look," Daniel replied, "pull up a chair."

Sam sat down and passed his exam booklet over to Daniel. Daniel noticed that Sam had gotten 82 points out of 100 on the exam, which was a high B, but he had missed most of his points on problem 2. Then Daniel looked at the question, which said:

Problem 2 (20 points). Let $f(x) = x^3 - 5$. Use the definition of the derivative to compute the slope of the tangent line to the graph of $f(x)$ at the point where $x = 2$.

Then Daniel turned to Sam's exam paper. Sam had written the following:

Sam's Answer: $f(x) = x^3 - 5$. $f'(x) = 3x^2$. Slope $= f'(2) = 12$.

The grader of the problem had given Sam 5 out of the 20 points.

"Well, Sam," said Daniel, "you see, you didn't do what the question asked. You are supposed to use the definition of the derivative to solve this problem, but you didn't give any method for deriving your answer. How did you do this problem?"

"I used the rule that the derivative of x^n is nx^{n-1}, which makes it really easy," replied Sam.

Daniel felt a little uncomfortable about this. He, like the rest of the Calculus teachers, was emphasizing understanding rather than algorithms for solving problems. He and his fellow instructors had specifically scheduled the first exam after a qualitative discussion of the derivative, and an introduction to the definition, but before discussing the various techniques of differentiation. He hadn't gone over the nx^{n-1} rule in class yet.

"Where did you get that from?" he asked Sam.

"I took Calc in high school, and we learned it there. We learned lots of other methods too. The answer is right, isn't it?"

"Yes, it's correct as far as it goes, but as I said it isn't what we asked for. We wanted you to show that you can use the definition of the derivative."

"You mean that thing with the limit?" said Sam.

"Yes," said Daniel, "exactly, that thing with the limit—the difference quotient. In the review for the test I emphasized that if we asked you to use the definition of the derivative, then we wanted you to use the difference quotient."

"Well," said Sam, "I didn't come to the review session. But it doesn't really seem fair to me that I got so many points off because I did the problem an easy way instead of a hard way."

"It isn't just a question of easy and hard," said Daniel. "We are trying to teach you to understand what the derivative means and where it comes from. We don't want you to just learn a bunch of formulas and how to make them go."

"Look, Professor, I know what the derivative means. It's the slope of the tangent line to the curve at the point, just like you asked. I knew that, because I knew what to calculate once I used my rule. Look at the rest of my exam—I got all the other problems basically right. I think I deserve more points on this problem."

"Sam, before we get into a discussion of points, let me ask you this. Do you know what the difference quotient is? Do you know WHY the formula you used gives you the slope of the tangent line?"

"Yeah, well, you did that in class a while ago, and I understood it then. It has something to do with secant lines and stuff, but I forget right now. I figured it doesn't really matter, 'cause I know these other, easier ways to do the problems. I just feel sorry for the other students who have to do it the hard way. I taught my roommate in another section about the methods I learned and he really appreciated it."

"But, Sam, that's just the point we are trying to get across. It IS just as important to know WHY the formula works as how to use it. The formulas you learned all had to be figured out by someone using the difference quotient. Let's take the problem from the test. What we wanted to see was the following:

$$\begin{aligned} f'(2) &= \lim_{h\to 0} \frac{((2+h)^3 - 5) - (2^3 - 5)}{h} \\ &= \lim_{h\to 0} \frac{2^3 + 3\cdot 2^2\cdot h + 3\cdot 2\cdot h^2 + h^3 - 5 - 2^3 + 5}{h} \\ &= \lim_{h\to 0} \frac{12h + 6h^2 + h^3}{h} \\ &= \lim_{h\to 0} 12 + 6h + h^2 \\ &= 12 \end{aligned}$$

So the derivative is 12, and so is the slope. This calculation shows that the slope, 12, is the limiting value of the slopes of the secant lines."

"Well, maybe it shows that to you, but it looks like a bunch of formulas to me. Just different formulas. You really think all those people who wrote that instead of what I wrote know something I don't? They just went to the review session, which I admit I shoulda done. Look, Prof, I'm not here to argue about all of Mathematics. I promise from now on I'll come to your review sessions and do the problems just the way you want them. I just want 5 more points so I can get an A on this exam."

Daniel's heart sank. It was pretty clear this kid Sam didn't get Daniel's argument about "underlying ideas." And him promising to do whatever Daniel wanted on the next exam just made Daniel feel worse—that made it seem like the kid was just humoring him. As for more points—well, lots of people had made this mistake on the exam, and they'd all gotten five points. So Daniel couldn't really change this kid's point score without changing the others, too, though he did think Sam seemed pretty sharp.

"Sam, I'm afraid I can't give you any more points on this problem. We graded the exam consistently, and we gave everyone who made your mistake 5 points. I appreciate what you're telling me, and I get the impression you are following the course pretty well, so if you continue to do well, you can get your A on the next midterm and the final and you'll get your A in the course."

"So you mean you graded lots of people unfairly, and you don't want to fix it? OK, you're the prof, I guess. And I'll be sure to come to the review session next time so I find out how you want us to do the problems."

Sam picked up his exam and left the room. Daniel stared after him for a minute or two, visibly upset, then took a deep breath and turned back to his desk. He had promised to read this paper before his next meeting with his advisor. Where was he? Oh, yes, he could see that the argument he was reading worked if he used the theorem on flat descent. He remembered sitting in on a lecture during his second year where his professor had described flat descent in detail; he couldn't exactly remember the proof of the theorem, but he did remember that you could apply it in this situation....

studies, Seeking Points, is included as a sidebar to this article.) The cases were created by an extensive process of writing, feedback from graduate students and faculty, and rewriting. Each of the cases raises a variety of interwoven issues to be explored through group discussion and analysis (though they can also be read independently of such a discussion). The cases give graduate students the chance to analyze complicated realistic teaching situations (perhaps applying general principles they have formulated or discussed); to think in advance about how to handle teaching crises so that they can deal with them when they arise in real life; to formulate their own approach to teaching; and to view teaching as nontrivial and sometimes ambiguous, and as something to talk about. They supplement TA experiences and contribute to the development of good judgment. Discussion of the cases also contributes to listening and communication skills. Our cases were piloted at diverse institutions, public and private, large and small (around twenty in all). The evaluation[6] and extensive feedback from graduate students and faculty colleagues showed that the cases were in fact an effective way of broadening individuals' experience base and of promoting thought and dialogue about teaching.

To give the flavor of this feedback, here are several verbatim comments made by graduate students who had participated in a case discussion: "It helps me get some of these vague ideas I have about teaching, etc., to solidify a little bit and also brings up issues of things I've never considered before." "I had the opportunity to think about some issues that, even though they come up daily as a graduate student, we don't really take the time to think about these issues the way I had time today.... The problems these case studies raise are problems that touch me." "It was a really good situation to sit down and talk with different people who had different experiences. There were differences in the level of experience that people had and that made there be a chance for a lot of new ideas and a lot of seasoned ideas." "It's given me a vocabulary to talk and think about teaching that I wouldn't necessarily have just come up with as I'm worrying about writing my dissertation otherwise."

There were several surprises. We had special concern about the appeal of such a method for foreign graduate students and concern with their ability to be involved in such a discussion. In fact, it turned out that many foreign graduate students found the cases a useful window on American university culture, and many had deep ideas about teaching that were useful to all. We thought that the cases would work the same with all levels of graduate students, but we found that many beginning graduate students did not have the experience base to discuss all cases, since they had not given any thought to the teaching aspect of their designated profession. Fortunately, it also turned out that this could be addressed by having more experienced peers, such as a head TA or two, in the case discussion. Most crucially, we learned that leading a case study discussion requires different skills from lecturing on the part of the faculty leader and that there is a learning curve to leading a successful case study discussion.

To address this last point, we organized two multiday workshops for faculty interested in our case studies while they were under development and added extensive materials to the published faculty edition concerning the use of the cases. Since the conclusion of the development project, the author and Diane Herrmann of the University of Chicago have offered a series of workshops at AMS meetings for faculty interested in learning to lead case discussions (our workshop at the 2005 Joint Meetings was attended by, among others, participants from four non-English-speaking countries).[7] An additional workshop is planned for the 2006 Joint Meetings.[8]

At this point the case studies we have written and the materials we created to guide their use have been published [4], and they are being used in diverse ways in a significant number of institutions. They have been used as part of a first course in teaching and as the basis for a second course in teaching. They have been used as stand-alone materials and coupled with a book giving advice about how to teach, such as [5]. Just as learning mathematics is facilitated by well-thought-out exercises, our materials serve as a comprehensive set of exercises for teaching.

In concluding, let me observe that the ability to teach and to communicate well is of concern throughout science and engineering. Indeed, the National Academy of Sciences's publication *Preparing for the 21st Century: The Education Imperative* reports that "employers do not feel that the current level of education [of Ph.D. graduates in science and engineering] is sufficient in providing skills and abilities...particularly in communications skills (including teaching and mentoring abilities for academic positions),..., [and] teamwork...." Discipline-based efforts seem most likely to be effective in addressing this concern. Fortunately, an increasing number of individuals are now thinking about how to develop teaching

[6] *Carried out by independent evaluator Mary Sullivan.*

[7] *For a discussion of the use of case studies internationally, see [3].*

[8] *These workshops have been supported by a grant awarded to the AMS by the Calculus Consortium for Higher Education, with additional support provided by the AMS through the efforts of AMS associate director Jim Maxwell.*

strength in mathematics graduate students and investigating how mathematics graduate students learn to teach. Other authors have started to share their own successful materials and programs (for example, [2], [5], [6]). Let us hope that these efforts will lead us to the day when every mathematics graduate student completing a Ph.D. is fully prepared to teach a class independently—and excellently—upon graduation.

References

[1] L. B. BARNES, C. R. CHRISTENSEN, and A. J. HANSEN, *Teaching and the Case Method*, Third Edition, Harvard Business School Press, Boston, MA, 1994.

[2] M. DELONG and D. WINTER, *Learning to Teach and Teaching to Learn Mathematics: Resources for Professional Development*, Math. Assoc. Amer., Washington, DC, 2002.

[3] S. FRIEDBERG, Teaching mathematics graduate students to teach: An international perspective, to appear in *Proceedings of the First KAIST International Symposium on Enhancing University Mathematics Teaching*, Korean Advanced Institute of Science and Technology, Daejeon, Korea. (Available online at: `http://math.kaist.ac.kr/2005/proceedings/`.)

[4] S. FRIEDBERG AND THE BCCASE DEVELOPMENT TEAM, *Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom*, Issues in Mathematics Education, vol. 10 (available in faculty and graduate student editions), Amer. Math. Soc., Providence, RI, 2001.

[5] S. KRANTZ, *How to Teach Mathematics*, Second Edition, Amer. Math. Soc., Providence, RI, 1999.

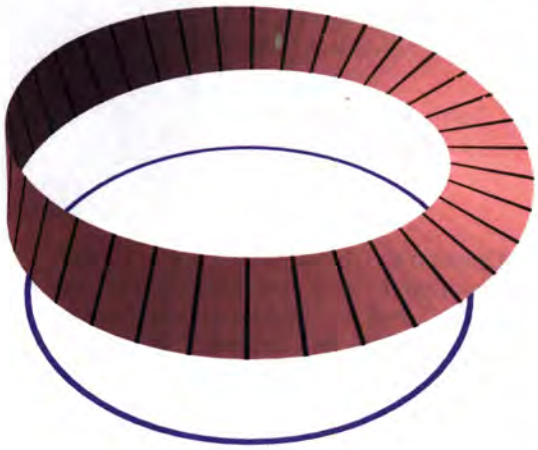
[6] T. RISHEL, *Teaching First: A Guide for New Mathematicians*, Math. Assoc. Amer., Washington, DC, 2000.

WHAT IS . . .

a Lefschetz Pencil?

Robert E. Gompf

One of the most challenging subjects in topology is the study of smooth 4-manifolds. For a simple approach to this, we list some examples. After the 4-sphere, the best known compact 4-manifolds are Cartesian products of surfaces. For more variety, we can "twist" the product structure to obtain a *fiber bundle*. Consider the Möbius band, with its projection $\pi : M \to S^1$ to the circle. Each *fiber* (point preimage) is an interval I, and any sufficiently small neighborhood U in S^1 has preimage given by $U \times I$, with π corresponding to projection to the first factor. Thus, M is locally indistinguishable from the product $S^1 \times I$ with its projection to S^1.



The Möbius band fibered by intervals.

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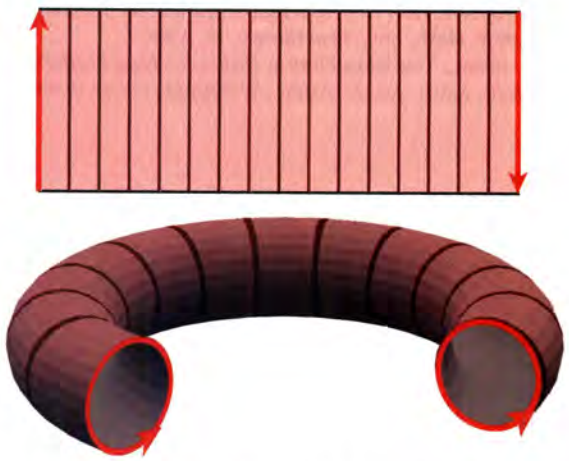
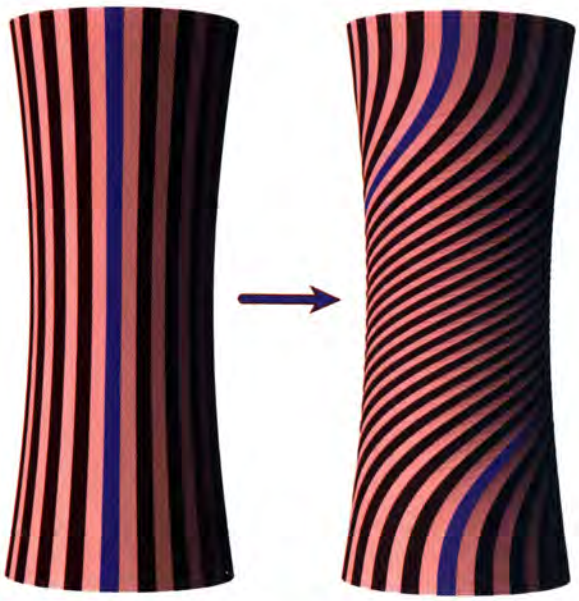
Of course, M is not globally a product, since its boundary is connected, unlike the fiber I. There are also two bundles over S^1 with S^1-fibers: the torus $T = S^1 \times S^1$ and the Klein bottle $\pi : K \to S^1$. (Try to visualize each of these surfaces filled by a family of disjoint circles.) For each pair of compact surfaces Σ and F, we can now consider bundles $\pi : X \to \Sigma$ with fiber F. Most choices of Σ and F will yield infinitely many 4-manifolds X in this manner. When $\Sigma = F = T$, for example, we can obtain each of the 4-manifolds $T \times T$, $T \times K$, and $K \times K$ as a product of two S^1-bundles over S^1 (with the product of the two projection maps). Alternatively, we can obtain infinitely many examples by thinking of



Just as the Möbius band is obtained from a rectangle by identifying opposite ends, the Klein bottle is obtained by an identification of opposite ends of a tube.

$\Sigma = T$ as being obtained from the cylinder $S^1 \times I$ by gluing the two boundary components together. Then every self-diffeomorphism of F gives a way to glue the boundary components of $(S^1 \times I) \times F$ to obtain a bundle over T. (Compare with the Klein bottle $K \to S^1 = I/\partial I$ as pictured above.) For every bundle $\pi : X \to \Sigma$, the preimage of each circle $C \subset \Sigma$ is itself a bundle over C, determined by a self-diffeomorphism of F called the *monodromy* around C. (What is the monodromy around each factor of $S^1 \times S^1$ in each of the above examples?)

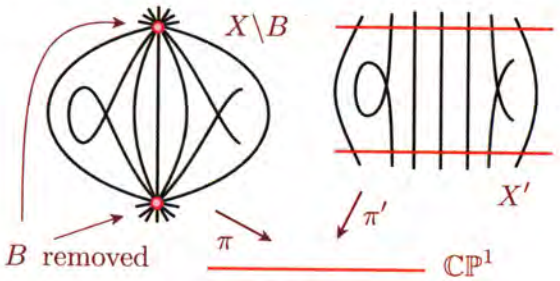
Unfortunately, fiber bundles do not form a very representative class of 4-manifolds, especially in the simply connected case, where the two S^2-bundles over S^2 are the only examples. To obtain more generality, we relax the requirement that π be locally a product by allowing critical points of the simplest type, locally modeled by the complex quadratic map $q : \mathbb{C}^2 \to \mathbb{C}$, $q(u, v) = u^2 + v^2$. The resulting maps $\pi : X \to \Sigma$ (for X, Σ oriented) are called *Lefschetz fibrations* (e.g., [3], Chapter 8). These have only finitely many critical points, and each singular fiber (preimage of a critical value) looks like a surface with a transverse self-intersection. (In the local model, $q^{-1}(0)$ is the union of the two planes $v = \pm iu$.) The complement in X of the singular fibers is then a fiber bundle, and the monodromy around a curve in Σ encircling a single critical value is given by a right-handed *Dehn twist* φ. That is, a certain subset of a non-singular fiber F is identified with the oriented cylinder $S^1 \times [0, 2\pi]$, and φ is given there by $\varphi(\theta, t) = (\theta + t, t)$, adjusted near $S^1 \times \{0, 2\pi\}$ to fit smoothly together with the identity map elsewhere on F.



The bundle over a circle around a critical value of a Lefschetz fibration is obtained from the product $[0, 1] \times F$ by identifying the boundary surfaces through a Dehn twist, shown here on the subset of F outside which it is fixed.

For any word w (i.e., finite sequence) in right-handed Dehn twists on F, we can construct a Lefschetz fibration $X \to D^2$ over the disk, whose monodromies around consecutive critical values realize w, by suitably gluing copies of the model critical point onto the trivial fibration $D^2 \times F$. If the composite of all Dehn twists in w is the identity on F (up to homotopy through diffeomorphisms), then the boundary of X is $S^1 \times F$, so we can glue on another copy of $D^2 \times F$ to obtain a Lefschetz fibration over S^2. In fact, Lefschetz fibrations over S^2 are essentially classified by such words with trivial composite, up to a suitable equivalence relation corresponding to rearranging the critical values in S^2. The resulting classification problem for words in the self-diffeomorphism group of F is still unsolved when F has genus ≥ 2 and is the subject of ongoing research. Lefschetz fibrations over surfaces Σ of higher genus can be studied similarly, but the resulting 4-manifolds will never be simply connected. Fortunately, the case $\Sigma = S^2$ already includes an extensive collection of simply connected 4-manifolds.

To construct a typical example, we begin with a generic pair p_0, p_1 of homogeneous degree-d polynomials on $\mathbb{C}^3$. That is, each p_j satisfies $p_j(\lambda z) = \lambda^d p_j(z)$, so its zero-locus is a well-defined subset of $\mathbb{CP}^2 = \mathbb{C}^3 \setminus \{0\}$ modulo complex scalar multiplication. For each $(t_0, t_1) \in \mathbb{C}^2 \setminus \{0\}$, the homogeneous polynomial $t_0 p_0 + t_1 p_1$ also has a well-defined zero locus C_t in $\mathbb{CP}^2$, and this depends only on $t = \frac{t_0}{t_1} \in \mathbb{CP}^1 = \mathbb{C} \cup \{\infty\} = S^2$. We would like to identify each C_t as $\pi^{-1}(t)$, for some map π to S^2. However, the subset B given by $\{z \in \mathbb{CP}^2 \mid p_0(z) = p_1(z) = 0\}$ consists of d^2 points, and it is easy to see that for distinct $t, t' \in \mathbb{CP}^1$ we have $C_t \cap C_{t'} = B$. The resulting map $\pi : \mathbb{CP}^2 \setminus B \to \mathbb{CP}^1$ is an example of a *Lefschetz pencil* [3]. At each point of B it is locally modeled by $p : \mathbb{C}^2 \setminus \{0\} \to \mathbb{CP}^1$, $p(u, v) = \frac{u}{v}$, and the critical points are quadratic as before. A Lefschetz pencil $\pi : X \setminus B \to \mathbb{CP}^1$ can always be extended to a Lefschetz fibration $\pi' : X' \to \mathbb{CP}^1 = S^2$ by *blowing up*



A Lefschetz pencil and the corresponding Lefschetz fibration.

B, or one-point compactifying each fiber separately at each $b \in B$. This changes X by connected summing with a copy of $\mathbb{CP}^2$, with orientation opposite the complex orientation, at each $b \in B$. Thus, our example results in a Lefschetz fibration on each $\mathbb{CP}^2 \# d^2\overline{\mathbb{CP}^2}$, $d \in \mathbb{Z}^+$, each obtained from a Lefschetz pencil on $\mathbb{CP}^2$.

Which 4-manifolds admit Lefschetz pencils? In the early twentieth century, Lefschetz constructed such a structure on every *algebraic surface*, i.e., 4-manifold arising as the zero-locus in $\mathbb{CP}^n$ of a collection of homogeneous polynomials. This allowed him to intensively study the topology of algebraic surfaces, a large class of 4-manifolds including many simply connected examples. A decade ago Donaldson showed that the much larger class of *symplectic* 4-manifolds admits Lefschetz pencils. These admit *symplectic forms*, closed differential 2-forms that are nondegenerate as bilinear forms [2]. Symplectic manifolds have themselves been extensively studied for several decades. Unlike algebraic surfaces, symplectic 4-manifolds realize all finitely presented groups as their fundamental groups. A typical simply connected 4-manifold is homeomorphic to infinitely many diffeomorphism types of symplectic manifolds, only finitely many of which are algebraic, and to infinitely many other manifolds that do not admit symplectic structures [3]. It can be shown [2], [3] that a Lefschetz pencil on a 4-manifold determines a symplectic form on it. Thus, the class of 4-manifolds admitting Lefschetz pencils is identical to the class admitting symplectic structures. This class is large and well studied but still somewhat mysterious. It is hoped that the interplay between the two structures will shed new light on both of them.

There are various ways to generalize our discussion of Lefschetz fibrations and pencils. First, we can consider 4-manifolds with boundary. If $\Sigma = D^2$, and F also has boundary, then the boundary of X will be a 3-manifold with an *open book* decomposition [1] whose monodromy is a composite of right-handed Dehn twists. It is not fully understood which 3-manifolds admit such right-handed open books, but such structures correspond to holomorphically fillable contact structures. In fact, the corresponding 4-manifolds are precisely those admitting *Stein structures* (with finite topology), a classical notion from complex analysis. (A Stein manifold is a complex manifold that properly and biholomorphically embeds in some $\mathbb{C}^n$.) Alternatively, we can move to higher dimensions [2]. Donaldson's work still produces Lefschetz pencils $X \setminus B \to \mathbb{CP}^1$, where the critical points are locally $q(u_1, \ldots, u_n) = \sum u_j^2$ and B has codimension 4 with local model u_1/u_2 as before. The corresponding classification theory via diffeomorphisms of the fiber is analogous to the 4-dimensional case but harder. One would like to extend Donaldson's theory to *linear k-systems* $X \setminus B \to \mathbb{CP}^k$ for all k, as Auroux has done when $k = 2$. If this can be done for $2k = \dim X - 2$ (so the fibers are surfaces), then the corresponding linear systems (*hyperpencils*) exist precisely on manifolds admitting symplectic structures, characterizing the latter as Lefschetz pencils do on 4-manifolds. While these generalizations are receiving well-deserved study, much remains to be done in the basic setting of closed, simply connected 4-manifolds.

Further Reading

[1] E. Giroux, What is an open book? *Notices Amer. Math. Soc.* **52** (2005), 42–43.

[2] R. Gompf, The topology of symplectic manifolds, Proceedings of 7th Gökova Geometry-Topology Conference, *Turkish J. Math.* **25** (2001), 43–59; `http://www.ma.utexas.edu/~gompf`.

[3] R. Gompf and A. Stipsicz, *4-Manifolds and Kirby Calculus*, Grad. Studies Math., vol. 20, Amer. Math. Soc., Providence, RI, 1999.

Manifolds with Density

Frank Morgan

Introduction

We consider a Riemannian manifold M^n with a positive density function $\Psi(x)$ used to weight volume and hypersurface area. In terms of the underlying Riemannian volume dV_0 and area dA_0, the new, weighted volume and area are given by

$$dV = \Psi dV_0, \quad dA = \Psi dA_0.$$

Such a density is not equivalent to scaling the metric conformally by a factor $\lambda(x)$, since in that case volume and area would scale by different powers of λ. Manifolds with density long have arisen on an ad hoc basis in mathematics. Quotients of Riemannian manifolds are manifolds with density. For example, $\mathbf{R}^3$ modulo rotation about the z-axis is the half-plane

$$H = \{(x, z) : x \geq 0\}$$

with density $2\pi x$; volume and area in $\mathbf{R}^3$ are given by integrating this density over the generating region or curves in H. A manifold with density of much interest to probabilists is *Gauss space* G^n: Euclidean space with Gaussian probability density

$$\Phi = (\gamma/2\pi)^{n/2} e^{-\gamma x^2/2}$$

(see e.g. [LT] or [S]; or [Bo1], [Bo2] for applications to Brownian motion and to stock option pricing). Different values of γ arise from scaling the metric and renormalizing to unit volume.

Manifolds with density merit further study. Gromov [G2] studies manifolds with density $\Psi = e^{\psi}$ as "mm spaces" and mentions the natural generalization of mean curvature

$$H_\psi = H - \frac{1}{n-1}\frac{d\psi}{dn}, \tag{1}$$

corresponding to the first variation of weighted area (see Proposition 10). There are various useful generalizations of Ricci curvature (see Bayle [Bay1] and references therein to Bakry, Émery, Ledoux, and others), generally involving Hess ψ and $d\psi \otimes d\psi$. My favorite generalization of Ricci curvature is simply

$$\mathrm{Ric}_\psi = \mathrm{Ric} - \mathrm{Hess}\,\psi, \tag{2}$$

the generalized curvature of Bakry-Émery [BE, Prop. 3] and Bakry-Ledoux [BL, p. 265]. For Gauss space G^n with density $\Phi = e^{\varphi}$ it is constant:

$$\mathrm{Ric}_\varphi = 0 - \mathrm{Hess}\,\varphi = \gamma I.$$

For a 2D Riemannian manifold with density $\Psi = e^{\psi}$, Corwin et al. [CHSX] use such a generalized Gauss curvature,

$$G_\psi = G - \Delta\psi,$$

and obtain a generalization of the Gauss-Bonnet formula for a smooth disc R:

$$\int_R G_\psi + \int_{\partial R} \kappa_\psi = 2\pi,$$

where κ_ψ is generalized curvature as in (1) and the integrals are with respect to unweighted Riemannian area and arclength.

Different generalizations of Gauss curvature, involving $|\nabla\psi|^2$, are needed to recover asymptotic formulas for areas and perimeters of small discs [CHSX, Props. 5.17 and 5.18].

Heintze-Karcher

In this note we present after Bakry-Ledoux, Bayle, and others (see [BL], [Bay1]) generalizations to manifolds with density $\Psi = e^{\psi}$ of the Heintze-Karcher volume estimate and the Levy-Gromov isoperimetric inequality. Heintze-Karcher [HK] provides an upper bound on the volume of a one-sided neighborhood of a hypersurface in terms of

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its mean curvature and the Ricci curvature of the ambient manifold. Our first, sharper generalization of Heintze-Karcher (Theorem 1) requires separate lower bounds on Ric and -Hess ψ. Our second generalization of Heintze-Karcher (Theorem 2) requires a single lower bound on the generalized Ricci curvature Ric_ψ of formula (2) above. Corollary 4 deduces a weak generalization of the theorem of Myers.

Levy-Gromov

The standard Levy-Gromov isoperimetric inequality, for a (compact) Riemannian manifold M with Ricci curvature bounded below by a positive constant δ, can be more easily stated after M and the comparison sphere of constant curvature δ are given constant densities with unit volume. After such renormalization, it says that M's isoperimetric profile $P(V)$ (least perimeter to enclose given volume) is greater than or equal to the comparison sphere's. Our generalization of the Levy-Gromov inequality to manifolds with variable density (Theorem 5) says that if the generalized Ricci curvature is bounded below by $\gamma > 0$,

$$\mathrm{Ric}_\psi = \mathrm{Ric} - \mathrm{Hess}\,\psi \geq \gamma > 0,$$

then M's isoperimetric profile satisfies

$$P(V) \geq P_G(V),$$

where $P_G(V)$ is the isoperimetric profile of *Gauss space* with constant generalized Ricci curvature γ.

Other Approaches

Finally, following Bayle [Bay1], [Bay2], we present first and second variation formulas, which provide an alternative, direct approach to isoperimetric inequalities. The related, more abstract, original approach of Bakry and Ledoux [BL] used Markov semigroup arguments. Our approach via Heintze-Karcher seems to be the simplest.

Acknowledgments

We acknowledge inspiring conversations with Ros [Ros], Bayle [Bay1], [Bay2], Tapp, and many students, including Joe Corneli, Neil Hoffman, and the 2004 Geometry Group [CHSX], at the 2001 Clay Research Institution Summer School at MSRI, in Granada, at the 2004 Minimal Surfaces School at Jussieu, Paris, and at Williams College. We thank the *Mathematical Intelligencer* editor and referee for helpful suggestions. This work is partially supported by grants from the National Science Foundation.

Isoperimetric Regions in Manifolds with Density

The isoperimetric problem in a smooth, n-dimensional Riemannian manifold with smooth density seeks a region of prescribed (weighted) volume of least (weighted) perimeter. If the total volume is finite so that no volume can disappear to infinity in the limit, the existence of an isoperimetric region with prescribed volume follows from standard compactness arguments of geometric measure theory [M1]. Furthermore, standard regularity applies [M2, 3.10]: the boundary of an isoperimetric region is a smooth submanifold except for a singular set of dimension at most $n - 8$. Vanishing first variation implies constant generalized curvature (see Prop. 7).

The Estimate of Heintze and Karcher

For a closed hypersurface S in a Riemannian manifold M, the useful theorem of Heintze and Karcher [HK, Thm. 2.1], [BuZ, 34.1.10(1)] bounds the volume of a one-sided neighborhood of S in terms of the mean curvature of S and a lower bound on the Ricci curvature of M. The theorem has the following generalization to manifolds M with density. If the density is constant, formula (3) recovers the classical case as the exponential term reduces to unity. The proof is an easy modification of the classical case, as we will explain.

Theorem 1 *(Generalized Heintze-Karcher I). Let M^n be a smooth, complete Riemannian manifold with smooth density $\Psi = e^\psi$. Suppose that the Ricci curvature and density satisfy*

$$\mathrm{Ric} \geq (n-1)\delta$$

and

$$-\mathrm{Hess}\,\psi \geq \gamma.$$

Let S be a smooth, oriented, finite-area hypersurface in M with classical mean curvature $H(s)$. Let $V(r)$ denote the volume of the region within distance r of S on the side of the unit normal (which determines the sign of H). Then

$$V(r) \leq \int_S \int_0^{r^*(s)} [c_\delta(t) - H(s)s_\delta(t)]^{n-1} \times \exp(t\frac{d\psi}{dn}(s) - \gamma t^2/2)dtds, \tag{3}$$

where ds denotes weighted surface area,

$$s_\delta(t) = \begin{cases} \delta^{-1/2}\sin\delta^{1/2}t & \text{for } \delta > 0, \\ t & \text{for } \delta = 0, \\ |\delta|^{-1/2}\sinh|\delta|^{1/2}t & \text{for } \delta < 0, \end{cases}$$

$c_\delta(t) = ds_\delta(t)/dt$, and r^* is the lesser of r and the first zero of $c_\delta(t) - H(s)s_\delta(t)$.

If equality holds, then S is umbilic, the region has constant curvature δ, and inside the region, along geodesics normal to S, $-d^2\psi/dt^2 = \gamma$.

Remark. Theorem 1 is sharp for hyperspheres and hyperplanes in Gauss space, where $-\mathrm{Hess}\,\psi = \gamma$, as well as for umbilic surfaces in Riemannian manifolds with constant density and constant curvature. The result generalizes to closed surfaces of higher

codimension. Bayle ([Bay1], corrected and extended in [Bay2]), provides earlier alternative versions with an alternative hypothesis on ψ involving $d\psi$ and with the hypotheses on the Ricci curvature and the density combined into a single hypothesis, as in our Theorem 2.

Proof. When Ψ is constant, this is the standard Heintze-Karcher estimate, proved by integrating over infinitesimal normal wedges from S. (Every point in $V(r)$ is covered by the wedge from the nearest point of S and perhaps others as well.) Since $\mathrm{Hess}\,\psi \le -\gamma$, at a point a distance t along a geodesic normal to S at s,

$$\psi(s,t) \le \psi(s,0) + t\frac{d\psi}{dn}(s,0) - \gamma t^2/2,$$

$$\Psi(s,t) \le \exp\left(t\frac{d\psi}{dn}(s,0) - \gamma t^2/2\right)\Psi(s,0),$$

with equality only if $d^2\psi/dt^2 = -\gamma$. The only change in the proof from the classical case is the introduction of this exponential factor.

By sacrificing some sharpness, Theorem 2 combines Ricci curvature and density in hypothesis and conclusion. This time we present a proof from scratch, which is easier than the standard proof of Heintze-Karcher for unit density.

Theorem 2 *(Generalized Heintze-Karcher II). Let M^n be a smooth, complete Riemannian manifold with smooth density $\Psi = e^{\psi}$ satisfying*

$$\mathrm{Ric}_\psi = \mathrm{Ric} - \mathrm{Hess}\,\psi \ge \gamma.$$

Let S be a smooth, oriented, finite-area hypersurface in M with generalized mean curvature

$$H_\psi(s) = H(s) - \frac{1}{n-1}\frac{d\psi}{dn}.$$

Let $V(r)$ denote the volume of the region within distance r of S on the side of the unit normal (which determines the sign of H_ψ). Then

$$(4)\quad V(r) \le \int_S \int_0^r \exp(-(n-1)H_\psi(s)t - \gamma t^2/2)\,dt\,ds,$$

where ds denotes weighted surface area.

If equality holds, then S is umbilic, the region is flat, and inside the region, along geodesics normal to S, $-d^2\psi/dt^2 = \gamma$.

Remark. Theorem 2 is sharp for hyperspheres and hyperplanes in Gauss space and for totally geodesic surfaces in flat Riemannian manifolds of constant density.

Proof. We begin with the case $\Psi = 1$. This case actually follows almost immediately from the standard Heintze-Karcher or from Theorem 1, but we want to incorporate variable Ricci curvature, as in (6) below. Consider the volume element $e^{f(s,t)}dt\,ds$, corresponding to an infinitesimal slice dt of an infinitesimal normal wedge from S. Then $e^{f(s,t)}ds$ represents an element of surface area parallel to S. By the first variation formula for example (cf. (10)), its derivative $f'e^f ds$ equals $-(n-1)He^f ds$, so that

$$f' = -(n-1)H.$$

Since $-(n-1)H' = \Pi^2 + \mathrm{Ric}(n,n)$, where Π is the second fundamental form (see e.g. Remark 8),

$$f'' = -\Pi^2 - \mathrm{Ric}(n,n) \le -\mathrm{Ric}(n,n),$$

with equality only if Π^2 vanishes. Hence by Taylor's theorem,

$$(5)\quad f(s,t) \le -(n-1)H(s)t - \int_0^t \mathrm{Ric}(n,n)dt.$$

Consequently, since every point of $V(r)$ is covered by the infinitesimal wedge from the nearest point of S,

$$(6)\quad V(r) \le \int_S \int_0^r \exp\Big(-(n-1)H(s)t - \int_0^t \tau\,\mathrm{Ric}(n,n)d\tau\Big)dt\,ds_0$$

where we now write ds_0 to emphasize that this is the case of unweighted area.

For general density $\Psi = e^{\psi}$,

$$(7)\quad \psi(s,t) \le \psi(s,0) + t\frac{d\psi}{dn}(s,0) + \int_0^t \tau\frac{d^2\psi}{dn^2}d\tau.$$

Preparing to add f and ψ, note that

$$-(n-1)H(s) + t\frac{d\psi}{dn}(s) = -(n-1)H_\psi(s)$$

and that by hypothesis

$$-\int_0^t \tau\,\mathrm{Ric}(n,n)d\tau + \int_0^t \tau\frac{d^2\psi}{dn^2}d\tau \le -\gamma\int_0^t \tau\,d\tau = -\gamma t^2/2.$$

Hence

$$f(s,t) + \psi(s,t) \le \psi(s,0) - (n-1)H_\psi(s)t - \gamma t^2/2.$$

Therefore

$$V(r) \le \int_S \int_0^r e^f e^\psi\,dt\,ds_0 \le \int_S \int_0^r \exp(-(n-1)H_\psi(s)t - \gamma t^2/2)dt(e^{\psi(s,0)}ds_0),$$

as desired.

Remark 3. Theorem 2 and its proof apply to perimeter minimizers S with singularities. Indeed, for any point off S, the nearest point on S is a regular

point, because the tangent cone lies in a halfspace and hence must be a hyperplane.

The following immediate corollary of Theorem 2 provides a generalization of Myers's theorem [M3, 9.6], which says that a smooth, complete, connected Riemannian manifold with a positive lower bound on the Ricci curvature is compact (and provides an estimate on the diameter).

Corollary 4. *Let M^n be a smooth, complete, connected Riemannian manifold with smooth density $\Psi = e^{\psi}$ satisfying*

$$\mathrm{Ric}_\psi = \mathrm{Ric} - \mathrm{Hess}\,\psi \geq \gamma > 0.$$

Then M has finite volume.

Remark. It does not follow that M is compact, as shown for example by Gauss space. Nor is there any quantitative bound on the volume, since scaling the density scales the volume but leaves Ric_ψ unchanged.

The Isoperimetric Inequality of Levy and Gromov

Theorem 5 gives a generalization of the isoperimetric inequality of Levy and Gromov ([Gr1, 2.2], [BuZ, 34.3.2], or [Ros, Sect. 2.5]) to a manifold M with density, with the sphere replaced by Gauss space as the model of comparison. It includes the sharp isoperimetric inequality for Gauss space of Sudakov-Tsirel'son [ST] and Borell [Bo1]. If M has finite volume, we may assume by scaling the density that M has unit volume. Such scaling does not affect the generalized Ricci curvature (8), because multiplying the density e^{ψ} by a constant just adds a constant to ψ and leaves Hess ψ unchanged. As described in the introduction, such a normalization makes the statement of even the classical Levy-Gromov much more transparent.

Theorem 5 *(Generalized Levy-Gromov). Let M^n be a smooth, complete, connected Riemannian manifold with smooth density $\Psi = e^{\psi}$, unit volume, and generalized Ricci curvature*

$$\mathrm{Ric}_\psi = \mathrm{Ric} - \mathrm{Hess}\,\psi \geq \gamma > 0. \tag{8}$$

Then the isoperimetric profile $P(V)$ (least perimeter to enclose given volume) satisfies

$$P \geq P_{G_\gamma}, \tag{9}$$

where P_{G_γ} is the isoperimetric profile of Gauss space with density

$$\Phi = e^{\varphi} = (\gamma/2\pi)^{n/2} e^{-\gamma x^2/2},$$

so that $\mathrm{Ric}_\varphi = -\mathrm{Hess}\,\varphi = \gamma$.

In Gauss space, perimeter minimizers are hyperplanes. If equality holds in (9) for some $0 < V < 1$, then M is a product of 1D Gauss space with some $(n-1)$D Euclidean space with density.

Remark. P_{G_γ} is independent of dimension, because the volume of a hyperplane bounding given volume is independent of dimension, because Gauss space is a product of 1D Gauss spaces. Hence P_{G_γ} is just the value of the Gaussian density

$$\sqrt{\frac{\gamma}{2\pi}} e^{-\gamma x^2/2}$$

at the endpoint of a half-line with the given mass.

Proof. Note that the generalized curvature H_φ of the hyperplane $S_0 = \{x_1 = a\}$ in Gauss space is given by

$$H_\varphi = H - \frac{1}{n-1}\frac{d\varphi}{dn} = 0 - \frac{1}{n-1}\gamma a,$$

which is constant. For given $0 < V < 1$, let P be the perimeter of a minimizing hypersurface S in M, and let P_0 be the perimeter of the hyperplane S_0 in Gauss space. By replacing V by $1 - V$ (which changes the sign of the mean curvatures) if necessary, we may assume that the generalized mean curvature of S is greater than or equal to that of S_0. By generalized Heintze-Karcher (Theorem 2 with Remark 3),

$$\frac{V}{P} \leq \frac{V}{P_0} = \int_0^\infty \exp(\gamma a t - \gamma t^2/2)\,dt.$$

Taking M to be Gauss space, we conclude that hyperplanes are perimeter minimizing. If equality holds, then equality holds in (4) for $r = \infty$ on both sides of S, S is umbilic with mean curvature $H = 0$, and hence S is a hyperplane. We conclude that in Gauss space, hyperplanes are uniquely perimeter minimizing.

Returning to general M, we conclude that $P \geq P_{G_\gamma}$. Suppose that equality holds for some $0 < V < 1$. Then S has the same generalized mean curvature as S_0, and equality in Theorem 2 holds on both sides of S (with $r = \infty$). Consequently, S is totally geodesic; M is Euclidean space (with some density); and along geodesics normal to S, $-d^2\psi/dt^2 = \gamma$. Since S has constant generalized mean curvature, on S, $d\psi/dn$ is constant. Therefore M is a product of 1D Gauss space with some $(n-1)$D Euclidean space with density.

As a corollary, we recover a nonsharp version of an isoperimetric inequality of Barthe.

Corollary 6 *[Bar, Prop. 11]. For an nD round sphere of radius and density to make the volume and equator area both* 1,

$$P/P_{G_{2\pi}} > c_n = \sqrt{\frac{n-1}{2}}\,\frac{\frac{n-2}{2}!}{\frac{n-1}{2}!},$$

where $x!$ *means* $\Gamma(x+1)$.

As n approaches infinity, c_n approaches Barthe's value of 1, which is sharp at $V = 1/2$.

Proof. Since the unit nD sphere has volume

$$V_n = \frac{(n+1)\pi^{(n+1)/2}}{((n+1)/2)!}$$

and equator area V_{n-1}, our sphere has Ricci curvature

$$\gamma = (n-1)(V_n/V_{n-1})^2.$$

By Theorem 5,

$$P > P_{G_\gamma} = \sqrt{\gamma/2\pi}\, P_{G_{2\pi}}.$$

Finally, note that

$$\sqrt{\gamma/2\pi} = \sqrt{\frac{n-1}{2\pi}}\frac{v_n}{V_{n-1}} = \sqrt{\frac{n-1}{2}}\frac{\frac{n+1}{2}}{\frac{n}{2}}\frac{\frac{n}{2}!}{\frac{n+1}{2}!} = \sqrt{\frac{n-1}{2}}\frac{\frac{n-2}{2}!}{\frac{n-1}{2}!}.$$

First and Second Variation

An alternative approach to isoperimetric inequalities, and the one followed by Bayle [Bay1], [Bay2], uses just second variation. For the record, we present such formulas for manifolds with density $\Psi = e^{\psi}$. The classical formulas are augmented by terms involving the first and second normal derivatives of ψ.

Proposition 7 *[Bay1, Sect. 3.4.6]. Let M^n be a smooth Riemannian manifold with smooth density $\Psi = e^{\psi}$. Let S be a smooth hypersurface, and consider a smooth normal variation of compact support of constant velocity $u(s)$ along the geodesic normal to S at s. Then the first and second variations of (weighted) area satisfy*

$$\delta^1(u) = -\int_S u(n-1)H_\psi, \tag{10}$$

$$\delta^2(u) = \int_S |\nabla u|^2 + u^2(n-1)^2H_\psi^2 - u^2\Pi^2 - u^2\mathrm{Ric}(n,n) + u^2(d^2\psi/dn^2), \tag{11}$$

where Π is the second fundamental form and the generalized mean curvature H_ψ satisfies

$$H_\psi = H - \frac{1}{n-1}\frac{d\psi}{dn}.$$

Remark 8. If $u = 1$, then the second variational formula is equivalent to the first, plus the fact that

$$(n-1)\frac{dH}{dt} = \Pi^2 + \mathrm{Ric}(n,n),$$

which follows from the case of the curvature κ of a curve in a surface of Gauss curvature G:

$$\frac{d\kappa}{dt} = \kappa^2 + G.$$

The following corollary of Proposition 7 on the isoperimetric profile $P(V)$ (least perimeter for given volume) follows from the fact that $P(V+\Delta V)$ is at most the perimeter of a uniform perturbation of the minimizer for volume V, as in [MJ, 2.1] (it turns out that the singularities of S are negligible).

Corollary 9 *[Bay1, (3.40)]. Let M^n be a smooth, complete, finite-volume Riemannian manifold with smooth density $\Psi = e^{\psi}$ with*

$$\mathrm{Ric} - \mathrm{Hess}\,\psi \geq \gamma.$$

Then the isoperimetric profile P and its derivatives P', P'' satisfy

$$PP'' \leq -\frac{P'^2}{n-1} - \gamma \tag{12}$$

almost everywhere (and in a weak sense everywhere). If equality holds, then a perimeter minimizer is flat.

Remark 10. By scaling the density, which does not affect $\mathrm{Hess}\,\psi$ or PP'' or hence the hypothesis or conclusion of Corollary 9, one may assume that M has unit volume. Since equality holds in (12) for Gauss space, isoperimetric estimates such as Levy-Gromov (Theorem 5) follow.

References

[BE] D. Bakry and M. Émery, Diffusions hypercontractives, J. Azéma and M. Yor, eds., *Séminaire de Probabilités XIX 1983/4* (A. Dold and B. Eckmann, eds.), Lecture Notes Math., vol. 1123, Springer-Verlag, 1985, pp. 177–206.

[BL] D. Bakry and M. Ledoux, Lévy-Gromov's isoperimetric inequality for an infinite dimensional diffusion generator, *Invent. Math.* **123** (1996), 259–281.

[Bar] F. Barthe, Extremal properties of central half-spaces, *J. Funct. Anal.* **182** (2001), 81–107.

[Bay1] Vincent Bayle, *Propriétés de concavité du profil isopérimétrique et applicationes*, graduate thesis, Institut Fourier, Univ. Joseph-Fourier, Grenoble I, 2004.

[Bay2] ——, in preparation.

[Bo1] Christer Borell, The Brunn-Minkowski inequality in Gauss space, *Invent. Math.* **30** (1975), 207–216.

[Bo2] ——, Geometric inequalities in option pricing, *Convex Geometric Analysis* (K. M. Ball and V. Milman, eds.), Cambridge Univ. Press, Cambridge, 1999, pp. 29–51.

[BuZ] Yu. D. Burago and V. A. Zalgaller, *Geometric Inequalities*, Springer-Verlag, 1988.

[CHSX] Ivan Corwin, Stephanie Hurder, Vojislav Sesum, and Ya Xu, *Double bubbles in Gauss space and high-dimensional spheres, and differential geometry of manifolds with density*, Geometry Group report, Williams College, 2004.

[G1] M. Gromov, Isoperimetric inequalities in Riemannian manifolds, Appendix I to Vitali D. Milman and Gideon Schechtman, *Asymptotic Theory of Finite Dimensional Normed Spaces*, Lecture Notes Math., vol. 1200, Springer-Verlag, 1986.

[G2] ——, Isoperimetry of waists and concentration of maps, *Geom. Funct. Anal.* **13** (2003), 178–215.

[HK] Ernst Heintze and Hermann Karcher, A general comparison theorem with applications to volume estimates for submanifolds, *Ann. Sci. École Norm. Sup.* **11** (1978), 451–470.

[LT] Michel Ledoux and Michel Talagrand, *Probability in Banach Spaces*, Springer-Verlag, New York, 2002.

[M1] Frank Morgan, *Geometric Measure Theory: A Beginner's Guide*, third edition, Academic Press, 2000.

[M2] ——, Regularity of isoperimetric hypersurfaces in Riemannian manifolds, *Trans. Amer. Math. Soc.* **355** (2003), 5041–5052.

[M3] ——, *Riemannian Geometry: A Beginner's Guide*, A K Peters, Natick, MA, 1998.

[MJ] Frank Morgan and David L. Johnson, Some sharp isoperimetric theorems for Riemannian manifolds, *Indiana Univ. Math J.* **49** (2000), 1017–1041.

[Ros] Antonio Ros, The isoperimetric problem, *Global Theory of Minimal Surfaces* (Proc. Clay Math. Inst. Summer School, 2001), Amer. Math. Soc., Providence, RI, 2005, to appear; `www.ugr.es/~aros/isoper.pdf`.

[S] Daniel W. Stroock, *Probability Theory: An Analytic View*, Cambridge Univ. Press, 1993.

[ST] V. N. Sudakov and B. S. Tsirel'son, Extremal properties of half-spaces for spherically invariant measures, *J. Soviet Math.* (1978), 9–18.

The IAS School of Mathematics at 75

Susan Friedlander and Mark Goresky

This year the Institute for Advanced Study (IAS) in Princeton, New Jersey, celebrates the seventy-fifth anniversary of its founding. The "Peerless Institute," to quote Allyn Jackson's article [1], "has had an enormous influence on the development of mathematics, especially in America." Endowed in 1930 by Louis Bamberger and Carrie Bamberger Fuld, the IAS was created as a sort of ivory tower for basic research, along the lines described by Abraham Flexner in his lectures and writings [2]. It was an idea whose time was ripe: American science and mathematics were not considered to be competitive with the cutting edge developments in Europe. Flexner's drive, the Bambergers' foresightful generosity, Oswald Veblen's scientific leadership, and the appalling level of anti-Semitism in Europe assured the rapid assemblage of a stellar mathematics faculty at the IAS. By 1934 the faculty included James Alexander, Albert Einstein, Marston Morse, Oswald Veblen, John Von Neumann, and Hermann Weyl.

Einstein, Weyl, and Veblen decided from the beginning that the IAS would have a much greater impact with the establishment of a "vigorous" visitor's program. By October 1933 the institute already had over twenty visitors, or "workers", later referred to as "members".

The outstanding success of the IAS over the next seventy-five years in terms of the achievements of its faculty and members was highlighted in lectures and discussions during the weekend of March 11-12, 2005. The event was well attended by an eclectic group, including current and former members, faculty, and friends of the IAS. A series of distinguished mathematicians emphasized the importance of the institute in fostering their careers and in the development of twentieth-century mathematics.

The March 11 lectures were delivered to an overflow audience in Wolfensohn Hall, the large lecture/performance hall on the IAS campus. Peter Sarnak (professor, Courant Institute of Mathematical Sciences and Princeton University) lectured on "Number theory, symmetry and zeta functions". Using the single theme of zeta functions, Sarnak managed to address some of the mathematical accomplishments of Srinivasa Ramanujan, Carl Ludwig Siegel, André Weil, Atle Selberg, Enrico Bombieri, Harish-Chandra, Armand Borel, Pierre Deligne, Goro Shimura, and Robert Langlands, each of whom (except Ramanujan) is/was associated with the IAS for a significant period of time.

Avi Wigderson (Herbert Maass Professor, IAS) spoke on "Kurt Gödel, John von Neumann, and the theory of computation". The talk was devoted to explaining some of the fundamental ideas developed by these two early IAS faculty members. Wigderson described how their contributions have greatly influenced (and continue to stimulate) the theory of computation. The powerpoint presentation for this lecture is available at: `http://www.math.ias.edu/75/files/avi_wigderson.ppt`.

George Dyson (research associate, Western Washington University) gave an entertaining lecture on "Veblen's Circle: Early years of mathematics at the Institute for Advanced Study". By presenting old

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Pictured, left to right are speakers Peter Sarnak, Avi Wigderson, George Dyson, Michael Atiyah, and Raoul Bott.

photographs and letters from the IAS archives, Dyson explored Veblen's enormous influence on the founding and early development of the IAS.

On Saturday afternoon the crowd of participants once again squeezed into Wolfensohn Hall to hear lectures by Sir Michael Atiyah ("Solitons and symmetry"), Friedrich Hirzebruch ("My joint work with Armand Borel, 1952–1954), Raoul Bott ("What Morse missed by not talking to Weyl"), Weinan E ("A mathematical theory of solids—from atomic to macroscopic scales"), and Peter Ozsvath ("Heegard diagrams and holomorphic disks"), each of which was addressed to a wide audience. Videos of these lectures are expected to appear eventually on the IAS website.

On Friday evening a banquet for over one hundred (paying) participants was served in the IAS dining hall. It was prepared by the institute's talented chef, Michel Reymond, and his dedicated staff. The dessert featured an unusual chocolate cookie sporting the IAS-75 School of Mathematics logo, apparently the product of a PostScript-to-chocolate printer. A (non-chocolate) version of the logo illustrates this page. The figure is the paving of the unit disk in the complex plane by alternately colored fundamental domains of the principal congruence subgroup $\Gamma(2)$ of level two. This is one of the basic examples in the subject of modular forms which, together with closely related phenomena in representation theory and number theory, has been of central interest at the IAS since its founding.

During the morning of March 12, James Simons (Renaissance Technologies Corporation) chaired a panel discussion with Sir Michael Atiyah (University of Edinburgh), Raoul Bott (Harvard University), Fritz Hirzebruch (Max-Planck-Institut in Bonn), Weinan E (Princeton University), and Peter Ozsvath (Columbia and Berkeley). Bott recalled that his invitation to the IAS carried the expectation that he would use this time to write a book on electrical network theory. Soon after arriving (1949), Bott discovered that the book project was incompatible with his desire to pursue the many mathematical opportunities that Princeton offered. Marston Morse quickly assured him that he was absolutely free to do as he pleased. The result, Bott said, was that "my graduate education occurred here—and Jean-Pierre Serre was my tutor." Peter Goddard, director of the IAS, commented that the financial independence of the institute allows it to provide this kind of academic freedom.

Fritz Hirzebruch referred to the four academic years he spent at the IAS as the most important period of his mathematical development, as well as the venue for his marriage. On hearing that Hirzebruch would be living in Bonn, Serre was surprised and commented, "Who is in Bonn except Adenauer?" Hirzebruch took this to heart and began a thirty-year project to create a mathematical research institute in Bonn following the IAS model of an independently funded institution designed primarily to support the advanced research of postdoctoral scholars without teaching obligations. Although it differs from the School of Mathematics at the IAS in some respects, the Max-Planck-Institut für Mathematik in Bonn has been enormously successful in promoting the development of mathematics throughout Germany. In fact, the IAS has been the "mother" for many institutes worldwide, although, as Langlands observed, even the "mother" may have had a mother of her own, as Weyl's early leadership at the IAS was much influenced by Hilbert's institute at Göttingen.

Sir Michael Atiyah first came to the IAS fifty years ago and eventually spent a total of seven years at the IAS. During these periods he encountered I. M. Singer, J-P. Serre, K. Kodaira, R. Bott, and F. Hirzebruch. He wrote papers and became good friends with each of these mathematicians. He observed that collaborations established at the IAS continue through generations and diffuse around the world.

Weinan E and Peter Ozsvath, as representatives of a younger generation of mathematicians, discussed the crucial impact of the IAS on their careers. For Ozsvath it was "the institute for advanced lunch" (another testament to the excellence of

Left to right, speakers Friedrich Hirzebruch, Peter Ozsvath, Weinan E, and IAS director Peter Goddard.

IAS food!). During his two years as a member at the IAS, he began his very fruitful collaboration with Zoltan Szabo, Thomas Mwroka, and Peter Kronheimer. This illustrates that the words of I. M. Singer written in 1976 remain true to this day: "The members' stay at the IAS under the guidance of the faculty affects their mathematical careers enormously. Their contacts with their peers continue for decades. They leave the Institute, disperse to their universities, and carry with them a deeper understanding of mathematics, higher standards for research, and a sophistication hard to attain elsewhere."

References

[1] A. JACKSON, The IAS School of Mathematics, *Notices* **49** (2002), 896–904.

[2] A. FLEXNER, *Universities, American, English, German*, Oxford University Press, New York, 1930.

[3] A. BOREL, The School of Mathematics at the Institute for Advanced Study, *A Century of Mathematics in America*, vol. 3, Amer. Math. Soc., Providence, RI, 1989, pp. 119–148.

Fuld Hall, IAS campus.

Abstract for Avi Wigderson's lecture:

Kurt Gödel, John von Neumann, and the Theory of Computation

The purpose of the talk was to survey some important ideas and results of these two prominent faculty members of the School of Mathematics and explain their relation to exciting research areas (past and current) in the theory of computation.

Some of the topics discussed were the following.

- The fundamental notion of *proof*, and its fundamental relation to the notion of *computation*. Gödel's Incompleteness Theorem and its relation to limits on computation and Turing's undecidability.
- The notion of *efficient computation*. Gödel's letter to von Neumann in 1954 foreseeing the major problem of the relation between finding a proof and verifying one, namely the P vs. NP problem.
- Computation taking place in biological, physical, and other natural processes. von Neumann's model of *cellular automata*, motivated by the study of self-reproduction. Conway's "Game of Life" being a universal Turing machine.
- von Neumann's study of *fault tolerant* computers and networks. Relation to persistence of information in cellular automata and to the current study of *expander graphs*. The use of deep results in number theory (of Selberg, Deligne, and others) in the efficient construction of such expanders.
- The use of *randomness* in computation, starting with the Monte Carlo algorithms of Ulam, Metropolis, von Neumann, and others. von Neumann's questions about the source of or randomness in these procedures, leading to the current research in *pseudo-random generators* and of *randomness extractors* for weak random sources.
- von Neumann's minimax theorem and his book with Morgenstern, starting off game theory. Applications of the minimax theorem in the theory of computation and current research in algorithmic game theory, joining economists and computer scientists.

Abstract of George Dyson's talk:

Veblen's Circle: Early Years of Mathematics at the Institute for Advanced Study

"What could be wiser than to give people who can think the leisure in which to do it?" economist Walter W. Stewart advised the Institute for Advanced Study's founding director, Abraham Flexner, in 1939, the year that Fuld Hall was built. The beginnings of the IAS are usually credited to Flexner's association with Louis Bamberger and his sister, Caroline Fuld, who incorporated the new institution on May 20, 1930, with an initial US$5 million endowment and a commitment to start out with a school of math.

This talk, based on unpublished material in the IAS archives, followed the development of IAS from the perspective of Oswald Veblen (1880–1960), who first arrived in Princeton in 1905 and "conceived the whole project" in the words of P. A M. Dirac. "The way to make another step forward," Veblen had written to the Rockefeller Foundation's Simon Flexner on February 23 of 1924, "is to found and endow a Mathematical Institute." Simon Flexner replied to Veblen, "I wish that sometime you might speak with my brother, Mr. Abraham Flexner, of the General Education Board." For the next thirty-six years Veblen was directly involved with the establishment and day-to-day operation of the IAS.

Dyson covered the parallels between Veblen's career and the development of the IAS, mentioning in particular Veblen's custodianship of mathematics at Princeton University, Veblen's work during WWI and WWII at the Aberdeen Proving Ground, his leadership of the Emergency Committee for Displaced German Scholars, his support of both pure and applied mathematics (and the importance of this to the genesis of von Neumann's Electronic Computer Project at IAS), and his love of the outdoors, which led to the acquisition and preservation of what is now the Institute Woods.

The talk concluded with a note of appreciation on behalf of all the families who have enjoyed free run of the institute for seventy-five years. Mathematicians tend to produce their best ideas about the same time that they produce their children. In this, as in so much else, the Institute for Advanced Study (especially through its Housing Project and the Crossroads Nursery School) broke new ground in the cultivation of ideas.

Abstract of Peter Sarnak's talk:

Number Theory, Symmetry and Zeta Functions

An attractive feature of number theory is that the fundamental problems can often be described in elementary terms even though their resolution might require sophisticated mathematical tools. We use two such probing questions of Ramanujan as a theme for a rapid tour of some of the research in number theory carried out at the Institute for Advanced Study. Specifically, we touch on works of the regular faculty members Bombieri, Borel, Deligne, Harish-Chandra, Langlands, Selberg, Siegel, and Weil concerning counting solutions to diophantine equations, zeta functions, and automorphic forms. Their contributions individually and collectively are to a large extent responsible for the advanced state of the subject today.

Mathematics by Experiment and *Experimentation in Mathematics*

Reviewed by Jeffrey Shallit

Mathematics by Experiment
Jonathan Borwein and David Bailey
A K Peters, 2003
288 pages, $45.00
ISBN 1-56881-211-6

Experimentation in Mathematics
Jonathan Borwein, David Bailey, and Roland Girgensohn
A K Peters, 2004
357 pages, $49.00
ISBN 1-56881-136-5

Is mathematics an experimental science? And is the computer the microscope (or the telescope) of mathematics? As a young mathematician I was certainly convinced this was so. Influenced by Kenneth Iverson (1920–2004), the inventor of the computer language APL, I saw the computer as an experimental tool that would reveal new mathematical worlds. As Iverson and others wrote in 1970, with the use of a computer, "mathematics becomes a laboratory science, open to experiment, conjecture, and discovery" [1].

Inspired by a 1972 paper of Lang and Trotter [3], as a teenager I wrote programs to compute the continued fraction expansion of various algebraic numbers. After verifying their results, I was naturally led to compute the expansions of other real numbers. One of the numbers I tried was

$$\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^4}+\frac{1}{2^8}+\cdots,$$

and I was astonished to find that all the partial quotients (i.e., the terms of the continued fraction) were either 1, 2, 4, or 6. I then tried other numbers of the same form and found similar behavior. Of course, this demanded an explanation. I eventually found one, and this led to my first serious published paper [5].

In this I was following in famous footsteps. Gauss, for example, was led to conjecture the prime number theorem by studying the distribution of primes in published tables. It is clear that experimentation with examples is an important part of the mathematician's toolbox. And the computer allows experimentation far beyond the range of hand calculation.

Yet there was—and still is—resistance to the computer as a tool. Tymoczko, for example, suggested that the computer-aided solution of the four-color conjecture in graph theory introduced a new and fundamentally different form of unreliability in mathematical proof [6], [7]. At a recent conference, when I presented a result on avoidability in combinatorics on words that depended on a large calculation by computer, a colleague expressed his dissatisfaction that he could not verify my theorem entirely by hand. Yet why should every simple theorem have a simple proof?

Even today, with nearly universal access to computers, many students are unfamiliar (or uncomfortable) with the experimental approach. When I ask my students whether the decimal expansion of $\sqrt{3}$ contains three consecutive identical digits, many are completely stumped how to even begin to attack the problem. The idea that they should use a computer to find the first hundred or thousand digits does not occur to them.

So, despite the wide availability of computers, the experimental approach needs advocates, and Jonathan Borwein and David Bailey are happy to step in. In the two books under review (*Mathematics by Experiment* and *Experimentation in*

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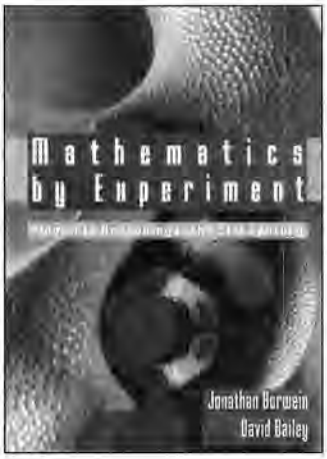


Mathematics) they develop the value of this approach in grand style (in the second book they are joined by Roland Girgensohn).

In *Mathematics by Experiment* they define experimental mathematics to be "the methodology of doing mathematics that includes the use of computations for:

1. Gaining insight and intuition.
2. Discovering new patterns and relationships.
3. Using graphical displays to suggest underlying mathematical principles.
4. Testing and especially falsifying conjectures.
5. Exploring a possible result to see if it is worth formal proof.
6. Suggesting approaches for formal proof.
7. Replacing lengthy hand derivations with computer-based derivations.
8. Confirming analytically derived results."

The two books are quite similar in scope, but *Mathematics by Experiment* is more introductory in nature. *Experimentation in Mathematics* covers some of the same material but is longer (357 pages versus 288 pages) and takes a deeper, less conversational approach. Both books emphasize areas where experimental mathematics has been most successful: number theory, algebra, and combinatorics.

Mathematics by Experiment covers a wide variety of topics: evaluation of definite integrals, evaluation of infinite series, the $3x+1$ problem, simplification of radicals, dilogarithms, hypergeometric functions, the calculation of π, normality of real numbers, the fundamental theorem of algebra, the gamma function, Stirling's formula, the arithmetic-geometric mean, arbitrary precision arithmetic, and integer relation algorithms. Along the way we get song lyrics by Tom Lehrer; pictures of sculptures by Helaman Ferguson; and entertaining quotations from Hardy, Feynman, Milnor, Darwin, Thurston, and Keynes. Although undisciplined at times, it is a book that can be enjoyed by undergraduates and professional mathematicians alike.

For deeper applications the reader will want to continue with *Experimentation in Mathematics*. Here the reader will find chapters entitled "Sequences, Series, Products and Integrals", "Fourier Series and Integrals", "Zeta Functions and Multizeta Functions", "Partitions and Powers", "Primes and Polynomials", "The Power of Constructive Proofs II", and "Numerical Techniques II". There is also more emphasis on theorems and proofs.

To illustrate the game, let's look at two basic tools of experimental mathematics: *sequence recognition* and *real number* recognition.

Sequence recognition comes in handy when we are given a sequence $(a(n))_{n\geq 1}$ defined by a summation formula and we want to find a simpler expression for it, perhaps in "closed form". The traditional mathematical approach would be to examine the definition for $a(n)$ and manipulate it in some way, perhaps using familiar tools such as binomial coefficient identities, changing the order of summation, etc. An experimental mathematician, however, will simply compute the first ten or so values of $a(n)$ and then look up the result in Neil Sloane's "On-Line Encyclopedia of Integer Sequences", available at `http://www.research.att.com/~njas/sequences/`. With luck such a search will produce a known closed form and half a dozen citations to the literature where the sequence's properties are discussed. All that is left to do (!) is prove that our expression is, indeed, identical to the known representation. Here a symbolic algebra system, such as Maple, often proves useful. Depending on the problem domain, special-purpose tools, such as the Wilf-Zeilberger algorithm, can actually prove our result for us.

This process is illustrated in section 2.2 of *Mathematics by Experiment*. Borwein and Bailey discuss the observation that if Gregory's series for π,

$$4\sum_{k\geq 1}\frac{(-1)^{k+1}}{2k-1},$$

is truncated after 5,000,000 terms, then the decimal expansion of the result agrees with π at many places, with exceptions occurring with a period of 14. When one examines the coefficients corresponding to the errors at these positions, one finds the coefficients are $2,-2,10,-122,2770,\ldots$. Dividing by 2 and searching Sloane's table produces the guess that these are the Euler numbers, and indeed one can then find an asymptotic expansion for

$$\frac{\pi}{2}-2\sum_{1\leq k\leq N/2}\frac{(-1)^{k+1}}{2k-1}$$

involving the Euler numbers.

Constant recognition is similar. How, for example, could we evaluate

$$\sum_{k\geq 1}\left(\frac{k^k}{k!e^k}-\frac{1}{\sqrt{2\pi k}}\right)?$$

An experimental mathematician might simply compute the sum to twenty digits and then use a "number recognizer" (such as that at `http://www.cecm.sfu.ca/projects/ISC`) to find that the sum appears to be

$$-\frac{2}{3}-\frac{1}{\sqrt{2\pi}}\zeta\left(\frac{1}{2}\right).$$

Once the form of the result is suspected, a proof follows (aided by the symbolic algebra system Maple).

Although I found both books very entertaining, they each show some signs of being put together too hastily. Sometimes terms are used before they are defined. For example, on page 24 of *Mathematics by Experiment* Borwein and Bailey present a collection of ten interesting challenges in experimental mathematics. While most will be comprehensible to bright undergraduates in mathematics, the very first says, "Compute the value of r for which the chaotic iteration $x_{n+1} = rx_n(1 - x_n)$, starting with some $x_0 \in (0, 1)$, exhibits a bifurcation between 4-way periodicity and 8-way periodicity." There is no explanation of the meaning of this technical jargon, and the reader has to wait until page 51 to find one.

In the same book, pages 56 and 248 both contain very similar accounts of the discovery that

$$\sum_{k=1}^{\infty}\left(1+\frac{1}{2}+\cdots+\frac{1}{k}\right)^2 k^{-2}=\frac{17\pi^4}{360}.$$

And Section 1.8.1 of *Experimentation in Mathematics* reprises Section 2.2 of *Mathematics by Experiment* without adding anything really new (and mistakenly calls it Section 1.3). More careful editing would have removed these redundancies.

Also, the scholarship is not as good as it could be. The authors do not adequately address the influence of experimental pioneers such as Derrick Lehmer [4] or Horst Zimmer [8]. In fact, none of the papers in the bibliography below are cited in either of the two books.

As I said at the beginning of this review, as a young man I believed strongly in the gospel of experimental mathematics. And it is certainly true that this approach has led to dozens of interesting new directions in combinatorics, number theory, and algebra. Do I still believe? Yes. Experimental mathematics is, and will continue to be, very fruitful. But let me offer three caveats.

First, mindless computation can be counterproductive. I often see queries on electronic mailing lists devoted to mathematics of the form "I wrote a program to verify the following property for the first billion integers. Is it always true?" immediately answered by someone else who gives a one-line proof of the property. Time used thinking—away from the computer—is often time well spent. As H. H. Williams remarked, "Furious activity is no substitute for understanding."

Second, naive computation can lead to incorrect conjectures. For example, computers typically (but not always) represent real numbers using floating-point numbers, and careless computation with these approximations can have surprisingly bad results—a fact well known to numerical analysts for years [2]. To their credit, Borwein, Bailey, and Girgensohn recognize this and even give some entertaining examples in a section of *Experimentation in Mathematics* entitled "High Precision Fraud". Does

$$\sum_{n\geq 1} 10^{-n}\lfloor n\tanh(\pi)\rfloor$$

really equal $1/81$? No, but you won't find the answer by computing the first two hundred digits.

Third, experimental mathematics has its limits. Experimental mathematics probably would not have led to a proof of Gödel's theorem or the Poincaré conjecture. And how, for example, can it be fruitfully used in Kolmogorov complexity, where the objects under discussion are often uncomputable in a formal sense?

Still, experimental mathematics is here to stay. The reader who wants to get an introduction to this exciting approach to doing mathematics can do no better than these interesting books.

References

[1] P. C. Berry, A. D. Falkoff, and K. E. Iverson, *Using the Computer to Compute: A Direct But Neglected Approach to Teaching Mathematics*, IBM New York Scientific Center Technical Report No. 320-2988 (May 1970).

[2] George Forsythe, Pitfalls in computation, or why a math book isn't enough, *Amer. Math. Monthly* **77** (1970), 931–956.

[3] S. Lang and H. F. Trotter, Continued fractions of some algebraic numbers, *J. Reine Angew. Math.* **255** (1972), 112–134.

[4] D. H. Lehmer, Computer technology applied to the theory of numbers, *Studies in Number Theory* (W. J. LeVeque, ed.), Prentice-Hall, New York, 1969, pp. 117–151.

[5] J. O. Shallit, Simple continued fractions for some irrational numbers, *J. Number Theory* **11** (1979), 209–217.

[6] Thomas Tymoczko, Computers, proofs and mathematics: A philosophical investigation of the four-color problem, *Math. Mag.* **53** (1980), 131–138.

[7] ———, The four-color problem and its philosophical significance, *J. Philos.* **76** (1979), 57–83.

[8] H. Zimmer, *Computational Problems, Methods, and Results in Algebraic Number Theory*, Springer-Verlag, 1972.

Book Review

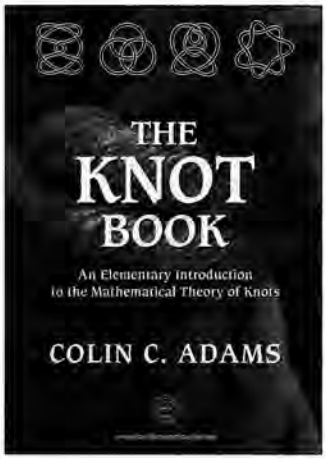
Knots for Everyone: *The Knot Book*

Reviewed by Alexey Sossinsky

The Knot Book: An Elementary Introduction to the Mathematical Theory of Knots
Colin C. Adams
Reprinted with corrections, 2004, American Mathematical Society
307 pages, Paperback US$29.00
ISBN 0-8218-3678-1

Knot theory has been very fortunate with books—from the first one, Kurt Reidemeister's basic and elegant *Knottentheorie* (1928); to the small *Introduction to Knot Theory* by R. Crowell and R. Fox (1963), with its beautiful exposition of the Alexander polynomial based on the free differential calculus; to Dale Rolfsen's superb *Knots and Links* (1976),[1] where many of us learned knot theory; to the fundamental *Knots* by W. Burde and H. Zieschang (1984), with a wealth of material summarizing the pre-Vaughan-Jones period in the theory; to L. Kauffman's *Knots and Physics* (1992), brimming with unexpected ideas and interconnections—to name only the first five titles that come to mind.[2] Nevertheless, the book under review stands out even in this elite company and deserves the definite article in its title: this is indeed THE knot book.

The Knot Book is addressed to the nonspecialist, requires practically no knowledge of any serious college math, and can be read with ease and pleasure by any undergraduate interested in mathematics. In fact, it can give rise to such an interest, showing as it does the beauty and depth of what may be called "living mathematics", and can convince the beginner that math is not just a set of dogmatic rules that one is forced to learn because they are useful, that "doing mathematics" can be just as creative and exciting as writing music or designing bridges.



At the same time, the professional research mathematician (and even experts in the field) will find the book equally rewarding: it is densely packed with facts and ideas, clearly explains the motivation of ongoing research, cleverly avoids the technically difficult places or succeeds in giving clear and simple explanations in situations that had previously seemed very intricate to some,[3] and lists a large number of open problems.

Originally, the book was published in 1994, and the American Mathematical Society's edition is an exact page-by-page replica of the original text and illustrations. The only difference is that a page of corrections to the first edition has been added.

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[1] *Originally published by Publish or Perish, it is now available in a new AMS edition.*

[2] *Of course, there are more books on knot theory worthy of mention: in particular, the recent ones by V. Jones, A. Kawauchi, K. Murasugi, W. Lickorish, and C. Livingston, but those listed above were the first to come to my mind.*

[3] *For example, this reviewer, who has known and used the Arf invariant during his whole mathematical life, finally understood what it really means upon reading the short text devoted to it in the book.*

The early 1990s was an excellent period for writing and publishing a book on knot theory. Indeed, the main content of knot theory before 1985 had just been systematically described in the Burde-Zieschang book when the field suddenly exploded after Vaughan Jones's discovery of his famous polynomial and the subsequent research of those who followed him: Edward Witten, Vladimir Drinfeld, Maxim Kontsevich, to mention only the Fields Medallists. Perhaps even more important (if unrewarded) was the seminal work of Victor Vassiliev. All of the above-mentioned research required some very sophisticated mathematics. Colin Adams would hardly have succeeded in giving an elementary treatment of knot polynomials if Conway had not drastically simplified the theory of the Alexander polynomial and if Louis Kauffman had not unexpectedly come up with his simple and extremely original approach to the Jones polynomial.

One may wonder why the book was reprinted without any changes ten years later. Couldn't the exposition of the book's material be improved in the light of the past decade? Shouldn't new material be added? After the flurry of brilliant research in the late 1980s and early 1990s, had the flow of results in the field suddenly gone dry? My answer to the first question is a resolute NO. Of course there is no such thing as ultimate perfection in any textbook, but this one is so solidly composed and so well written that I see no need for any rewriting. And although knot theory has continued to develop with great intensity, nothing has happened in the last decade that would warrant changing the exposition of the subject matter chosen by the author.

Concerning the new material developed in the past decade, much of it is far from elementary and therefore not suited to the style of Adams's book. However, I seriously regret that some of the new results have not been added. Several have very simple and important formulations and would fit nicely in the book. For example, the result of Joel Hass and Jeff Lagarias asserting that there is an upper bound on the number of Reidemeister moves required for unknotting would fit well in the first introductory chapter (without proof, of course). Other results having a strong geometric flavor and not involving any intricate mathematics, e.g., Ivan Dynnikov's work on three-page books and unknotting algorithms or Louis Kauffman's results on virtual knots, are conceptually quite elementary and would be appropriate as additional material to the book. Of course these are not the most important knot theory results of the past decade, just some new developments that would be in the spirit of Colin Adams's book—i.e., can be explained to the undergraduate math major—nor are they the only ones of that type, just some that came to mind.

Now let us look at the structure of the book, summarize its contents, and, as we go along, point out some of its characteristic stylistic aspects.

The first chapter is an introduction that goes very far to the heart of the subject. It includes Reidemeister moves, knot composition, and the first nontrivial practically computable example of a knot invariant (tricolorability). All of this is explained with remarkable simplicity and visual clarity (there is at least one figure on each page of the introduction). An important feature of this chapter is the large number of exercises (thirty-seven in all, most of them quite simple, usually meant to be solved by manipulations with strings, electric cords, or on paper with pencil and eraser). There are no less than six unsolved questions (problems) in the thirty pages of the introduction, and, surprisingly, they sound just as simple as the exercises, immediately demonstrating to the beginner that knot theory is very much alive and full of challenges and reminding the expert about many simple questions to which we still have no answers.

The second chapter is about how it all started (with the knot tables of Tait and Little) and what has been achieved since in the tabulation of knots (mostly by Morwen Thistlethwaite's computer). The exposition includes Hugh Dowker's and John Conway's computer-friendly notation for knots (the latter involving tangles). Here again there are several unsolved questions and numerous exercises (thirty of them). The chapter begins with a hilarious quotation from a nineteenth-century paper by the Reverend Thomas Kirkman (politely described by Colin Adams as due to the latter's "opaque writing style"); contains a very transparent description of the beautiful relationship between the construction of rational tangles and continued fractions (nothing opaque about Adams's writing style!); and ends with the encoding of alternating knots by graphs (via checkerboard coloring), a neat geometric construction now used in statistical physics.

The third chapter, called "Invariants of Knots", does not deal with knot polynomials (as the expert would expect), but with three extremely simple but hopelessly uncomputable (from the practical[4] point of view) invariants: namely, the crossing number, the bridge number, and the unknotting number. (Actually, there is a practically implementable algorithm for computing the crossing number, based on polynomial invariants and explained in one of the book's concluding chapters.)

Chapter 4 is about surfaces and their relationship with knots. Before going on to the expected

[4] *Theoretically, these invariants* **are** *computable, since the knot classification problem is algorithmically decidable according to Serguei Matveev; see his book* Algorithmic Topology of 3-Manifolds, *Springer-Verlag, 2004.*

topic of Seifert surfaces, the chapter begins with a very visual account of topological surfaces, giving the beginner a clear understanding of the intrinsic topology of a surface (the difference between homeomorphism and isotopy is explained) and a number of ideas underlying the proof of the classification theorem of compact 2-manifolds (triangulation, connected sum, orientability, the Euler characteristic). However, no proof of the classification theorem appears; in fact, the theorem is not even stated. This is in keeping with the style of the book: the definition-theorem-proof kind of exposition, standard in most math textbooks, first appears in this chapter (the fourth!) and is used very sparingly further; there are no long or complicated proofs at all. (It should be noted that in proofs and other arguments, many intuitively clear facts are not proved but used, e.g., the Jordan curve theorem and general position in this chapter.) After a glance at surfaces with boundary, the chapter concludes with the construction of the Seifert surface of a knot and the notion of genus.

In the next, fifth, chapter, Colin Adams undertakes a seemingly impossible task: to explain, in an elementary way to people lacking the necessary prerequisites, what a hyperbolic knot and a hyperbolic manifold are, and what curvature and volume are. This reviewer, who has always regarded Thurston's work with pious admiration, would never have thought this could be done. But Adams performs this *tour de force* with remarkable clarity and in simple, everyday words. In passing, he mentions Jeff Weeks's amazing SNAPPEA software (which computes the volumes of complements to hyperbolic knots) and lists a number of simply formulated but extremely difficult unsolved problems. The exposition then unexpectedly shifts to braids (as a way of constructing knots and links), goes on to essentially explain Artin's theorem (without stating or proving or even naming it), and concludes with the Markov theorem (stated and explained, but not proved). The chapter ends with a discussion of almost alternating knots, about which several unsolved questions appear.

The sixth chapter is central to the book and gives a clear exposition of the Jones polynomial (via the Kauffman bracket), as well as of the Alexander and HOMFLY polynomials (via the appropriate skein relations). It also describes the Jones polynomial for alternating knots, which leads up to the Kauffman-Murasugi-Thistlethwaite theorem justifying Tait's hundred-year-old conjectures about alternating knot projections. This theorem is actually rigorously proved in the text.

I will not describe the contents of the fascinating seventh chapter, devoted to applications to biology and connections with various branches of physics. Read it, if nothing else in the book.

Chapter 8 is mostly about graphs and explains the beautiful Conway-Gordon theorem about the appearance of linked circles or nontrivial knots (Hamiltonian cycles) in the embedding of certain nonplanar graphs (with almost complete proofs). Then there is a discussion of the famous dichromatic polynomial and its relationship with the link polynomials described in Chapter 6 and—this is one of the most striking connections of knot theory and physics—with the Potts model (two-dimensional water-ice).

The last two chapters, entitled "Topology" and "Higher Dimensional Knotting", are not about classical knots (in 3D), but still contain a lot of beautiful and relevant information.

There is an appendix with knot and link tables (up to nine and seven crossings respectively) supplied with the values of their standard invariants.

The bibliography is organized by chapters, and the references are supplied with Colin Adams's brief comments, intended to clarify their contents to the reader. This is very convenient for the beginner and rather annoying for the expert (it takes a while to find any given reference unless you correctly guess what chapter it pertains to).

Any self-respecting reviewer is expected to demonstrate his competence and meticulousness by pointing out errors, misprints, and other defects of the book under review. This turned out to be practically impossible in this case: I was unable to find any of the aforementioned drawbacks in Colin Adams's book. The best I can do is to reiterate my regrets about the fact that none of the achievements of the last decade appear in the present edition and to note that many names important for knot theory are never mentioned in it. Thus, it seemed strange to me that, in the chapter on braids, neither Emil Artin nor Joan Birman is cited, and there is no mention at all in the book of four of the mathematical superstars who have contributed the most to knot theory: Vladimir Drinfeld, Maxim Kontsevich, Victor Vassiliev, and Edward Witten.

This is a beautiful, fascinating, and very readable book, written in a clear, down-to-earth, and nononsense style. It is, in my opinion, one of the best books of all time for introducing mathematics and for giving an in-depth idea of present-day research mathematics to the beginner. I am sure it will convince many young people that mathematics is alive and worth doing. For the professional mathematician, it contains a very accessible account of a huge amount of material about knot theory and can be used as a reference book even by the experts.

By all means, get this book and start reading it. But beware: you'll find it hard to stop once you do.

Wiles Receives 2005 Shaw Prize

On June 3, 2005, the Shaw Prize Foundation announced that ANDREW J. WILES of Princeton University will receive the Shaw Prize in the Mathematical Sciences for 2005 for his proof of Fermat's Last Theorem. The prize bears a monetary award of US$1 million. This is the second year that the Shaw Prize has been awarded.

Citation

The equation $x^2 + y^2 = z^2$ has infinitely many solutions for which x, y, and z are positive integers. The smallest such solution is $3^2 + 4^2 = 5^2$, which has been known since antiquity. In 1630 Fermat (1601–1665) conjectured that the more general equation $x^n + y^n = z^n$, for $n =$ an integer > 2, has no integer solutions. This was later called Fermat's Last Theorem. It remained the most famous unproven conjecture in mathematics for more than three centuries until 1994, when Wiles completed his long and difficult proof, which uses powerful mathematical ideas and insights developed in the nineteenth and twentieth centuries.

Biographical Note

Andrew Wiles (born 1953) is a professor at Princeton University. He earned his B.A. from Oxford University (1974) and Ph.D. from Cambridge University, United Kingdom (1979). Following in the footsteps of his father, Wiles went on to become an assistant professor at Harvard University. In 1982 he became a professor of mathematics at Princeton. In 1994 Wiles was appointed Eugene Higgins Professor of Mathematics at Princeton.

Among the prizes and awards Wiles has received are the King Faisal Prize (1998), the Wolfskehl Prize (1997), a MacArthur Fellowship (1997), the Wolf Prize (1996), the Royal Medal of the Royal Society, London (1996), the Ostrowski Prize (1996), the NAS Award in Mathematics of the U.S. National Academy of Sciences (1996), the Schock Prize of the Royal Swedish Academy of Sciences (1995), and the Prix Fermat (1995). Wiles was elected a fellow of the Royal Society, London (1989), and a foreign member of the U.S. National Academy of Sciences (1996). At the International Congress of Mathematicians in Berlin in 1998, Wiles received a one-time special tribute from the International Mathematical Union, the IMU Silver Plaque.

Andrew J. Wiles

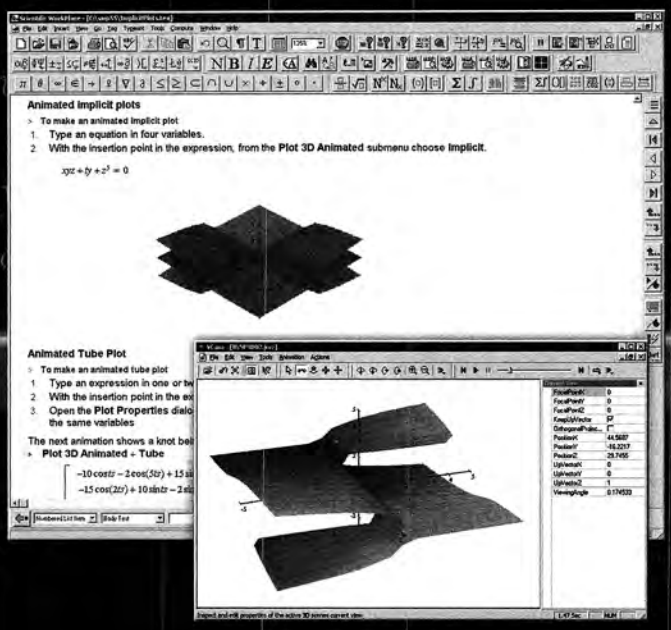
About the Shaw Prize

Established under the auspices of Run Run Shaw, the Shaw Prize honors individuals, regardless of race, nationality, and religious belief, who have achieved significant breakthroughs in academic and scientific research or application and whose work has resulted in a positive and profound impact on mankind. Shaw Prizes are presented annually in astronomy, life sciences and medicine, and mathematical sciences.

The Shaw Prize is an international award managed and administered by the Shaw Prize Foundation, based in Hong Kong. Run Run Shaw has also founded the Sir Run Run Shaw Charitable Trust and the Shaw Foundation Hong Kong, both dedicated to the promotion of education, scientific and technological research, medical and welfare services, and culture and the arts.

The first awardee of the Shaw Prize in Mathematical Sciences was the late S.-S. Chern, who received the prize in 2004.

—Allyn Jackson



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2004 Annual Survey of the Mathematical Sciences

(Third Report)

Faculty Profile
Enrollment and Degrees Awarded Profile
Graduate Student Profile

Ellen E. Kirkman, James W. Maxwell, and Colleen A. Rose

This Third Report of the 2004 Annual 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. Prior to 2000, these data were included as part of the Second Report.

The 2004 Annual Survey represents the forty-eighth in an annual series begun in 1957 by the American Mathematical Society. The 2004 Survey is under the direction of the 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 Amy Cohen-Corwin, Donald M. Davis, Nicholas M. Ercolani, J. Douglas Faires, Naresh Jain, Donald R. King, Ellen E. Kirkman (chair), David J. Lutzer, James W. Maxwell (ex officio), Polly Phipps, David E. Rohrlich, and Henry Schenck. The committee is assisted by AMS survey analyst Colleen A. Rose. Comments or suggestions regarding this Survey Report may be directed to the committee.

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 883 of this report. Departments in the former Group Vb are no longer surveyed. We present information about the faculties and instructional programs at the undergraduate and graduate levels in these departments for the 2004–2005 academic year. For 1999–2000 and earlier years, these data were presented as part of the Second Report.

Information about departments was gathered on a questionnaire called the Departmental Profile. This questionnaire was mailed to all departments in Groups I, II, III, IV, and Va and to stratified random samples from Groups M and B. The percentage of the departments responding in each of the doctoral groups was greater than 94 percent. Prior to 2001, if doctoral departments did not respond, simple projections were made to the whole population using the data from those departments who did respond. Beginning in 2002, if a department did not return the Departmental Profile questionnaire but had returned one within the last three years, the data from the most recent questionnaire was used.

The Departmental Profile questionnaire is mailed to a stratified random sample of departments drawn from each of Groups M and B, and standard statistical projections are made using the data from the respondents. The stratification for Groups M and B is based on the enrollment of the school and whether it is a public or a private school. For the third year, standard errors are reported for several of the more important projections made in Groups M and B. The box on page 872 discusses these standard errors in more detail.

The careful reader will note that a row or column total may differ slightly from the sum of the individual entries. All the table entries are the rounded values of the individual projections associated with each entry, and the differences are the result of this rounding (as the sum of rounded numbers is not always the same as the rounded sum).

Ellen E. Kirkman is professor of mathematics, Wake Forest University. James W. Maxwell is AMS associate executive director for Meetings and Professional Services. Colleen A. Rose is AMS survey analyst.

Highlights

The number of nondoctoral full-time faculty is estimated at 3,673, up from 3,602 last year. The estimated number of part-time faculty is 8,089, up from 7,338 last year. The number of full-time doctoral non-tenure-track faculty (including postdoctoral appointments) is estimated at 2,064, up from 2,032 last year. The size of the standard error makes it possible that the changes observed are due to sampling error.

The estimated total number of full-time doctoral positions under recruitment during 2003-04 in Groups I, II, III, Va, M, and B combined is up to 1,721 from 1,504 last year (an increase of 14%). Of these 1,721 full-time positions, 1,128 were tenured/tenure-track, up from 1,007 last year (an increase of 12%). Of the 1,721 full-time tenured/tenure-track doctoral positions, 919 were open to new doctorates, up from 869 last year (an increase of 6%).

The estimated total number of full-time doctoral positions filled with a doctoral hire in mathematics departments is up to 1,344 from 1,116 last year (an increase of 20%). The total number of tenured/tenure-track doctoral hires is down 3% in Groups I, II, III, and Va combined (to 214 from 220 last year), and up 20% in Groups M and B combined (to 606 from 503 last year).

The estimated total number of new doctoral hires in mathematics departments is up 54% (590 from 384) this year from last year: it is up 33% (to 232 from 174) in Groups I, II, III, and Va combined; and up 70% (to 358 from 210) in Groups M and B combined. The number of new doctoral tenured/tenure-track hires is up 65% (318 from 193): it is up 12% (to 37 from 33) in Groups I, II, III, and Va combined; and up 76% (to 281 from 160) in Groups M and B combined.

The estimated total number of not-new doctoral hires into tenured/tenure-track positions is down 5% in the mathematics groups combined. In Groups I, II, III, and Va combined 66% of those hired into tenured/tenure-track positions had held a non-tenure-track position the previous year (52% held a postdoctoral position); in Groups M & B combined these precentages were 43% and 21%, respectively.

Group IV (statistics) showed even more improvement than mathematics in terms of increased numbers of positions posted and increased hires. There was a 34% increase in the total number of doctoral positions under recruitment, and there were 119 new full-time doctoral hires, a 31% increase over last year.

The estimated number of full-time graduate students in mathematics departments in fall 2004 increased to 12,853 from 11,997 last year. In Groups I, II, III, and Va combined the numbers of full-time graduates students, of full-time graduate students that are U.S. citizens, of full-time graduate students that are first-year, of full-time graduate students that are first-year and U.S. citizens, and of full-time graduate students that are female are each at the highest in the past ten years.

Remarks on Statistical Procedures

This report is based on information gathered from departments of mathematical sciences in the U.S., separated into groups by highest degree granted as defined on page 883. Groups for doctoral-granting departments are I (Public), I (Private), II, III, IV, and Va. Groups M and B consist of those departments offering master's and bachelor's degrees respectively.

While the questionnaire on which this report is based is sent to every doctoral department, it is sent to a stratified random sample in Group M and B departments.

The response rate is typically between 90 and 100 percent for the doctoral groups. Prior to last year, simple projections were made using the questionnaires that were returned to get estimated totals for the entire population. After a couple of years of experimentation, a new procedure was begun for the 2001 survey. If a doctoral department did not return its questionnaire this year but had returned one within the past three years, those numbers were used as its response for the current year. This procedure will give us even more accurate estimates than we have gotten in the past.

The stratified random sampling procedures used for Groups M and B were put in place four years ago. Beginning with the 2001 Annual Survey, standard errors were calculated for some of the key estimates. Standard errors are calculated using the variability in the data and can be used to crudely measure how close our estimate is to the true value for the population. As an example, the number of full-time faculty in Group M is estimated at 4,224, with a standard error of 134. This means the actual number of full-time faculty in Group M is most likely between 4,224 plus or minus two standard errors, or between 3,956 and 4,492. This is much more informative than simply giving the estimate of 4,224.

Estimates are also given for parameters that are totals from all groups, such as the total number of full-time faculty. The values given for the doctoral groups are assumed to be the true parameters for these groups, because they are not sampled and hence are not subject to sampling variability. The only variability in a total of several groups comes from the sampling for Groups M and B. Using the standard errors for M and B, it is possible to calculate a standard error for the total. For example, an estimate of the total number of full-time faculty in all groups but group IV is 20,224, with a standard error of 308.

Standard errors, when calculated for an estimate, appear in the tables in parentheses underneath the estimate.

Table 1A: Total Faculty, Fall 2004

	GROUP									
	I Public	I Private	II	III	Va	I, II, III, & Va	M	B	I, II, III, Va, M, & B	IV
Total full-time faculty *(Standard error)*	**1753**	**951**	**2516**	**2093**	**307**	**7620**	**4224** *(134)*	**8380** *(278)*	**20224** *(308)*	**1597**
Doctoral full-time faculty	1690	945	2229	1762	292	**6918**	3390	6243	**16551**	1537
Tenured	1142	554	1589	1260	170	**4715**	2287	4045	**11046**	841
Untenured, tenure-track	165	73	275	343	33	**889**	826	1726	**3441**	332
Postdoctoral appointments	250	186	198	30	66	**730**	10	24	**764**	126
Other non-tenure-track *(Standard error)*	133	132	167	129	23	**584**	267 *(63)*	448 *(66)*	**1300** *(92)*	238
Nondoctoral full-time faculty	63	6	287	331	15	**702**	835	2137	**3673**	60
Total part-time faculty *(Standard error)*	**233**	**58**	**409**	**611**	**44**	**1355**	**1888** *(222)*	**4846** *(336)*	**8089** *(403)*	**246**

Faculty Profile

The Departmental Profile, sent in fall 2004 to mathematical sciences departments at four-year colleges and universities as part of the Annual Survey, gathered information about faculties at these schools in fall 2004; this section presents some of that data. The 2004 First Report presented data collected earlier about faculty salaries (pages 236–51 of the February 2005 issue of the *Notices of the AMS*).

Faculty

Table 1A gives the number of faculty for different categories of faculty broken down by group. Table 1B gives the same information for females only. Table 1C gives some percentages based on the information in Tables 1A and 1B. The estimated total number of full-time faculty in the mathematics groups (Groups I, II, III, Va, M, and B combined) is 20,224, down 197 from last year, with a standard error of 308. We can be quite confident that the actual total number of faculty in these groups is in the interval 20,224 plus or minus 616. The doctoral mathematics departments I, II, III, and Va are up 42 full-time faculty members, Group M is up 123 faculty members, and Group B is down 362. Since the standard errors for the total number of full-time faculty in Groups M and B are 134 and 278 respectively, there may not be an actual change, as these increases are well within the variability we expect with standard errors of 134 and 278. The total faculty size in the statistics group (Group IV) is up to 1,597 this year from 1,482 last year (an 8% increase).

The number of non-tenure-track doctoral full-time faculty and the number of part-time faculty in mathematics departments had been increasing in recent years, a disturbing trend highlighted in "Staffing shifts in mathematical sciences departments, 1990–2000" (David J. Lutzer and James W. Maxwell, *Notices*, June/July 2003, pages 683–6). This year the estimated number of part-time faculty in Groups I,II, III, Va, B, and M combined is up to 8,089 (with a standard error of 403) from 7,338 last year, and the number of non-tenure-track doctoral faculty (including postdoctoral positions) is estimated at 2,064 this year, up slightly from 2,032 last year. This year the increase in part-time faculty seems largely due to changes in Group B. This year in Group B the estimated number of full-time faculty is down by 389 (the standard error is 278), and the number of part-time faculty is up by 849 (the standard error is 336) to 4,846, considerably larger than any value in the last seven years; while in Groups I, II, III, and Va combined the number of non-tenure-track doctoral faculty and number of part-time faculty decreased slightly over last year. In Group IV the number of part-time faculty decreased from 263 last year to 240 this year, and the number of non-tenure-track doctoral faculty increased from 327 last year to 364 this year due to the increased number of postdoctoral positions. Table 1D gives a seven-year history of tenure/tenure-track, non-tenure-track, and part-time faculty for Groups I, II, III, and Va combined, for Group M, and for Group B. Also shown for each number in this table is the percentage of females. Comparing the values over the last seven years, we see that in Groups I, II, III, and Va combined the number of tenured/untenured, tenure-track appointments is down 1%, the number of non-tenure-track doctoral appointments is up 45%, and the number of part-time faculty is up 19%. Over the last seven years in Group M the estimated number of tenured/untenured, tenure-track appointments is down 22%, the estimated number of non-tenure-track doctoral appointments is up 98%, and the estimated number of part-time faculty is up 7%; and in Group B, the estimated number of tenured/untenured, tenure-track appointments is up 1%, the estimated number

Table 1B: Female Faculty, Fall 2004

	GROUP									
	I Public	I Private	II	III	Va	I, II, III, & Va	M	B	I, II, III, Va, M, & B	IV
Female full-time faculty *(Standard error)*	**255**	**113**	**475**	**477**	**51**	**1371**	**1345** *(58)*	**2586** *(143)*	**5302** *(154)*	**415**
Doctoral full-time faculty	213	111	300	291	41	**956**	853	1568	**3378**	383
Tenured	95	32	130	156	18	**431**	438	912	**1780**	132
Untenured, tenure-track	26	7	67	86	5	**191**	283	518	**992**	114
Postdoctoral appointments	53	41	37	7	13	**151**	6	3	**159**	34
Other non-tenure-track	39	31	66	42	5	**183**	126	136	**446**	103
Nondoctoral full-time faculty	42	2	175	186	10	**415**	492	1018	**1925**	32
Female part-time faculty	82	6	149	252	16	**505**	700	2131	**3335**	91

Table 1C: Full-Time Faculty, Fall 2004

	GROUP								
	I Public	I Private	II	III	Va	M	B	IV	TOTAL
Full-time faculty									
Number	1753	951	2516	2093	307	4224	8380	1597	**21821**
Percentage of total full-time faculty	8%	4%	12%	10%	1%	19%	38%	7%	**100%**
Female full-time faculty									
Number	255	113	475	477	51	1345	2586	415	**5717**
Percentage of female full-time faculty	4%	2%	8%	8%	1%	24%	45%	7%	**100%**
Female full-time faculty									
Percentage female full-time faculty by group	15%	12%	19%	23%	17%	32%	31%	26%	**26%**

Table 1D: Faculty Counts and Percentage Female, Fall 1998-2004

	1998	1999	2000	2001	2002	2003	2004
Groups I, II, III, & Va							
Doctoral full-time faculty							
Tenured/Untenured, tenure-track	5662	5765	5568	5598	5616	5559	5604
Percentage female	9%	9%	9%	10%	10%	10%	11%
Non-tenure-track	904	1014	993	1233	1274	1343	1314
Percentage female	21%	22%	21%	21%	23%	25%	25%
Part-time faculty	1141	1217	1399	1467	1504	1389	1355
Percentage female	38%	38%	37%	38%	35%	35%	37%
Group M							
Doctoral full-time faculty							
Tenured/Untenured, tenure-track	3991	3599	3670	3191	3188	3005	3113
Percentage female	19%	20%	21%	23%	22%	22%	23%
Non-tenure-track	140	146	262	183	276	230	277
Percentage female	27%	56%	29%	24%	39%	33%	48%
Part-time faculty	1768	1768	1906	2323	2393	1952	1888
Percentage female	43%	43%	35%	36%	37%	37%	37%
Group B							
Doctoral full-time faculty							
Tenured/Untenured, tenure-track	5726	4580	5486	5665	5569	6172	5770
Percentage female	23%	25%	22%	24%	23%	26%	25%
Non-tenure-track	427	514	407	504	507	460	472
Percentage female	31%	24%	30%	29%	36%	20%	29%
Part-time faculty	3585	3298	3580	4197	4117	3997	4846
Percentage female	42%	41%	40%	43%	45%	42%	44%

of non-tenure-track doctoral appointments is up 11%, and the number of part-time faculty is up 35%. Another group that has been increasing the past few years is the nondoctoral full-time faculty; this year this group is estimated at 3,674 in Groups I, II, III, Va, M, and B combined, up from 3,602 last year.

Table 1E gives a summary of the various types of faculty found in departments of mathematical sciences by sex and group.

Tables 1F and 1G give more information about two types of faculty: full-time faculty without a doctorate and part-time faculty. The top half of Table 1F is a somewhat condensed version of the doctoral full-time faculty in Table 1A broken down by sex. The bottom half of Table 1F shows this same information for the 3,674 full-time faculty who do not have doctoral degrees. The majority of these faculty, 2,971 (81%), are found in Groups M and B departments. Table 1G shows the part-time faculty broken down by sex and whether they have a doctoral degree.

Table 1E: Summary of Full-Time and Part-Time Faculty, Fall 2004

	GROUP					
	I, II, III, & Va		M & B		IV	
	Male	Female	Male	Female	Male	Female
Full-time faculty	**6249**	**1371**	**8673**	**3931**	**1182**	**415**
Percentage	82%	18%	69%	31%	74%	26%
Doctoral full-time faculty	5959	956	7211	2421	1154	383
Percentage	86%	14%	75%	25%	75%	25%
Tenured	4284	431	4982	1349	709	132
Percentage	91%	9%	79%	21%	84%	16%
Untenured, tenure-track	698	191	1751	801	217	114
Percentage	78%	22%	69%	31%	66%	34%
Postdoctoral appointments	579	151	26	9	92	34
Percentage	79%	21%	75%	25%	73%	27%
Other non-tenure-track	401	183	453	263	135	103
Percentage	69%	31%	63%	37%	57%	43%
Nondoctoral full-time faculty	287	415	1461	1510	28	32
Percentage	41%	59%	49%	51%	47%	53%
Part-time faculty	**850**	**505**	**3904**	**2830**	**154**	**91**
Percentage	63%	37%	58%	42%	63%	37%

Table 1F: Doctoral and Nondoctoral Full-Time Faculty, Fall 2004

	GROUP					
	I, II, III, & Va		M & B		TOTAL	
	Male	Female	Male	Female	Male	Female
Doctoral full-time faculty	**5959**	**956**	**7211**	**2421**	**13170**	**3378**
Tenured	4284	431	4982	1349	9266	1780
Untenured, tenure-track	698	191	1751	801	2449	992
Postdoctoral appointments	579	151	26	9	605	159
Other non-tenure-track	401	183	453	263	854	446
Nondoctoral full-time faculty	**287**	**415**	**1461**	**1510**	**1749**	**1925**
Tenured	15	7	613	319	628	326
Untenured, tenure-track	3	4	149	216	152	220
Postdoctoral appointments	2	1	0	0	2	1
Other non-tenure-track	269	404	699	976	968	1379

Table 1G: Part-Time Faculty, Fall 2004

	GROUP				
	I, II, III, & Va		M & B		
	Male	Female	Male	Female	TOTAL
Doctoral part-time faculty	393	118	886	277	1673
Nondoctoral part-time faculty	457	387	3018	2553	6416
TOTAL	**850**	**505**	**3904**	**2830**	**8089**

Faculty Profile for Females

Table 1B gives a complete breakdown of all categories of female faculty by group and shows increasing estimated numbers of female faculty in most categories. The estimated total number of full-time faculty in Groups I, II, III, Va, M, and B combined for 2004–2005 is 20,224, of which 5,302 (26%) are females, up from 5,195 (25%) last year. In the B group the estimated number of doctoral female faculty decreased to 1,568 from 1,698 last year, of tenured female faculty decreased from 921 last year to 912 this year, of untenured tenure-track female faculty decreased from 685 last year to 518 this year (a 24% decrease), and of non-tenure-track doctoral female faculty increased from 92 last year to 136 this year. In the M group estimated doctoral full-time female faculty increased from 752 last year to 853 this year; in Groups I, II, III, and Va combined doctoral full-time female faculty increased from 919 to 956; and in Group IV doctoral full-time female faculty increased from 372 to 383.

Table 1C shows the number and percentage of all full-time and female full-time faculty that fall into each group for 2004–2005. The number of faculty in each group and the percentage who are female are given in the bottom section of Table 1C. The number of females as a percentage of full-time faculty varies considerably among the groups, from 12% for Group I Private to 32% for Group M; this year the percentage of females in each mathematical group was greater than or equal to the per-

Table 2A: Recruitment of Doctoral Faculty, Fall 2004

	GROUP									
	I Public	I Private	II	III	Va	I, II, III, & Va	M	B	I, II, III, Va, M, & B	IV
Posted Doctoral Positions										
Total number[1]	**162**	**130**	**188**	**136**	**23**	**639**	**345**	**736**	**1721**	**180**
(Standard error)							*(52)*	*(74)*	*(91)*	
Tenured/tenure-track	62	35	96	100	17	**309**	270	549	**1128**	130
Open to new doctoral recipients	120	95	148	110	18	**491**	284	647	**1423**	123
Tenured/tenure-track	22	7	67	83	13	**192**	229	497	**919**	95
Open at assoc/full level	22	21	25	31	11	**110**	69	125	**305**	62
Reported Hires for Above										
Total number	**136**	**120**	**165**	**111**	**20**	**551**	**279**	**668**	**1499**	**123**
Male doctoral hires	103	89	131	78	17	**417**	182	341	**939**	68
Tenured/tenure-track	29	18	52	49	11	**159**	134	260	**553**	40
Female doctoral hires	33	31	26	23	3	**117**	79	208	**404**	51
Tenured/tenure-track	12	9	12	20	2	**55**	65	147	**267**	33
Male temporary hires	0	0	8	9	0	**16**	7	54	**78**	4
Female temporary hires	0	0	0	1	0	**1**	11	65	**77**	0
Total new doctoral hires	75	51	64	34	9	**232**	114	243	**590**	**65**
Male new doctoral hires	54	35	48	22	8	**166**	71	150	**388**	38
Tenured/tenure-track	0	0	7	13	2	**22**	65	98	**185**	23
Female new doctoral hires	21	16	15	12	1	**66**	43	93	**202**	27
Tenured/tenure-track	1	0	4	10	0	**16**	35	83	**134**	23
Unfilled positions	**26**	**10**	**23**	**25**	**3**	**88**	**66**	**68**	**222**	**57**

[1] Number of full-time doctoral positions under recruitment in 2003-2004 to be filled for 2004-2005.

Table 2B: A Summary of Recruitment of Doctoral Faculty, Fall 2004

	GROUP		
	I, II, III, & Va	M & B	IV
Posted Doctoral Positions			
Total number	**639**	**1081**	**180**
Tenured/tenure-track	309	819	130
Open to new doctoral recipients	491	932	123
Tenured/tenure-track	192	726	95
Reported Hires for Above			
Total new doctoral hires[1]	**232**	**358**	**65**
Tenured/tenure-track	37	281	45
Male	166	222	38
Tenured/tenure-track	22	163	23
Female	66	136	27
Tenured/tenure-track	16	118	23
Total other doctoral hires	**302**	**452**	**54**
Tenured/tenure-track	177	325	27
Male	251	301	30
Tenured/tenure-track	137	230	17
Female	51	152	24
Tenured/tenure-track	39	94	10

[1] New doctoral hires are individuals who have held a doctorate for less than one year at the time of hiring.

centage of females last year. Note: In Table 1C 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 1D contains information about the percentage of female tenure/untenured, tenure-track, non-tenure-track doctoral full-time faculty, and part-time faculty for the years 1998 to 2004 for Groups I, II, III, and Va combined, M, and B. This table includes the total number for each category as well as the percentage of females for each number. While this year females comprise 26% of the full-time faculty, they are a larger percentage of the part-time faculty in all three categories and a larger percentage of the non-tenure-track faculty in Groups M and B.

Table 1E gives the male/female breakdown by count and percentage for Groups I, II, III, and Va combined, Groups M and B combined, and Group IV for various categories of faculty. It shows that the percentage of women is generally higher in statistics (Group IV) than in the doctoral mathematics groups (Groups I, II, III, and Va combined) and that the percentage of tenured faculty who are women is highest in Groups M and B combined.

Table 1F shows that of the 3,674 nondoctoral full-time faculty in Groups I, II, III, Va, M, and B combined, 1,925 (52%) are females. In Table 1G we see that in these same groups there are 8,089 part-time faculty, of which 3,335 (41%) are females.

Faculty Recruitment

Table 2A contains detailed information on the number of full-time doctoral faculty positions in mathematical sciences departments under recruitment in 2003–2004 for employment beginning in the academic year 2004–2005. Among mathematics departments (Groups I, II, III, Va, M, and B), 1,721 positions were under recruitment in 2003–2004 for em-

Table 2C: Positions Posted and Filled, Fall 2004

Positions	GROUP		
	I, II, III, & Va	M & B	IV
Posted positions opened to new doctoral recipients	491	932	123
% tenured/tenure-track	39%	78%	77%
Positions filled by new doctoral recipients	232	358	65
% tenured/tenure-track	16%	79%	70%
Positions filled by not-new doctoral recipients [1]	302	452	54
% tenured/tenure-track	59%	72%	50%

[1] Not-new doctoral recipients are individuals who have held their doctorate for more than one year.

ployment beginning in the academic year 2004–2005, up 14% compared to last year. Of those 1,721 positions, 1,423 (83%) were available to new doctoral recipients, and of those 1,423 positions, 919 (65%) were tenured/tenure-track positions. The 919 tenured/tenure-track positions open to new doctoral recipients is up 6% from the 869 such positions under recruitment in 2002–2003. The total number of tenured/tenure-track full-time doctoral positions under recruitment in Groups I, II, III, Va, M, and B combined is 1,128, up from last year's 1,007 (an increase of 12%). In Groups I, II, III, and Va combined, the total number of posted doctoral positions open at the associate/full level increased from 108 last year to 110 this year.

Table 2B condenses the information in Table 2A. It also reorganizes the doctoral hires into one section for new doctoral hires and another for other doctoral hires (so excludes posted doctoral positions that were temporarily filled with a person without a doctorate). Table 2C is derived from Table 2B, with the percentage of the filled positions that were tenured/tenure-track included in the table.

From Table 2B we find that the total number of full-time doctoral positions filled in mathematics departments (Groups I, II, III, Va, M, and B combined) is up to 1,344 from 1,116 last year (an increase of 20%); it is up 25% in Groups I, II, III, and Va combined and 18% in Groups B and M combined. This year Groups I, II, III, and Va combined filled 534 doctoral positions, of which 214 (40%) were tenured/tenure-track positions. Last year these same groups filled 427 doctoral positions, of which 220 (52%) were tenured/tenure-track. Groups M and B combined filled 810 doctoral positions this year, and 606 (75%) of these were tenured/tenure-track positions. Last year these two groups filled 689 doctoral positions, of which 503 (73%) were tenured/tenure-track.

Beginning with the 2004 Annual Survey, departments were asked to report the number of doctoral hires in tenured/tenure-track positions filled by individuals who held a non-tenure-track position the previous year and of those, how many where postdoctoral appointments. For Groups I, II, III, and Va

Figure 1: Number of Full-Time Doctoral Positions under Recruitment
Groups I, II, III, Va, M, & B Combined, Fall 1992 to Fall 2004

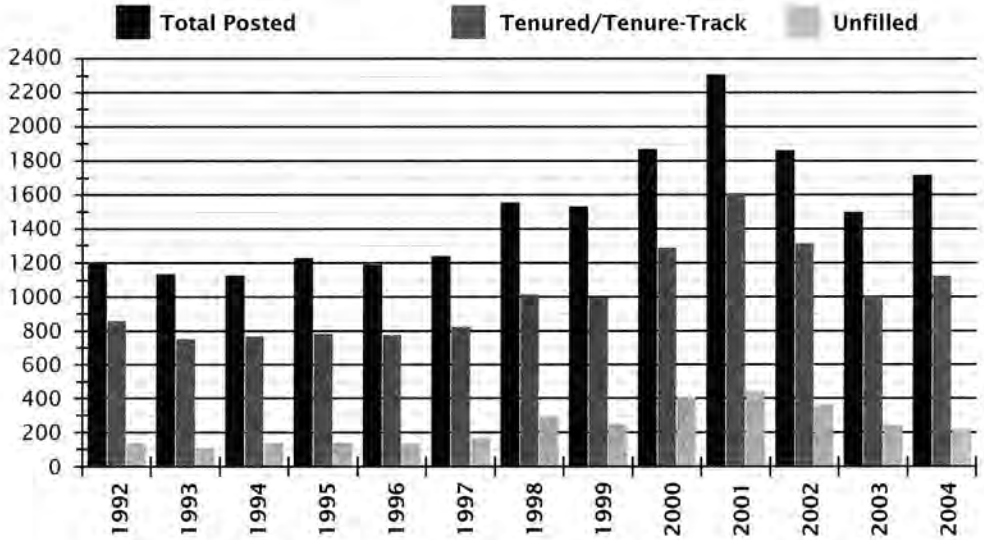
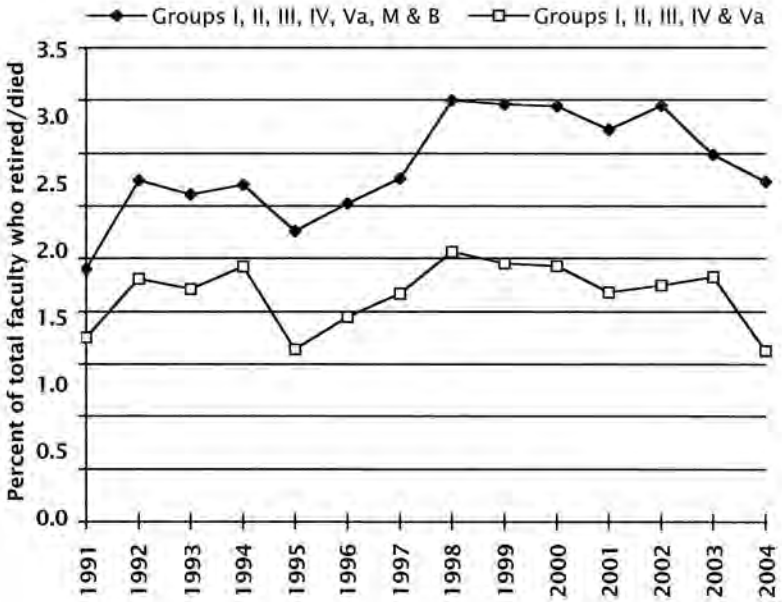


Table 3: Faculty Attrition,[1] Fall 2004

	GROUP									
	I Public	I Private	II	III	Va	I, II, III, & Va	M	B	I, II, III, Va, M, & B	IV
Full-time faculty who retired or died										
Total number	46	15	34	34	3	**132**	102	303	**538**	18
(Standard error)							*(16)*	*(44)*	*(47)*	
Percentage	2.6	1.6	1.4	1.6	1.1	**1.7**	2.5	3.6	**2.7**	1.2

[1] Number and percentage of full-time faculty who were in the department in fall 2003 but were reported to have retired or died by fall 2004.

Figure 2: Faculty Attrition



combined, 142 (66% of the 214 tenure-track hires) individuals reported having held a non-tenure-track position the previous year, with 112 (52%) individuals having held a postdoctoral appointment the previous year; last year 93 (42%) were filled by individuals who held a postdoctoral appointment the previous year. For Groups M and B combined, 258 (43% of the 606 tenure-track hires) individuals reported having held a non-tenure-track position the previous year, with 127 (21%) individuals having held a postdoctoral appointment the previous year; last year 188 (37%) were filled by individuals who held a postdoctoral appointment the previous year.

This year the estimated total number of new doctoral hires in mathematics departments is up 54% (590 from 384) from last year; it is up 33% (to 232 from 174) in Groups I, II, III, and Va combined, and up 70% (to 358 from 210) in Groups M and B combined. The number of new doctoral tenured/tenure-track hires is up 65% (318 from 193); it is up 12% (to 37 from 33) in Groups I, II, III, and Va combined, and up 76% (to 281 from 160) in Groups M and B combined. From Table 2C we see that in Groups I, II, III, and Va 16% of the hires of new doctoral recipients are in tenured/tenure-track positions (last year it was 19%), while in Groups M and B 79% of the new doctoral hires are in tenured/tenure-track positions (last year it was 76%).

The estimated number of not-new doctoral hires in mathematics departments is 754, up from 732 last year. The estimated total of not-new doctoral hires into tenured/tenure-track positions is down 5% in all the mathematics groups combined; it is down in Groups I, II, III, and Va combined (177 from 187 last year), and down in Groups M and B combined (325 from 344). This year the percentage of not-new doctoral recipients among those hired is about the same in both the doctoral and nondoctoral mathematics groups; in Groups I, II, III, and Va combined 57% of the positions hired went to not-new doctoral recipients (last year 59%), while in Groups M and B combined 56% of the positions hired went to not-new doctoral recipients (last year 69%).

From Table 2B we find that of the new doctoral recipients hired in Groups I, II, III, and Va combined, 13% of the males and 24% of the females took tenured/tenure-track positions. For new doctoral recipients hired in Groups M and B combined, 73% of the males and 87% of the females took tenured/tenure-track positions.

Figure 1 shows the number of full-time doctoral positions available in all groups except Group IV, as well as the number of those that were tenured/tenure-track and the number unfilled for the years 1992 to 2004. There was a sharp decrease in available positions in the first few years of the 1990s, but the number of positions and the number of tenured/tenure-track positions steadily increased, reaching a maximum in 2001; this number declined the next two years and is slightly up this year.

This year the recruitment situation in statistics (Group IV) shows even more improvement than that in mathematics. The number of positions under recruitment is up 34% (to 180 from 134), the number of tenure-track positions under recruitment is up 44% (to 130 from 90), and the number of tenure-track positions open to new doctoral recipients under recruitment is up 61% (to 95 from 59). Except for the number of not-new doctoral hires into tenure-track positions, the number of hires in Group IV is generally improved over last year. The number of hires of new doctoral recipients is 65 (45 tenure-track) this

Table 4A: Total Undergraduate Course Enrollments (thousands)

Fall	GROUP								
	I Public	I Private	II	III	Va	M	B	IV	Total
1999	182	45	271	251	13	568	810	92	**2232**
2000	175	47	279	241	13	526	729	77	**2087**
2001	176	42	279	246	12	513	743	81	**2092**
2002	187	41	275	250	16	507	774	76	**2125**
2003	185	41	283	255	17	498	774	72	**2125**
2004 *(Standard error)*	159	42	277	261	16	492 *(15)*	782 *(31)*	72	**2101** *(34)*

Table 4B: Total Graduate Course Enrollments (thousands)

Fall	GROUP							
	I Public	I Private	II	III	Va	M	IV	Total
1999	4	6	4	6	7	2	21	50
2000	7	4	9	9	2	14	24	69
2001	7	5	9	9	2	14	26	72
2002	10	4	11	10	3	12	29	79
2003	10	5	11	11	2	16	31	87
2004	9	4	12	10	2	12	31	81

Table 4C: Undergraduate and Graduate Enrollments per Full-Time Faculty Member, Fall 2004

	GROUP							
	I Public	I Private	II	III	Va	M	B	IV
Undergraduate Course Enrollments Number per full-time faculty member	90	44	113	126	49	120	89	49
Graduate Course Enrollments Number per full-time faculty member	5	5	5	4	6	3	—	14

Table 4D: Undergraduate Enrollments per Full-Time Faculty Member

Fall	GROUP							
	I Public	I Private	II	III	Va	M	B	IV
1999	115	54	111	122	43	127	114	68
2000	107	52	117	119	39	110	95	56
2001	101	47	114	120	41	118	94	57
2002	107	43	114	121	50	117	95	55
2003	104	42	113	121	46	121	89	46
2004	90	44	113	126	49	120	89	49

year and 43 (30 tenure-track) last year, up 51% (50%) respectively. The number of not-new doctoral hires is 54 (27 tenure-track) this year and 48 (34 tenure-track) last year. Females were 51% of the new doctoral tenure-track hires and 37% of the not-new doctoral tenure-track hires; last year these percentages were 34% and 26% respectively.

Faculty Attrition

Table 3 displays losses of full-time mathematical sciences faculty due to retirements and deaths over the

Table 5A: Undergraduate Degrees Awarded (hundreds), Fall 2004

	GROUP								
	I Public	I Private	II	III	Va	M	B	I, II, III, Va, M, & B	IV
Total Undergraduate Degrees Awarded	21	10	20	16	3	42	133	244	3
(Standard error)						*(3)*	*(10)*	*(10)*	
Computer science only	1	0	0	2	0	10	34	47	0
Female Undergraduate Degrees Awarded	7	3	8	7	1	19	57	102	2
Computer science only	0	0	0	0	0	2	10	13	0

Table 5B: Undergraduate Degrees Awarded (hundreds)

Groups I, II, III, Va, M & B Combined

Fall	2002	2003	2004
Total Undergraduate Degrees Awarded	217	220	244
Female Undergraduate Degrees Awarded	91	90	102
Percentage female	42%	41%	42%

past year for each departmental grouping. The fall 2004 mathematics faculty attrition rate for Groups I, II, III, Va, M, and B combined is 2.7%, and in statistics (Group IV) it is 1.2%. For fall 2004, Group Va had the lowest attrition rate at 1.1%, while Group B the highest at 3.6%.

Figure 2 shows the trends in these attrition rates between 1991 and 2004. While the rates vary from group to group and from year to year within each group, the dominant trend over this time period has been one of increasing attrition. There is preliminary evidence of a change in the trend toward reduced attrition in the coming years. The trend in attrition rates for Groups I, II, II, IV, and Va (combined) roughly parallels the overall trend, though they are consistently lower.

Enrollment Profile and Degrees Awarded Profile

Enrollment

The Departmental Profile Survey obtained information about enrollments and numbers of undergraduate degrees awarded in mathematical sciences departments. Tables 4A and 4B give the total undergraduate and total graduate enrollments in mathematics courses in fall 2004 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, as discussed on page 872. In fall 2004, for the sixth year the projections for Groups M and B were made from those schools responding in the stratified random sample for each of these groups. This makes it possible to calculate standard errors for the estimated enrollments for these groups and for the estimated total enrollment for all groups. These standard errors, available for the fourth year, are also found in Table 4A. The estimated total undergraduate enrollment in fall 2004 for all groups combined is 2,101,000, with a standard error of

Table 5C: Master's Degrees Awarded (hundreds), Fall 2004

	GROUP							
	I Public	I Private	II	III	Va	M	I, II, III, Va, M, & B	IV
Total Master's Degrees Awarded	4	4	6	6	1	13	34	11
(Standard error)						*(1)*	*(1)*	
Computer science only	0	0	0	1	0	2	3	0
Female Master's Degrees Awarded	1	1	3	3	0	6	15	5
Computer science only	0	0	0	0	0	1	1	0

34,000, indicating that the actual total enrollment is likely within 2,101,000 plus or minus 68,000. Table 4A gives these totals for fall 1999 to fall 2004. Total undergradaute enrollments for all groups combined is down 1% from last year; the total is down 14% in Group I Public.

Table 4B gives total graduate enrollments for 1999 to fall 2004. Total graduate course enrollments for all groups combined is down 6% from last year; the total is down 25% for Group M and up only slightly in Group II.

Looking at the historical data on enrollment numbers presented in Tables 4A and 4B for fall 1999 to fall 2004, one sees no major trends; though one sees variablility from year to year, this has been a relatively stable period for enrollments.

Table 4C gives the undergraduate enrollments per faculty member and the graduate enrollments per faculty member for each group. Table 4D gives the undergraduate enrollments per faculty member in each group for fall 1999 to fall 2004. Table 4D on undergraduate enrollments per faculty member shows a slightly downward trend over the period shown.

Beginning with the 2002 survey, the Departmental Profile form no longer requests a breakdown of the total undergraduate enrollments into eight subcategories of courses. For a comprehensive survey of specific undergraduate courses, please refer to the report of the 2000 CBMS survey, Statistical Abstract of Undergraduate Programs in the Mathematical Sciences in the U.S.: Fall 2000 CBMS Survey (American Mathematical Society, Providence, RI, 2002). This publication is available on the AMS website at `www.ams.org/cbms/`.

Undergraduate and Master's Degrees

Beginning with the 2004 Annual Survey, departments were asked to report the number of master's degrees awarded, as well as undergraduate degrees awarded, during 2003–2004. Tables 5A and

Table 6A: Graduate Students, Fall 2004

	GROUP								
	I Public	I Private	II	III	Va	I, II, III, & Va	M	I, II, III, Va, & M	IV
Total Graduate Students									
Full-time	2906	1451	3221	2329	800	10707	2146	12853	4190
(Standard error)							(160)	(160)	
First-year full-time	676	404	966	765	193	3004	923	3927	1337
Part-time	223	168	406	902	83	1782	1794	3576	626
(Standard error)							*(188)*	*(188)*	
Female Graduate Students									
Full-time	749	334	1056	858	248	3245	904	4149	2144
First-year full-time	184	105	327	303	65	983	371	1354	670
Part-time	94	37	193	384	27	735	879	1615	320
U.S. Citizen Graduate Students									
Full-time	1541	717	1895	1261	463	5877	1698	7567	1636
(Standard error)							*(158)*	*(158)*	
First-year full-time	393	202	600	486	122	1803	687	2490	582
Part-time	171	105	349	758	76	1459	1701	3160	458
(Standard error)							*(170)*	*(170)*	

Table 6B: Full-Time Graduate Students in Groups I, II, III, & Va by Sex and Citizenship

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total full-time graduate students	9761	9476	9003	8791	8838	9637	9361	9972	10444	10707
First-year full-time	2601	2443	2386	2458	2664	2839	2875	2996	2711	3004
First-year full-time, U.S. citizen	1551	1465	1316	1349	1401	1527	1517	1630	1527	1803
Female full-time graduate students	2877	2760	2691	2770	2766	3016	2899	3136	3215	3245
Male full-time graduate students	6884	6716	6312	6021	6072	6621	6462	6836	7229	7462
U.S. citizen full-time graduate students	5623	5445	4947	4831	4668	5085	4631	5055	5590	5877
Non-U.S. citizen full-time graduate students	4138	4031	4056	3960	4170	4552	4730	4917	4854	4830

5C give the number of undergraduate and master's degrees awarded in 2003–2004, the number of each that are female, and the number that are computer science for each group. In 2002 we began tabulating the number of "undergraduate degrees", rather than the number of "junior/senior majors"; hence comparisons to previous years' numbers of undergraduate degrees can be made only to the last two years, and this is done in Table 5B. These three years show a trend of increasing numbers of undergraduate degrees awarded in mathematics.

The reader should be aware that at least 50 of the 192 departments in the 2004 Group M population and at least 270 of the 1,029 departments in the 2004 Group B population also offer a computer science program in addition to their offerings in mathematics. In some instances, these computer programs account for a major fraction of the department's undergraduate degrees. This year's estimated 24,400 undergraduate degrees awarded includes 4,700 in computer science, and 300 of the 3,400 master's degrees awarded were in computer science.

The report of the 2000 CBMS survey provides a more comprehensive study of departmental bachelor's degrees.

Graduate Student Profile

Table 6A summarizes information gathered by the 2004 Departmental Profile survey about graduate students enrolled in fall 2004. 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 female graduate students and for U.S. citizen graduate students.

The total number of full-time graduate students in Groups I, II, III, and Va combined increased from 10,444 in 2003 to 10,707 in 2004; this year's total is the highest during the period 1995–2004. The number of U.S. citizen full-time graduate students in Groups I, II, III, and Va combined increased by 5% to 5,877; this year's number is the highest during the period 1995–2004. The number of first-year full-time students in Groups I, II, III, and Va combined increased by 11%, from 2,711 last year to 3,004 this year (both the number of first-year U.S. citizens and the number of first-year non-U.S. citizens were up); both this year's number of first-year full-time graduate students and the number of first-year full-time U.S. citizens are the highest during the period 1995–2004. The number of female full-time graduate students in Groups I, II, III, and Va combined increased from 3,215 to 3,245; this year's number is also the highest during the period 1995–2004. In Group IV the number of full-time graduate students decreased this year by 2% to 4,190, but the number of U.S. citizen full-time graduate students increased by 4% to 1,636. The first-year full-time graduate student enrollment in Group IV decreased by 36 to 1,337, a decrease of 3%, but the number of first-year full-time U.S. citizens was up from 550 to 582. The number of female full-time graduate students in Group IV decreased from 2,203 to 2,144, a 3% decrease. The number of full-time graduate students in Group M declined from 2,265 to 2,146. There is a great deal of variability in the number of full-time graduate students in Group M, even in universities that are roughly the same size, and this is reflected in the standard errors of 160 this year and 172 last year. The number of part-time graduate students in Groups I, II, III, and Va increased to 1,782, an 11% increase this year, and in Group IV decreased 14% to 626. Group III has 902 (51%) of the part-time graduate students in the doctoral mathematics groups. In the doctoral mathematics groups, 41% of the part-time graduate students are females and 82% are U.S. citizens, and in Group IV 51% of the part-time graduate students are females and 73% are U.S. citizens. The number of Group M part-time graduate students decreased from 2,387 to 1,794, with a standard error of 188 this year and 308 last year. For Group M, 49% of the part-time graduate students are females and 95% are U.S. citizens.

Table 6B gives 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 in Groups I, II, III, and Va combined for fall 1995 through fall 2004. From this data we can see that total full-time graduate enrollment in the doctoral mathematics groups was falling until 1998 and has been generally increasing beginning in 1999. The number of first-year full-time graduate students declined in 1995–1997 and has been generally increasing since then. The number of full-time graduate students who are U.S. citizens has been increasing since 2001, and the number of non-U.S. citizens has been decreasing since 2002. The number of female full-time graduate students has been generally increasing since 1997 and is up 21% since 1997, slightly above the total increase of 19% in number of full-time graduate students.

Previous Annual Survey Reports

The 2004 Annual Survey First and Second Reports were published in the *Notices of the AMS* in the February and August 2005 issues respectively. For the last version of this report, the 2003 Annual Survey Third Report was published in the *Notices of the AMS* in the September 2004 issue. These reports and earlier reports, as well as a wealth of other information from these surveys, are available on the AMS website at `www.ams.org/employment/surveyreports.html`.

Acknowledgments

The Annual Survey 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

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 the number of Group I departments from 39 to 48, the 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 doctoral-granting departments with scores in the 3.00–5.00 range. Group I Public and Group I Private are Group I doctoral-granting departments at public institutions and private institutions respectively.

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

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

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

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

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

Group B or Bachelor's 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/outreach.

[1]Research-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.*

[2]*These 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.*

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 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.

Mathematics People

Varga Awarded Hans Schneider Prize

RICHARD S. VARGA of Kent State University has been awarded the 2005 Hans Schneider Prize of the International Linear Algebra Society (ILAS). Varga received his Ph.D. from Harvard University in 1951. He has written six books and edited five and has published more than two hundred papers. He is editor in chief of the online journal *Electronic Transactions on Numerical Analysis* and is on the editorial boards of several journals and of the *Computational Mathematics* series. His research interests are numerical analysis, approximation theory, and linear algebra.

—From an ILAS announcement

Ben Green Awarded 2005 Salem Prize

The Salem Prize for 2005 has been awarded to BEN GREEN of the University of Bristol for his work in combinatorial number theory related to progressions in the primes—more specifically, his extension of Van der Corput's theorem on triples and his joint paper with Terry Tao on the existence of progressions of arbitrary length.

The prize committee for 2005 consisted of J. Bourgain, C. Fefferman, P. Jones, N. Nikolski, P. Sarnak, and J-C. Yoccoz.

The Salem Prize is awarded yearly to young researchers for outstanding contributions in the field of analysis.

Previous recipients of the Salem Prize include: N. Varopoulos (1968), R. Hunt (1969), Y. Meyer (1970), C. Fefferman (1971), T. Körner (1972), E. M. Nikishin (1973), H. Montgomery (1974), W. Beckner (1975), M. R. Herman (1976), S. B. Bočkarëv (1977), B. E. Dahlberg (1978), G. Pisier (1979), S. Pichorides (1980), P. Jones (1981), A. B. Aleksandrov (1982), J. Bourgain (1983), C. Kenig (1984), T. Wolff (1985), N. G. Makarov (1986), G. David (1987), J. L. Journé (1987), A. L. Vol'berg (1988), J-C. Yoccoz (1988), S. V. Konyagin (1990), C. McMullen (1991), M. Shishikura (1992), S. Treil (1993), K. Astala (1994), H. Eliasson (1995), M. Lacey (1996), C. Thiele (1996), T. Wooley (1998), F. Nazarov (1999), T. Tao (2000), O. Schramm (2001), S. Smirnov (2001), Xavier Tolsa (2002), E. Lindenstrauss (2003), and K. Soundararajan (2003).

—Jean Bourgain, Institute for Advanced Study, Princeton

2005 AMS Menger Awards

The 2005 Intel International Science and Engineering Fair (ISEF) was held May 8–14 in Phoenix, Arizona. This was the fifty-sixth year of the ISEF competition. More than 1,400 students from over forty countries competed in the fair. The participants qualified by winning competitions in local and regional state fairs in the United States or national science fairs abroad. The ISEF administers the general awards. In addition, more than fifty organizations, including the AMS, participated by presenting special awards at the ISEF. Prizes awarded by the AMS included cash, certificates, books, and briefcases.

This is the eighteenth year of AMS participation in the ISEF, and it marked the sixteenth year of the presentation of the Karl Menger Awards. The members of the 2004–2005 AMS Menger Prize Committee and AMS Special Award Judges were Elwyn Berlekamp, University of California, Berkeley (chair); Gisele Goldstein, University of Memphis; Dmitry Fuchs, University of California, Davis, and Tatiana Shubin, San José State University. The panel of judges reviewed more than one hundred individual and team projects in the fields of mathematics, physics, and computer science. A member of the panel interviewed each entrant under consideration for a Menger Prize, and the entire panel interviewed the finalists. The AMS gave awards to one first-place, two second-place, and four third-place projects, and honorable mention to five others.

The Karl Menger Memorial Prize winners are as follows.

First-Place Award of $1,000: "On Universality Properties of Positive-Definite Integral Quadratic Forms", SCOTT DUKE KOMINERS, 18, Walt Whitman High School, Bethesda, Maryland.

Second-Place Award of $500: "Classification of Determinantal Sequences", SAMUEL MOHUN BHAGWAT, 16, Winston Churchill High School, Livonia, Michigan; "Complete Sequences of Positive Integers", KLEDIN DOBI, 16, Julia R. Masterman High School, Philadelphia, Pennsylvania.

Menger Prizes group photo: Back row (left to right), Elad Oster, John Sillcox, Oleg Mikhaylovsky, Vladimir Trubnikov, Niket Pandey, Carlos Fonseca; Middle (l. to r.), Kledin Dobi, Mikhail Ptichkin, Matthew Tierney, Paul Jacobs, Scott Kominers, Manuel Rivera; Front (l. to r.), Valentina Dobrovolskaya, Robert Cordwell, Samuel Bhagwat, Prize Committee Chair Elwyn Berlekamp.

Third-Place Award of $250: "Finding Varieties in Nonlinear Systems Using Algebraic-Geometry and Maple", MATTHEW RYAN TIERNEY, 17, Westview High School, Portland, Oregon; "A New Look at Cayley's Problem: Investigation of the Convergence of the Newton Algorithm Using Quaternions", ELAD OSTER, 18, Israeli Arts and Science Academy, Jerusalem, Israel; "Nonagonal Numbers in the Fibonacci Sequence and Related Diophantine Equations", JOHN MICHAEL SILLCOX, 18, Jericho High School, Jericho, New York; "On Structures Determined by Configurations on R^n", CARLOS MANUEL FONSECA, 18, and MANUEL LUIS RIVERA, 16, Colegio San Ignacio de Loyola, Rio Piedras, Puerto Rico.

Honorable Mention Award: "Investigating the Changes in the Poincaré Algebra and Group by Enlarging the Space-Time Dimensions", NIKET RANJAN PANDEY, 16, Bethel High School, Hampton, Virginia; "Some Results on Inclusive and Exclusive Partitions of Complete Graphs", ROBERT THOMAS CORDWELL, 18, Manzano High School, Albuquerque, New Mexico; "Graph Isomorphic Lattice Paths," PAUL FRANCIS JACOBS, 18, Good Hope School, St. Croix, Virgin Islands; "Discrepancy of Planar Parallelelipipedal Meshes", VALENTINA N. DOBROVOLSKAYA, 16, Advanced Education and Science Center, Moscow, Russia; "Classification of Rational Associative Operations", VLADIMIR N. TRUBNIKOV, 17, OLEG V. MIKHAYLOVSKY, 16, and MIKHAIL A. PTICHKIN, 17, Centre of Mathematical Education, Saint Petersburg, Russia.

The AMS'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, 201 Charles Street, Providence, RI 02904-2294 USA; send email to development@ams.org; or telephone 401-455-4111.

—AMS announcement

Royal Society of London Elections

Five mathematical scientists are among those elected as new fellows and foreign members of the Royal Society of London for 2005. They are: MARTIN T. BARLOW, University of British Columbia, for contributions to mathematical probability; DAVID W. MASSER, Universität Basel, for contributions to transcendence and diophantine geometry; LLOYD N. TREFETHEN, University of Oxford, for contributions to numerical analysis and its applications to applied mathematics and engineering science; and RICHARD S. WARD, University of Durham, for research in mathematical physics. Elected as a foreign member was RAOUL BOTT, Harvard University, for mathematical contributions that have underpinned the major advances in geometry and topology in the past fifty years.

—From a Royal Society announcement

Humboldt Foundation Research Awards

The Alexander von Humboldt Foundation grants up to one hundred Humboldt Research Awards annually to scientists and scholars from abroad with internationally recognized academic qualifications. The research award honors the academic achievements of the award winner's lifetime. Award winners are invited to carry out research projects of their own choice in Germany in cooperation with colleagues for periods of between six months and one year. The award can amount to a maximum of €75,000.

Among those receiving Humboldt Research Awards in 2005 are five mathematicians. Below are listed their names, home institutions, and the institutions in Germany that they will visit.

SUSANNE C. BRENNER, University of South Carolina: Humboldt Universität Berlin, Max-Planck-Institut für Mathematik in den Naturwissenschaften in Leipzig, Universität Augsburg, and Universität Hannover; RICHARD E. EWING, Texas A&M University: Universität Stuttgart; IDUN REITEN, Norwegian University of Science and Technology: Universität Bielefeld; ALAN L. SELMAN, State University of New York at Buffalo: Universität Würzburg, Universität Düsseldorf, and Universität Ulm; and JUAN J. L. VELAZQUEZ, Universidad Complutense de Madrid: Humboldt-Universität Berlin and Max-Planck-Institut für Mathematik in den Naturwissenschaften in Leipzig.

—Allyn Jackson

Mathematics Opportunities

American Mathematical Society Centennial Fellowships

Invitation for Applications for Awards for 2006–2007
Deadline December 1, 2005

The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. The eligibility rules are as follows.

Eligibility: 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 (that is, received between September 1, 1994, and September 1, 2003). 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.

Grant amount: The stipend for fellowships awarded for 2006–2007 is expected to be $64,000, with an additional expense allowance of about $3,250. 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 Society supplements contributions as needed. At most, two fellowships will be awarded for the 2006–2007 academic year. A list of previous fellowship winners may be found at `http://www.ams.org/prizes-awards`.

Deadline: The deadline for receipt of applications is **December 1, 2005**. Awards will be announced in February 2006 or earlier if possible.

Application information: 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.

Application forms are available via the Internet at `http://www.ams.org/employment/centflyer.html`. For paper copies of the form, write to the Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294 USA; or send electronic mail to `prof-serv@ams.org`; or call 401-455-4107.

—AMS announcement

NSA Grant and Sabbatical Programs

The Mathematical Sciences Program (MSP) of the National Security Agency (NSA) provides grants and sabbatical opportunities to support research by academic mathematical scientists. The MSP program offers four types of grants: the Young Investigators Grant; the Standard Grant; the Senior Investigators Grant; and the Conferences, Workshops, and Special Situations Grant.

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. Research grants are designed principally to provide summer salaries for professors and limited support for their graduate students. The deadline for submission of all grant proposals is **October 15, 2005**. Grants begin in the fall of the following year.

The sabbatical opportunities offered by the NSA provide support for academic mathematical scientists to visit the NSA for periods ranging from nine to twenty-four months. The sabbaticals primarily involve cryptanalysis, though sabbatical work may also involve algebra, probability, statistics, number theory, and discrete mathematics.

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 website: `http://www.nsa.gov/msp/index.cfm`. The telephone number is 301-688-0400, and the postal address is: Michelle D. Wagner, Director, NSA Mathematical Sciences Program, National Security Agency, ATTN: R1, Suite 6557, Ft. George G. Meade, MD 20755-6557.

—From an NSA announcement

Distinguished International Postdoctoral Research Fellowships

The Distinguished International Postdoctoral Research Fellowships Program of the Mathematical and Physical Sciences (MPS) Directorate of the National Science Foundation (NSF) provides opportunities for postdoctoral investigators to conduct research projects abroad as MPS Distinguished International Postdoctoral Research Fellows (MPS-DRF).

The objective of the program is to provide talented recent doctoral recipients in the mathematical and physical sciences an effective means of establishing international collaborations in the early stages of their careers.

Applicants must be citizens or permanent residents of the United States who have fulfilled the requirements for the doctoral degree between June 1 of the year of submission and September 30 of the year following submission. NSF expects to fund up to twenty awards that will provide up to $100,000 per year for up to twenty-four months.

The deadline for full proposals is **October 12, 2005**. For technical and scientific information, contact Lynne Walling, Program Director, Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; telephone 703-292-8104; email: lwalling@nsf.gov. For more detailed information, see the program announcement at http://www.nsf.gov/pubs/2001/nsf01154/nsf01154.txt.

—From an NSF announcement

NSF International Research Fellow Awards

The objective of the International Research Fellowship Program (IRFP) of the National Science Foundation (NSF) is to introduce scientists and engineers in the early stages of their careers to research opportunities abroad. The program provides support for postdoctoral and junior investigators to do research in basic science and engineering for nine to twenty-four months in any country in the world. The goal of the program is to establish productive, long-term relationships between U.S. and foreign science and engineering communities. Applicants must be U.S. citizens or permanent residents who have earned their doctoral degrees within three years prior to the date of application or who expect to receive their degrees by the date of the award.

The deadline for applying is **October 11, 2005**. For further information contact the program officer, Susan Parris, 703-292-8711, sparris@nsf.gov; or visit the website http://www.nsf.gov/sbe/int/fellows/start.htm.

—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. The deadline for applications had not been set at the time of this writing, but will likely occur during the **first week of November 2005**. More information and applications for the upcoming competition will be available at http://www.nsf.gov/grfpd.

—Elaine Kehoe

Travel Grants for ICM 2006, Madrid

The AMS has applied to the National Science Foundation (NSF) for funds to permit partial travel support for U.S. mathematicians attending the 2006 International Congress of Mathematicians (ICM 06) August 22–30, 2006, in Madrid, Spain. Subject to the award decision by the NSF, the Society is preparing to administer the selection process, which would be similar to previous programs funded in 1990, 1994, 1998, and 2002.

Applications for support are printed in this issue of the *Notices(pp. 971-973)*, and forms will be available on the AMS website (at http://www.ams.org/careers-edu/icmapp.html) beginning August 1, 2005. All completed application forms must be mailed to the AMS by **October 31, 2005**. This travel grants program, if funded, will be administered by the Membership and Programs Department, AMS, 201 Charles Street, Providence, RI 02904-2294. You may contact us at ICM06@ams.org; 800-321-4267, ext. 4058; or 401-455-4058.

This program is open to U.S. mathematicians (those who are currently affiliated with a U.S. institution). Early career mathematicians (those within six years of their doctorate), women, and members of U.S. groups underrepresented in mathematics are especially encouraged to apply. ICM 06 Invited Speakers from U.S. institutions should submit applications if funding is desired.

Applications will be evaluated by a panel of mathematical scientists under the terms of a proposal submitted to the NSF by the Society.

Should the proposal to the NSF be funded, the following conditions will apply: mathematicians accepting grants for partial support of travel to ICM 06 may not supplement them with any other NSF funds. Currently, it is the intention of the NSF's Division of Mathematical Sciences to provide no additional funds on its other regular research grants for travel to ICM in 2006. However, an individual mathematician who does not receive a travel grant may use

regular NSF grant funds, subject to the usual restrictions and prior approval requirements.

All information currently available about the ICM 06 program, organization, and registration procedure is located on the ICM 06 website, http://www.icm2006.org.

—AMS announcement

AWM Travel Grants for Women

The National Science Foundation (NSF) and the Association for Women in Mathematics (AWM) sponsor 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 2005 is **October 1, 2005**; the deadlines for 2006 are **February 1, 2006**; **May 1, 2006**; and **October 1, 2006**. For the Mentoring Travel Grants program the deadline is **February 1, 2006**. For further information and details on applying, see the AWM website, http://www.awm-math.org/travelgrants.html, or telephone 703-934-0163 or email: awm@math.umd.edu. The postal address is: Association for Women in Mathematics, 11240 Waples Mill Road, Suite 200, Fairfax, VA 22030.

—From an AWM announcement

Research Experiences for Undergraduates

The Research Experiences for Undergraduates (REU) program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation (NSF). Student research may be supported in two forms: REU supplements and REU sites.

REU supplements may be requested for ongoing NSF-funded research projects or may be included in proposals for new or renewable NSF grants or cooperative agreements.

REU sites are based on independent proposals to initiate and conduct undergraduate research participation projects for a number of students. REU site projects may be based in a single discipline or academic department or on interdisciplinary or multidepartment research opportunities with a strong intellectual focus. Proposals with an international dimension are welcomed. A partnership with the Department of Defense supports REU sites in research areas relevant to defense. Undergraduate student participants supported with NSF funds in either supplements or sites must be citizens or permanent residents of the United States or its possessions.

The deadline for full proposals for REU sites is **September 7, 2005**. Deadline dates for REU supplements vary with the research program; contact the program director for more information. The full program announcement can be found at the website http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf05592.

—From an NSF announcement

DMS Special Meetings Competition

In the spring of 2005 the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) held its first Special Meetings competition. Due to the relatively small number of proposals that were submitted, an additional competition has been scheduled for this fall. The deadline for this next competition is **October 18, 2005**.

These Special Meetings comprise longer-term or larger-scale activities that more widely engage and connect the mathematical sciences community, such as special research years or semesters, multi-institutional regional meetings, and "summer schools". Details for the Special Meetings competition and general information about DMS funding of conferences can be found on the Web at http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf05540.

The Special Meetings proposals will be reviewed by a panel. In addition to the usual review criteria of intrinsic intellectual merit and broader impacts, proposals are assessed on the following criteria:

1. diversity and breadth of participation by individuals and by institutions,
2. involvement of participants from underrepresented groups and of students and junior investigators,
3. connections to frontiers of the mathematical sciences and between the mathematical sciences and other science and engineering disciplines,
4. overall impact on the U.S. mathematical sciences community.

If you have any questions, please feel free to contact either the program officers of the DMS disciplinary program closest to the research area or one of these program officers: Joanna Kania-Bartoszynska, jkaniaba@nsf.gov; Wing Suet Li, wli@nsf.gov; Tie Luo, tluo@nsf.gov; Mike Steuerwalt, msteuerw@nsf.gov.

—From an NSF announcement

Inside the AMS

Ellen Maycock Joins AMS Executive Staff

Ellen Maycock, Johnson Family University Professor and professor of mathematics at DePauw University, has been appointed associate executive director of the American Mathematical Society, starting in September 2005. She succeeds James W. Maxwell, who has entered partial retirement and continues to work on selected projects part-time for the Society.

In hiring Maycock, the AMS brings on board a person with experience in all aspects of the mathematics profession: research, teaching, scholarship, and service. This experience will be crucial as Maycock oversees a large portfolio of AMS programs intended to serve members, support the profession, encourage young people in mathematics, and improve the public image of the field. "I feel very stimulated by the idea of learning new things [while working at the AMS]," Maycock said. "It's very exciting to think about the opportunities ahead."

Ellen Maycock

Maycock received her bachelor's degree in mathematics and economics in 1972 from Wellesley College. She earned her Ph.D. in mathematics in 1986 at Purdue University, with a dissertation on operator algebras written under the direction of Jerome Kaminker. After two years of teaching at Wellesley College, she joined the faculty at DePauw University and became a full professor there in 2001. In recognition of her outstanding record of sustained excellence in teaching, service, and professional accomplishment, DePauw University appointed Maycock as a University Professor for 2003–2007.

Maycock is perhaps best known for her development of innovative approaches to teaching abstract algebra. She created a course that used a software package called Exploring Small Groups to help students grasp algebraic concepts. "I used the old idea that most students learn by seeing concrete examples and generalizing to abstractions," she explained. "Technology gives students an easy way to generate a lot of examples, and then they can start to recognize patterns." She has also used computer technology in teaching analysis as well as Euclidean and non-Euclidean geometry. "It is hard at the undergraduate level for students to have any sense of what creative mathematics is about," she noted. "So using computer software in this way is very stimulating for them."

Maycock wrote *Laboratory Experiences in Group Theory*, which was published in 1996 by the Mathematical Association of America (MAA) in its series Classroom Resource Materials. She is also coeditor, with Allen Hibbard, of *Innovations in Teaching Abstract Algebra*, a collection of essays published in the MAA Notes series in 2002. Maycock has lectured widely on the use of technology in teaching undergraduate mathematics and has given several workshops and minicourses on the subject. She coorganized a national-level conference, supported by the National Science Foundation, that brought together mathematics faculty to explore the use of technology in teaching college-level algebra and geometry. She has also worked on ways to use writing in the teaching of mathematics, and she served for two years as the director of the "Writing Across the Curriculum" program at DePauw.

One reason for Maycock's interest in joining the AMS staff is her belief that the mathematics profession is changing in fundamental ways. She noted that there is a "new atmosphere" in the profession, in which all mathematicians are expected to take on combined responsibilities in scholarship and teaching. "The old myth of mathematicians doing research and putting minimal effort into teaching cannot hold anymore," she commented. "We cannot be one-dimensional as professionals.... We are all teacher-scholars." The balance between these two roles varies from

institution to institution and also evolves over the course of a career in mathematics. "[It] is very challenging to do both simultaneously and well," Maycock commented. "The Society needs to continue to find ways to support young mathematicians in these dual roles." Another issue she believes needs attention at the national level is encouraging underrepresented groups in mathematics.

"We're all sad to see Jim Maxwell step down, but eagerly awaiting Ellen's arrival," said AMS executive director John H. Ewing. "She brings valuable experience to the Society and fresh ideas. And she will forcefully remind us that the AMS represents all mathematicians, from the largest universities to the smallest colleges. This is a great opportunity for us."

In her new position Maycock oversees the meetings, public awareness, and membership departments of the AMS. In addition to ensuring a smooth transition for Maycock, Jim Maxwell will continue to manage the Annual Survey and will assist with other AMS projects. Maycock noted the professionalism and competence of the AMS staff and said she looks forward to working in such a positive environment. "It is very exciting to think about being involved at the national level," she remarked. "The profession is changing rapidly, and there are new pressures on all of us. I have always been interested in not only the subject of mathematics but also the people in mathematics: mathematicians. I feel I might have a chance of making a difference for them."

—Allyn Jackson

AMS Advocates Research Funding

The AMS joined other professional societies and educational institutions in participating in the 10th Annual Science-Engineering-Technology Congressional Visits Day (CVD) on May 10–11, 2005. CVD is a two-day annual event that brings diverse representatives of the scientific community to Washington to meet with legislators to discuss the importance of federally funded research to our nation.

Some 200–300 scientists, engineers, and business leaders converged on Washington DC to call on Congress to support an increased and balanced federal investment in scientific research. Samuel M. Rankin III, associate executive director of the AMS and the director of its Washington office, along with William Fitzgibbon of the University of Houston and Karen Parshall of the University of Virginia, met with congressional staff as part of this effort.

To learn more about Congressional Visits Day and how it helps to support the scientific enterprise, please visit the CVD website, `http://www.aas.org/policy/cvd/`.

—AMS Washington office

Deaths of AMS Members

PAUL CIVIN, professor emeritus, from Portland, OR, died on April 22, 2005. Born on April 29, 1919, he was a member of the Society for 65 years.

JACK T. KENT, retired, Texas A&M University, died in May 1999. Born on September 26, 1908, he was a member of the Society for 49 years.

ROBERT H. OEHMKE, professor, University of Iowa, died on October 10, 2003. Born on August 6, 1927, he was a member of the Society for 50 years.

JAMES F. PORTER, professor, from Hattiesburg, MS, died on January 25, 2005. Born on August 21, 1935, he was a member of the Society for 40 years.

RAYMOND M. REDHEFFER, of the University of California, Los Angeles, died on May 13, 2005. Born on April 17, 1921, he was a member of the Society for 58 years.

WILLIAM SALKIND, retired, from Brooklyn, NY, died on June 10, 2005. Born on November 6, 1913, he was a member of the Society for 59 years.

NATHAN SENTNER, from Brooklyn, NY, died on October 17, 2004. Born on February 20, 1926, he was a member of the Society for 15 years.

THOMAS J. WILLMORE, professor emeritus, University of Durham, England, died on February 20, 2005. Born on April 16, 1919, he was a member of the Society for 56 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.ou.edu in the case of the editor and notices@ams.org in the case of the managing editor. The fax numbers are 405-325-7484 for the editor and 401-331-3842 for the managing editor. Postal addresses may be found in the masthead.

Upcoming Deadlines

August 19, 2005: Letters of intent for NSF Focused Research Groups. See http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5671&org=DMS.

September 7, 2005: Full proposals for REU sites. See "Mathematics Opportunities" in this issue.

September 15, 2005: Nominations for Sloan Research Fellowships. See http://www.sloan.org/programs/fellowship_brochure.shtml.

September 16, 2005: Full proposals for NSF Focused Research Groups. See http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5671&org=DMS.

September 16, 2005: Proposals for NSF program on Enhancing the Mathematical Sciences Workforce in the Twenty-First Century. See the website http://www.nsf.gov/pubs/2003/nsf03575/nsf03575.htm.

September 30, 2005: Applications for AMS "Math in Moscow" Scholarships for spring 2006. See http://

Where to Find It

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

AMS Bylaws—*November 2003, p. 1283*

AMS Email Addresses—*December 2004, p. 1365*

AMS Ethical Guidelines—*June/July 2004, p. 675*

AMS Officers 2004 and 2005 (Council, Executive Committee, Publications Committees, Board of Trustees)—*May 2005, p. 564*

AMS Officers and Committee Members—*October 2004, p. 1082*

Conference Board of the Mathematical Sciences—*September 2005, p. 892*

Information for *Notices* Authors—*June/July 2005, p. 660*

Mathematics Research Institutes Contact Information—*August 2005, p. 770*

National Science Board—*January 2005, p. 76*

New Journals for 2004—*June/July 2005, p. 662*

NRC Board on Mathematical Sciences and Their Applications—*March 2005, p. 361*

NRC Mathematical Sciences Education Board—*April 2005, p. 465*

NSF Mathematical and Physical Sciences Advisory Committee—*February 2005, p. 261*

Program Officers for Federal Funding Agencies—*October 2004, p. 1078 (DoD, DoE); December 2004, p. 1368 (NSF)*

Stipends for Study and Travel—*September 2005, p. 900*

www.ams.org/outreach/mimoscow.html, or contact Math in Moscow Program, Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; email: student-serv@ams.org.

September 30, 2005: Nominations for 2005 Information-Based Complexity Young Researcher Award. See http://www1.cs.columbia.edu/~traub/ or send email to Joseph F. Traub at traub@cs.columbia.edu.

October 1, 2005: Applications for AWM Travel Grants. See "Mathematics Opportunities" in this issue.

October 1, 2005: Nominations for Lucien Godeaux Prize. Contact J. Aghion, c/o Secretariat of the Royal Society of Sciences of Liege, Institute of Mathematics of the University of Liege, 12 Grande Traverse, Sart Tilman Bat. B 37, B-4000 Liege 1, Belgium; email: jaghion@ulg.ac.be.

October 11, 2005: Applications for NSF International Research Fellow Awards. See "Mathematics Opportunities" in this issue.

October 12, 2005: Full proposals for NSF Distinguished International Postdoctoral Research Fellowships. See "Mathematics Opportunities" in this issue.

October 15, 2005: Proposals for NSA Grant and Sabbatical Programs. See "Mathematics Opportunities" in this issue.

October 18, 2005: Proposals for NSF Conferences, Workshops, and Special Meetings in the Mathematical Sciences. See http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=11701&org=DMS.

October 18, 2005: Proposals for DMS Special Meetings competition. See "Mathematics Opportunities" in this issue.

October 19, 2005: Applications for NSF Postdoctoral Research Fellowships (MSPRF). See http://www.nsf.gov/pubsys/ods.getpub.cfm?nsf05510.

October 31, 2005: Applications for NSF travel support for ICM 06. See http://www.ams.org/careers-edu/icmapp.html.

December 1, 2005: Applications for AMS Centennial Fellowships. See "Mathematics Opportunities" in this issue.

December 2, 2005: Submissions for Ferran Sunyer i Balaguer Prize. See http://www.crm.es/FSBPrize/fsb2005prize.htm.

January 1, 2006: Submissions for Competition 2006 of the European Mathematical Society. See http://www.mat.dtu.dk/people/V.L.Hansen/rpa/secondartcomp.html.

January 1, 2006: Applications for ICM 2006 Travel Grants. See http://www.icm2006.org or email: grants@icm2006.org.

January 27, 2006: Proposals for Partnerships for Adaptation, Implementation, and Dissemination Awards of the NSF ADVANCE Program. See the website http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5383.

February 1, 2006: Applications for AWM Travel Grants and Mentoring Travel Grants. See "Mathematics Opportunities" in this issue.

May 1, 2006: Applications for AWM Travel Grants. See "Mathematics Opportunities" in this issue.

October 1, 2006: Applications for AWM Travel Grants. See "Mathematics Opportunities" in this issue.

Conference Board on the Mathematical Sciences

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Member Societies

American Mathematical Association of Two-Year Colleges (AMATYC)
American Mathematical Society (AMS)
American Statistical Association (ASA)
Association for Symbolic Logic (ASL)
Association for Women in Mathematics (AWM)
Association of Mathematics Teacher Educators (AMTE)
Association of State Supervisors of Mathematics (ASSM)
Benjamin Banneker Association (BBA)
Institute for Operations Research and the Management Sciences (INFORMS)
Institute of Mathematical Statistics (IMS)
Mathematical Association of America (MAA)
National Association of Mathematicians (NAM)
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 are aimed at a broad audience potentially including mathematicians, students, and 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* notices-booklist@ams.org.

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

13: The Story of the World's Most Popular Superstition, by Nathaniel Lachenmeyer. Thunder's Mouth Press, October 2004. ISBN 1-568-58306-0.

1089 and All That. A Journey into Mathematics, by David Acheson. Oxford University Press, July 2002. ISBN 0-19-851623-1. (Reviewed February 2005.)

Action This Day, edited by Michael Smith and Ralph Erskine. Random

House of Canada, February 2003. ISBN 0-593-04910-1.

Alfred Tarski: Life and Logic, by Anita Burdman Feferman and Solomon Feferman. Cambridge University Press, October 2004. ISBN 0-521-80240-7.

Beyond Reason: Eight Great Problems That Reveal the Limits of Science, by A. K. Dewdney. Wiley, April 2004. ISBN 0-471-01398-6.

A Brief History of Infinity, by Paolo Zellini. Penguin Books (paperback), March 2005. ISBN 0-141-00762-1.

The Calculus Gallery: Masterpieces from Newton to Lebesgue, by William Dunham. Princeton University Press, December 2004. ISBN 0-691-09565-5.

Chance: A Guide to Gambling, Love, the Stock Market and Just About Everything Else, by Amir D. Aczel. Four Walls Eight Windows, October 2004. ISBN 1-568-58316-8. (Reviewed August 2005.)

The Colours of Infinity: The Beauty and Power of Fractals, by Michael Barnsley, Nigel Lesmoir-Gordon, Benoit B. Mandelbrot, Ian Stewart, Gary Flake, Robert Prechter, and Arthur C. Clarke. Clear Press, March 2004. ISBN 1-904-55505-5.

Complexities: Women in Mathematics, edited by Bettye Anne Case and Anne M. Leggett. Princeton University Press, January 2005. ISBN 0-691-11462-5.

Constantin Carathéodory: Mathematics and Politics in Turbulent Times, by M. Georgiadou. Springer, September 2004. ISBN 3-540-44258-8.

The Constants of Nature: From Alpha to Omega—The Numbers That Encode the Deepest Secrets of the Universe, by John D. Barrow. Jonathan Cape, September 2002. Pantheon Books, January 2003. ISBN 0-375-42221-8. (Reviewed November 2004.)

Converging Realities: Toward a Common Philosophy of Physics and Mathematics, by Roland Omnes. Princeton University Press, November 2004. ISBN 0-691-11530-3.

The Curious Incident of the Dog in the Nighttime, by Mark Haddon. Vintage, May 2004. ISBN 1-400-03271-7.

Dark Hero of the Information Age: In Search of Norbert Wiener, by Flo Conway and Jim Siegelman. Basic Books, December 2004. ISBN 0-738-20368-8.

* *The Equation That Couldn't Be Solved (How Mathematical Genius Discovered the Language of Symmetry)*, by Mario Livio. Simon and Schuster, September 2005. ISBN 0-743-25820-7.

The Essential Turing, edited by B. Jack Copeland. Oxford University Press, September 2004. ISBN 0-198-25080-0.

* *Experimentation in Mathematics: Computational Paths to Discovery*, by Jonathan Borwein, David Bailey, and Roland Girgensohn. A K Peters, March 2004. ISBN 1-56881-136-5. (Reviewed in this issue.)

From Eudoxus to Einstein: A History of Mathematical Astronomy, by C. M. Linton. Cambridge University Press, August 2004. ISBN 0-521-82750-7.

Geometry and Meaning, by Dominic Widdows. Center for the Study of Language and Information, November 2004. ISBN 1-575-86448-7.

The Golden Ratio: The Story of Phi, the World's Most Astonishing Number, by Mario Livio. Broadway Books, October 2002. ISBN 0-767-90815-5. (Reviewed March 2005.)

Graphic Discovery: A Trout in the Milk and Other Visual Adventures, by Howard Wainer. Princeton University Press, October 2004. ISBN 0-691-10301-1.

The Heart of Mathematics: An Invitation to Effective Thinking, by Edward B. Burger and Michael Starbird. Key College Publishing (Springer-Verlag), April 2000. ISBN 0-555953-407-9. (Reviewed February 2005.)

Incompleteness: The Proof and Paradox of Kurt Gödel, by Rebecca Goldstein. W. W. Norton, February 2005. ISBN 0-393-05169-2.

The Infinite Book: Where Things Happen That Don't, by John D. Barrow. Jonathan Cape, February 2005. ISBN 0-224-06917-9.

John Pell (1611–1685) and His Correspondence with Sir Charles Cavendish: The Mental World of an Early Modern Mathematician, by Noel Malcolm and Jacqueline Stedall. Oxford University Press, second edition, January 2005. ISBN 0-198-56484-8.

Karl Pearson: The Scientific Life in a Statistical Age, by Theodore M. Porter. Princeton University Press, February 2004. ISBN 0-691-11445-5.

Kepler's Conjecture: How Some of the Greatest Minds in History Helped Solve One of the Oldest Math Problems in the World, by George G. Szpiro. Wiley, January 2003. ISBN 0-471-08601-0. (Reviewed January 2005.)

The Knot Book: An Elementary Introduction to the Mathematical Theory of Knots, Colin C. Adams. AMS, September 2004. ISBN 0-8218-3678-1. (Reviewed in this issue.)

Knots and Links, by Peter R. Cromwell. Cambridge University Press, October 2004. ISBN 0-691-10301-1.

The Liar Paradox and the Towers of Hanoi: The Ten Greatest Math Puzzles of All Time, by Marcel Danesi. Wiley, August 2004. ISBN 0-471-64816-7.

Luck, Logic, and White Lies: The Mathematics of Games, by Jorg Bewersdorff. Translated by David Kramer. A K Peters, November 2004. ISBN 1-568-81210-8.

Math and the Mona Lisa: The Art and Science of Leonardo da Vinci, by Bulent Atalay. Smithsonian Books, April 2004. ISBN 1-588-34171-2.

The Math Instinct: Why You're a Mathematical Genius (Along with Lobsters, Birds, Cats, and Dogs), by Keith Devlin. Thunder's Mouth Press, March 2005. ISBN 1-560-25672-9.

Math Magic: How to Master Everyday Math Problems, by Scott Flansburg. Perennial Currents, revised edition, August 2004. ISBN 0-060-72635-0.

Math through the Ages: A Gentle History for Teachers and Others, by William P. Berlinghoff and Fernando Q. Gouvêa. Oxton House, 2002. ISBN 1-881929-21-3. (Reviewed October 2004.)

Mathematical Illustrations: A Manual of Geometry and PostScript, by Bill Casselman. Cambridge University Press, December 2004. ISBN 0-521-54788-1.

A Mathematician at the Ballpark: Odds and Probabilities for Baseball Fans, by Ken Ross. Pi Press, July 2004. ISBN 0-131-47990-3.

Mathematicians under the Nazis, by Sanford L. Segal. Princeton University Press, July 2003. ISBN 0-691-00451-X. (Reviewed April 2005.)

Mathematics: A Very Short Introduction, by Timothy Gowers. Oxford University Press, October 2002. ISBN

0-192-85361-9. (Reviewed February 2005.)

** Mathematics by Experiment: Plausible Reasoning in the 21st Century*, by David Bailey and Jonathan Borwein. A K Peters, December 2003. ISBN 1-568-81136-5. (Reviewed in this issue.)

Mathematics in Nature: Modeling Patterns in the Natural World, by John Adam. Princeton University Press, November 2003. ISBN 0-691-11429-3. (Reviewed June/July 2005.)

The (Mis)Behavior of Markets: A Fractal View of Risk, Ruin and Reward, by Benoit Mandelbrot and Richard Hudson. Basic Books, August 2004. ISBN 0-465-04355-0.

More Damned Lies and Statistics: How Numbers Confuse Public Issues, by Joel Best. University of California Press, August 2004. ISBN 0-520-23830-3.

More Mathematical Astronomy Morsels, by Jean Meeus. Willmann-Bell, 2002. ISBN 0-943396-743.

Musings of the Masters: An Anthology of Miscellaneous Reflections, edited by Raymond G. Ayoub. Mathematical Association of America, 2004. ISBN 0-88385-549-6.

The Newtonian Moment: Isaac Newton and the Making of Modern Culture, by Mordechai Feingold. New York Library and Oxford University Press, December 2004. ISBN 0-195-17735-5.

Number Theory from an Analytic Point of View, by Badih Ghusayni. Komati, December 2003. ISBN 9953-0-0282-7.

Numbers, the Language of Science, by Tobias Dantzig. Pi Press, fifth edition, March 2005. ISBN 0-131-85627-8.

The Oxford Murders, by Guillermo Martinez. Abacus, January 2005. ISBN 0-349-11721-7.

R. L. Moore: Mathematician and Teacher, by John Parker. Mathematical Association of America, 2004. ISBN 0-88385-550-X.

The Reader of Gentlemen's Mail: Herbert O. Yardley and the Birth of American Codebreaking, by David Kahn. Yale University Press, March 2004. ISBN 0-300-09846-4.

** Reality Conditions: Short Mathematical Fiction*, by Alex Kasman. Mathematical Association of America, May 2005. ISBN 0-88385-552-6.

The Road to Reality: A Complete Guide to the Laws of the Universe, by Roger Penrose. Knopf, February 2005. ISBN 0-679-45443-8.

Sneaking a Look at God's Cards: Unraveling the Mysteries of Quantum Mechanics, by Giancarlo Ghirardi, translated by Gerald Malsbary. Princeton University Press, revised edition, January 2005. ISBN 0-691-12139-7.

Spaceland, by Rudy Rucker. Tor Books, June 2002. ISBN 0-765-30366-3. (Reviewed August 2005.)

Stalking the Riemann Hypothesis: The Quest to Find the Hidden Law of Prime Numbers, by Dan Rockmore. Pantheon, April 2005. ISBN 0-375-42136-X.

Strange Curves, Counting Rabbits, and Other Mathematical Explorations, by Keith Ball. Princeton University Press, November 2003. ISBN 0-691-11321-1. (Reviewed December 2004.)

A Tour through Mathematical Logic, by Robert S. Wolf. Mathematical Association of America, January 2005. ISBN 0-88385-036-2.

Towards a Philosophy of Real Mathematics, by David Corfield. Oxford University Press, April 2003. ISBN 0-521-81722-6.

The Transformation of Mathematics in the Early Mediterranean World: From Problems to Equations, by Reviel Netz. Cambridge University Press, June 2004. ISBN 0-521-82996-8.

The Universal Book of Mathematics: From Abracadabra to Zeno's Paradoxes, by David Darling. Wiley, July 2004. ISBN 0-471-27047-4.

The Works of Archimedes: Translation and Commentary. Volume I: *The Two Books on the Sphere and the Cylinder.* Translated by Reviel Netz. Cambridge University Press, April 2004. ISBN 0-521-66160-9. (Reviewed May 2005.)

A World without Time: The Forgotten Legacy of Gödel and Einstein, by Palle Yourgrau. Basic Books, January 2005. ISBN 0-465-09293-4.

You Can Do the Math: Overcome Your Math Phobia and Make Better Financial Decisions, by Ron Lipsman. Praeger Publishers, November 2004. ISBN 0-275-98341-2.

Backlog of Mathematics Research Journals

Journal (Print and Electronic)	Number issues per Year	Approximate Number Pages per Year	2004 Median Time (in Months) from: Submission to Final Acceptance	Acceptance to Print	Acceptance to Electronic Posting	Editor's Current Estimate of Waiting Time between Submission and Publication (in Months) Print	Electronic
Abstr. Appl. Anal.	12	1080±	3.5	7	6	8	7
Acta Inform.	9	720	18	3	2	12	10
Acta Math.	4	600	8	9	9	9	9
Aequationes Math.	6	640	20	12	12	12	12
Algorithmica	12	100	NA	NA	NA	NA	NA
Amer. J. Math.	6	1400	NA	12.48	11.48	16-18	15-17
Ann. Appl. Prob.	5	2500	8	11	10	15	14
Ann. Mat. Pura Appl.	4	576	9.6	12.5	7.5	21.8	15
Ann. of Math.	6	2100	13	16	16	14	14
Ann. Probab.	NR	NR	NR	NR	NR	NR	NR
Ann. Statist.	6	2500	18	10-12	6	22	18
Anziam J.	4*	576/120*	9.71	8.19	1.11	12.71	10.82
Appl. Math. Lett.	12	1600	6	5	3	7	5
Appl. Math. Optim.	6	672	8	5	2.5	18	8.5
Arch. Hist. Exact Scis.	6	696	3	8	3	8	4
Arch. Math. Logic	8	800	14	10.5	6	25.4	20
Arch. Rational Mech. Anal.	12	1800	6	6	3	6	3
Balkan J. Geom. Appl.	2	200	5	5	3	5	3
Bull. London Math. Soc.	6	960	6.5	10	9.5	18.5	18
Bull. Soc. Math. France	4	600	6	12	8	11	7
Calc. Var. Partial Diff. Equations	12	1490	6.3	10.6	3.7	19	12
Canad. J. Math.	6	4500	9	8	8	9	9
Canad. Math. Bull.	4	630	7.3	11.5	12	17	18
Combinatorica	6	750	6	12	12	15	15
Comm. Algebra	12	4800	18	18	18	17	17
Comm. Math. Phys.	24	6100	5	3.5	1.5	4.5	2.5
Comm. Partial Diff. Equations	12	1800	4	6	**	10	7
Comm. Pure Appl. Anal.	4	1000	5	6	4	10	8
Compos. Math.	6	1632	6.5	14	13.5	14.5	14
Comput. Math. Appl.	24	4100	6	5	3	10	8
Computing	8	800	9.1	6.5	12	10	11
Constr. Approx.	6	864	10	NA	5	14	9
Discrete Comput. Geom.	8	1440	8	10	8	15	13
Discrete Contin. Dyn. Syst.	10	2000	7	7	4	12	9
Discrete Contin. Dyn. Syst. Ser. B	4	1200	5	7	4	12	9
Duke Math. J.	15	3000	8	9	9	16	16
Found. Comp. Math.	4	425	9	10.5	6	16	12
Graphs Combin.	4	596	14	6	2	12	12
Houston J. Math.	4	1240	6	15	11	18	14
Illinois J. Math.	4	1400	6	10	9	14	12
IMA J. Appl. Math.	6	960	21	9	NA	18	7
IMA J. Math. Control Inform.	4	500	9	20	11	24	NR
IMA J. Numer. Anal.	4	832	9	9	2	14	11
Indiana Univ. Math. J.	NR	NR	NR	NR	NR	NR	NR
Internat. J. Math. Math. Sci.	24	4000±	5	4	3	9	8
Internat. Math. Res. Not.	75	4500±	3	2.5	2	4.5	4
Invent. Math.	12	2740	8.7	9.2	3.9	17	13
J. Algebraic Geometry	4	800	8	8	2	9	5
J. Amer. Math. Soc.	4	1000	10.6	2.9	.8	17	14.5
J. Amer. Statist. Assoc.	4	1200	14	7	NA	21	NA
J. Appl. Math.	6	600±	6	3	2	9	8

Journal (Print and Electronic)	Number issues per Year	Approximate Number Pages per Year	2004 Median Time (in Months) from: Submission to Final Acceptance	Acceptance to Print	Acceptance to Electronic Posting	Editor's Current Estimate of Waiting Time between Submission and Publication (in Months) Print	Electronic
J. Appl. Math. Stochastic Anal.	4	400±	8	4	2	9	8
J. Assoc. Comput. Mach.	6	1000	approx. 20	3	3	approx. 15	approx. 15
J. Classification	2	320	14	3	6	12	6
J. Complexity	6	1000	8	6	4	14	4
J. Comput. System Sci.	8	200	12	3	1	14	NA
J. Cryptology	4	300	12	15	12	18	15
J. Differential Geom.	9	1800	3-6	3-6	0-2	6-9	0-1
J. Engrg. Math.	12	1200	approx. 6	1.5	.75	6	5
J. Eur. Math. Soc.	4	520	NA	6	6	9	8
J. Integral Equations Appl.	4	500	7	5	4	8	6
J. Lie Theory	2	700	15	7	NA***	11***	5***
J. London Math. Soc.	6	1632	6.5	7.5	7	14.5	14
J. Math. Biol.	12	1152	10.2	6.6	3.5	16.8	13.7
J. Math. Phys.	NR	NR	NR	NR	NR	NR	NR
J. Symbolic Logic	4	1320	10	5	3	12	10
Linear Algebra Appl.	18	6400	11-12	7	3	11	8
Linear Multilinear Algebra	6	480	6	10	10	14	14
Manuscripta Math.	12	1632	7.8	4.6	2.4	12.4	12.2
Math. Ann.	12	2900	11	5.7	2.9	16	12
Math. Biosci.	NR	NR	NR	NR	NR	NR	NR
Math. Comp.	4	2000	11.6	15.4	7.9	24.1	17.2
Math. Comput. Modelling	26	3200	7	6	4	10	8
Math. Control Signals Systems	†	†	†	7	est. 3	18	15
Math. Oper. Res.	4	1024	26.8	9.2	9.2	30	30
Math. Programming	9	1548	14.5	4.8	2.1	19.3	16.6
Math. Res. Let.	6	900	6	4	2	9	7
Math. Social Sci.	6	750	10	18	13	18	14
Math. Z.	12	2900	9.7	7.4	3.1	16	11.2
Michigan Math. J.	3	720	5	13	12	12	11
Monatsh. Math.	12	1056	7	11	7	22	14
Multiscale Model. Simul.	4	980	5.98	8.97	4.83	15	8
Nonlinear Anal.	36	3600	6-8	1-2	approx. 1	3-4	6-7
Numer. Funct. Anal. Optim.	8	1000	6	5	5	8	NR
Numer. Math.	12	2400	17	5	4	3	2
Oper. Res.	6	1070	21	13	13	12	12
Pacific J. Math.	10	2000	8	10	10	12	12
Probab. Theor. Relat. Fields	12	1824	10.2	5.5	3.4	15.7	13.6
Proc. Amer. Math. Soc.	12	3520	5.6	12.4	8.7	19	15.1
Proc. London Math. Soc.	6	1632	7.5	11	10.5	16.5	16
Publ. Math. Inst. Hautes Études Sci.	2	500	13	4.1	4	20	20
Quart. Appl. Math.	4	800	6.5	10.9	NA††	14.7	12
Quart. J. Math.	4	512	4	10	10	15	15
Quart. J. Mech. Appl. Math.	4	650	5	6	6	12	12
Reliab. Comput.	6	500	7	12	10	18	16
Rocky Mountain J. Math.	6	2100	9	18	16	25	23
Semigroup Forum	6	960	10	9	2	19	13
SIAM J. Appl. Math.	6	2200	8.51	9.89	6.67	15	11
SIAM J. Comput.	6	1600	12.7	7.13	4.37	16	13
SIAM J. Control Optim.	6	2300	12.76	14.71	7.59	24	16
SIAM J. Discrete Math.	4	880	16	14	6.9	24	16
SIAM J. Math. Anal.	6	1650	8.51	14.71	7.36	20	12
SIAM J. Matrix Anal. Appl.	4	1200	10	12.53	7	20	14
SIAM J. Numer. Anal.	6	2400	11.26	18.16	7.36	26	15
SIAM J. Optim.	4	1250	11.38	11.61	6.9	20	15
SIAM J. Sci. Comput.	6	2180	11.03	11.95	7.36	20	14
SIAM Rev.	4	800	12.48	7.09	6.09	17	16
Smarandache Notions J.	1	300-350	1	6	6	6	6
Theory Comput. Syst.	6	800	10	12	6	NA	NA
Topology	6	1300	11	10	8	21	19
Topology Appl.	27	2700	8	6	5	14	13
Trans. Amer. Math Soc.	12	5000	10.1	10.5	5.6	25.3	18.8

Journal (Print)	Number issues per Year	Approximate Number Pages per Year	2004 Median Time (in Months) from: Submission to Final Acceptance	2004 Median Time (in Months) from: Acceptance to Final Publication	Editor's Current Estimate of Waiting Time between Submission and Publication (in Months)
Algebras Groups Geom.	4	520	2	5	NR
Bull. Austral. Math. Soc.	6	1056	10	7	8
Circuits Systems Signal Proc.	6	600	10	4	15
Indag. Math.	4	approx. 600	3-6	3-6	3-6
Israel J. Math.	6	2280	6	6	12
J. Appl. Math. Stochastic Anal.	4	400	7	6	7
J. Austral. Math. Soc.	6	860	25	15	24
J. Geom. Anal.	4	741	5	8	12
J. Operator Theory	4	900	9.55	18.36	28.5
J. Theoret. Probab.	4	approx. 1000	8-10	8-10	approx. 18
Mem. Amer. Math. Soc.	6	3200	18.6	10.3	31
Methods Appl. Anal.	4	600-800	3-6	3-6	7-8
Results Math.	4	800	6	3	6

Journal (Electronic)	Number of Articles Posted in 2004	2004 Median Time (in days) from: Submission to Final Acceptance	2004 Median Time (in days) from: Acceptance to Posting	Format(s)
ACM J. Exp. Algorithmics (www.jea.acm.org)	5	less than 1 yr.	approx. 21	html, pdf, ps, dvi, tex, other
Acta Math. Acad. Paedagog. Nyházi. (www.emis.de/journals/AMAPN)	23	123	146	pdf, ps
Algebr. Geom. Topol. (www.maths.warwick.ac.uk/agt/index.html)	54	199	18	pdf, ps
Algebra Montpellier Announcements (www.emis.ams.org/journals/AMA/index.html)	1	50	30	pdf, ps, dvi
Appl. Math. E-Notes (math.nthu.edu.tw/~amen/)	24	100	60	pdf
Appl. Sci. (www.mathem.pub.ro/apps)	9	30	60	pdf, ps
Cent. Eur. J. Math. (www.cesj.com/mathematics.html)	55†††	116	24†††	pdf, ps, dvi, tex, other
Chicago J. Theoret. Comp. Sci. (cjtcs.cs.uchicago.edu/)	0	NA	NA	pdf, ps, dvi, tex
Conform. Geom. Dyn. (www.ams.org/ecgd/)	8	272	34	pdf, ps, dvi, tex
Diff. Eq. Contr. Process (www.neva.ru/journal)	16	30	5	pdf, tex
Differ. Geom. Dyn. Syst. (www.mathem.pub.ro/dgds)	7	45	90	pdf, ps
Discrete Math. Theor. Comput. Sci. (www.dmtcs.org)	21	300	14	pdf, ps
Doc. Math. (www.math.uni-bielefeld.de/documenta/)	30	173	11	pdf, ps, dvi
Electron. Comm. Probab. (www.math.washington.edu/~ejpecp/ECP/index.php)	20	135	30	html, pdf, ps
Electron. J. Combin. (www.combinatorics.org/)	115	165	18	pdf, ps
Electron. J. Differential Equations (ejde.math.unt.edu; ejde.math.txstate.edu)	147	96	8	html, pdf, ps, dvi, tex
Electron. J. Linear Algebra (www.math.technion.ac.il/iic/ela)	24	97	15	pdf, ps, tex, other
Electron. J. Probab. (www.math.washington.edu/~ejpecp)	28	181	29	html, pdf, ps

Journal (Electronic)	Number of Articles Posted in 2004	2004 Median Time (in days) from: Submission to Final Acceptance	Acceptance to Posting	Format(s)
Electron. J. Qual. Theory Differ. Equ. (www.math.u-szeged.hu/ejqtde/)	18	120	15	pdf, ps, dvi
Electron. Res. Announc. Amer. Math. Soc. (www.ams.org/era/)	17	95	12	pdf, ps, dvi, tex
Electron. Trans. Numer. Anal. (etna.mcs.kent.edu/)	21	approx. 135	15	pdf, ps
ESAIM Control Optim. Calc. Var. (www.edpsciences.org/cocv/)	36	229	450	ps
ESAIM Probab. Statist. (www.edpsciences.org/journal/index.cfm?edpsname=ps)	14	245	58	pdf, ps, tex
Forum Geom. (forumgeom.fau.edu)	29	57	23	pdf, ps
Geom. Topol. (www.maths.warwick.ac.uk/gt/index.html)	40	200	16	pdf, ps
Homology Homotopy Appl. (www.rmi.acnet.ge/hha/)	24	200	50	pdf, ps, dvi
Integers. Electron. J. Combin. Numb. Th. (www.integers-ejcnt.org)	30	252	NR	pdf, ps, dvi, tex
J. Artificial Intelligence Res. (www.jair.org/)	NR	NR	NR	NR
J. Funct. Logic Programming (danae.uni-muenster.de/lehre/kuchen/JFLP/)	6	250	2	pdf, ps
J. Graph Algorithms Appl. (jgaa.info/)	10	461	60	pdf
J. High Energy Phys. (jhep.sissa.it)	885	63	22	pdf, ps
J. Inequal. Pure Appl. Math. (jipam.vu.edu.au/)	114	90	30	pdf
J. Integer Seq. (www.cs.uwaterloo.ca/journals/JIS/)	24	170	13	html, pdf, ps, dvi, tex
JoT J. Turbul. (www.tandf.co.uk/journals/titles/14685248.asp)	40	167	26	html, pdf
LMS J. Comput. Math. (www.lms.ac.uk/jcm/)	15	161	48	html, pdf, other
Lobachevskii J. Math. (ljm.ksu.ru)	17	80	30	pdf, ps, dvi, other
Math. Phys. Electron. J. (www.maia.ub.es/mpej)	9	174	9	pdf, ps
New York J. Math. (nyjm.albany.edu:8000/nyjm.html)	19	190	10	pdf, ps, dvi
Represent. Theory (www.ams.org/ert/)	19	217	28	pdf, ps, dvi, tex
Sem. Lothar. Combin. (www.mat.univie.ac.at/~slc/)	22	196	8	pdf, ps, dvi, tex
SIAM J. Appl. Dyn. Syst. (epubs.siam.org/sam-bin/dbq/toclist/SIADS)	20	145	224	pdf, ps, dvi, other
Southwest J. Pure Appl. Math. (rattler.cameron.edu/swjpam/swjpam.html)	10	214	273	tex
Theory Appl. Categ. (www.tac.mta.ca/tac/)	30	152	31	pdf, ps, dvi

NR means no response received, NA means not available or not applicable. *4 hard copy and 1 electronic; 576 hard copy and 120 for the electronic part. **New electronic format starting 2005; the anticipated time for this is around 3 months. ***Available online-first beginning 2005; based on data for issue 15-1 (2005); currently, online within days of receipt of final electronic file. †4 per year in the past, 1 issue in 2004, 1 issue so far in 2005 with 2 other issues planned; 95 pages in 2004, normally 360 per year; 15 due to low number of papers published in 2004. ††Electronic format starting in 2005. †††Includes 15 papers for special issue; 24 days for regular issues.

Stipends for Study and Travel

Graduate Support

American Association for the Advancement of Science

Mass Media Summer Fellowship

(AMS supports at least one Fellow per year under this program)

Description: Fellows work for newspapers, magazines, and radio and television stations. Travel expenses and stipends are paid by the AAAS. Fellows have the opportunity to: observe and participate in the process by which events and ideas become news, improve their communication skills by learning to describe complex technical subjects in a manner understandable by the public, and increase their understanding of editorial decision making and the manner in which information is effectively disseminated. Each fellow will: attend an orientation and evaluation session in Washington, DC; begin the 10-week internship in mid-June; and submit an interim and final report to AAAS to help evaluate the program.
Eligibility: Provides support for 20–25 outstanding graduate students in mathematics, the natural and social sciences, and engineering as reporters, researchers, and production assistants in the mass media. (Exceptional undergraduate or postdoctoral students also considered.)
Grant amount: $450/week stipend for ten weeks.
Deadline: January 15, 2006.
Application information: Stacey Pasco, Manager, Mass Media Program, Mass Media Science and Engineering Fellows Program, American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005; telephone: 202-326-6441; `http://www.aaas.org/programs/education/massmedia/`.

American Association of University Women (AAUW) Educational Foundation

Selected Professions Fellowships

Description: These fellowships are awarded to women of outstanding academic ability who are citizens or permanent residents of the U.S. for full-time graduate study in designated fields where women's participation has traditionally been low. Eligible fields currently include mathematics and statistics.
Eligibility: Fellowships are for the final year of the master's degree. Fellowship year is July 1–June 30. Degree must be earned at the end of the fellowship year.
Grant amount: $5,000–$12,000.
Deadline: Must be postmarked by January 10 (applications are available August 1).
Application information: For more information contact: AAUW Educational Foundation, 2201 Dodge Street, Iowa City, IA 52243-4030; tel: 319-337-1716; or visit our website at `http://www.aauw.org/`.

Burroughs Wellcome Fund

Career Awards at the Scientific Interface

Description: The complexity inherent in biological research has always provided a fertile field for the development of new mathematical and physical approaches to biological problems. But now, with advances in genomics, quantitative structural biology, and modeling of complex systems, the possibilities for an exciting research career at the interface between the physical/computational sciences and the biological sciences have never been greater. Tackling key problems in biology will require scientists trained in areas such as chemistry, physics, applied mathematics, computer science, and engineering. In recognition of the vital role such cross-trained scientists will play in furthering biomedical science, the Burroughs Wellcome Fund has developed Career Awards at the Scientific Interface. These grants are intended to foster the early career development of researchers with backgrounds in the physical/computational sciences whose work addresses biological questions and who are dedicated to pursuing a career in academic research. Candidates are expected to draw from their training in a scientific field other than biology to propose innovative approaches to answer important questions in the biological sciences. Examples of approaches include, but are not limited to, physical measurement of

biological phenomena, computer simulation of complex processes in physiological systems, mathematical modeling of self-organizing behavior, building probabilistic tools for medical diagnosis, developing novel imaging tools or biosensors, applying nanotechnology to manipulate cellular systems, predicting cellular responses to topological clues and mechanical forces, and developing a new conceptual understanding of the complexity of living organisms. Proposals that include experimental validation of theoretical models are particularly encouraged.

Eligibility: Candidates must hold a Ph.D. degree in the fields of mathematics, physics, chemistry (physical, theoretical, or computational), computer science, statistics, or engineering. Exceptions will be made only if the applicant can demonstrate significant expertise in one of these areas, evidenced by publications or advanced course work. Candidates must have completed at least six months but not more than 48 months of postdoctoral training at the time of application and must not hold or have accepted a faculty appointment as a tenure-track assistant professor at the time of application. These awards are open to U.S. and Canadian citizens or permanent residents. Limited eligibility for temporary residents—please see program deadlines. Institutions may nominate two to three candidates. Up to eleven awards are made annually.

Grant amount: Career Awards at the Scientific Interface provide $500,000 over five years to support up to two years of advanced postdoctoral training and the first three years of a faculty appointment. During both the postdoctoral and the faculty periods, grants must be made to degree-granting institutions in the United States or Canada on behalf of the award recipient.

Deadline: May 1, 2006.

Application information: Full application information is available on the Burroughs Wellcome Fund website at `http://www.bwfund.org` or write to Burroughs Wellcome Fund, Interfaces Program, 21 T. W. Alexander Dr., P.O. Box 13901, Research Triangle Park, NC 27709-3901.

Florida Education Fund

The McKnight Doctoral Fellowship Program

Description: A McKnight Doctoral Fellowship provides funds for up to twenty-five African American citizens annually to pursue Ph.D. degrees at participating Florida universities. Contingent upon successful academic progress, the maximum length of the award is five years. The Florida Education Fund provides the first three years, and the student's university continues funding at the same level of support for an additional two years.

Eligibility: Applicants must hold or be receiving a bachelor's degree from a regionally accredited college or university.

Grant amount: Up to $5,000 in tuition and fees plus an annual stipend of $12,000. Tuition and fees over $5,000 will be waived.

Deadline: The deadline for applications for fall 2006 is January 15, 2006.

Application information: Detailed information and application packets can be obtained by writing or calling: The Florida Education Fund, 201 E. Kennedy Boulevard, Suite #1525, Tampa, FL 33602; 813-272-2772; `mdf@fl-educ-fd.org`; or visit our website at: `http://www.fl-educ-fd.org/`.

Ford Foundation Dissertation Fellowships for Minorities

Description: Approximately 40 dissertation fellowships will be awarded in a national competition administered by the National Research Council (NRC) of the National Academies for the Ford Foundation. The awards will be made to those individuals who, in the judgment of the review panels, have demonstrated superior scholarship and show the greatest promise for future achievement as scholars, researchers, and teachers in institutions of higher education.

Eligibility: Available to minorities who are Ph.D. or Sc.D. candidates at U.S. institutions studying mathematics, engineering, of one of several other fields. The fellowships will be offered on a competitive basis to individuals who are citizens or nationals of the U.S. and who are members of the following groups: Alaska Natives (Eskimo or Aleut), Native American Indians, Black/African Americans, Mexican Americans/Chicanas/Chicanos, Native Pacific Islanders (Polynesian or Micronesian), Puerto Ricans.

Application information: For more information, contact: Fellowship Office, GR 346A, National Research Council of the National Academies, 550 Fifth Street, NW, Washington, DC 20001; tel: 202-334-2872; email: `infofell@nas.edu`; website: `http://national-academies.org/fellowships/`.

Ford Foundation Predoctoral Fellowships for Minorities

Description: Approximately 60 predoctoral fellowships will be awarded in a national competition administered by the National Research Council (NRC) of the National Academies for the Ford Foundation. The awards will be made to those individuals who, in the judgment of the review panels, have demonstrated superior scholarship and show the greatest promise for future achievement as scholars, researchers, and teachers in institutions of higher education.

Eligibility: Available to minorities enrolled in or planning to enroll in research-based doctoral programs in mathematics, engineering, and other fields. The fellowships will be offered on a competitive basis to individuals who are citizens or nationals of the U.S. and who are members of the following groups: Alaska Natives (Eskimo or Aleut), Native American Indians, Black/African Americans, Mexican Americans/Chicanas/Chicanos,
Native Pacific Islanders (Polynesian or Micronesian), Puerto Ricans.

Application information: For more information, contact: Fellowship Office, GR 346A, National Research Council of

the National Academies, 550 Fifth Street, NW, Washington, DC 20001; tel: 202-334-2872; email: infofell@nas.edu; website: http://national-academies.org/fellowships/.

Georgia Institute of Technology

President's Fellowships

Description: These stipends are awarded to a selected number of highly qualified U.S. nationals who intend to pursue doctoral degrees. The fellowships are intended to supplement other forms of support and can be extended for three additional years based on academic performance and research potential.
Eligibility: The awards are highly competitive; selection is based on academic criteria and evidence of scholarship. Participants are expected to maintain high academic standing.
Grant amount: $5,500 for twelve months.

National Academies

Christine Mirzayan Science and Technology Policy Graduate Fellowship Program

Description: The Christine Mirzayan Science and Technology Policy Graduate Fellowship Program of the National Academies is designed to engage graduate and postdoctoral science, engineering, medical, veterinary, business, and law students in science and technology policy and to familiarize them with the interactions between science, technology, and government. As a result, students develop essential skills different from those attained in academia and make the transition from being a graduate student to a professional.
Eligibility: Applications are invited from graduate students through postdoctoral candidates in any physical, biological, or social science field or any field of engineering, medicine/health, or veterinary medicine, as well as business and law education, and other graduate and professional programs.
Grant amount: There are three 10-week sessions per year beginning in January, June, and September. The grant amount is $4,800 to $5,300 depending on location.
Deadline: Deadline for the receipt of materials is November 1 for the January program, March 1 for the June program, and June 1 for the September program.
Application information: For program details and a link to the online application, please visit the website at http://national-academies.org/policyfellows. For further information, email: policyfellows@nas.edu (preferred) or phone 202-334-2455. Résumés are not accepted.

National Science Foundation

Graduate Research Fellowships

Description: The NSF's Graduate Research Fellowship Program recognizes and supports outstanding graduate students in the relevant science, technology, engineering, and mathematics disciplines who are pursuing research-based master's and doctoral degrees. NSF provides three years of financial support which includes a $30,000 annual stipend, and a $10,500 annual cost-of-education allowance.
Eligibility: Applicants must be U.S. citizens, nationals, or permanent residents, and at or near the beginning of graduate studies in an NSF-supported field: Chemistry, Computer and Information Science and Engineering, Engineering, Geosciences, Life Sciences, Mathematical Sciences, Physics and Astronomy, Psychology, and Social Sciences.
Deadline: Applications and deadline information will be available online at http://www.fastlane.nsf.gov. Deadlines vary by field and applications must be submitted to NSF by the appropriate deadline.
Application information: For questions regarding the application process, please visit http://www.nsfgradfellows.orgor email: info@nsfgrfp.org. For program questions, please visit http://www.nsf.gov/grfp or email: grfp@nsf.gov.

Zonta International Foundation

Amelia Earhart Fellowship Awards

Description: Established in 1938 in honor of Amelia Earhart, Zonta member from 1928 to 1937, the fellowships recognize excellence and encourage and support women pursuing graduate degrees in aerospace-related sciences and/or engineering.
Eligibility: To qualify for the fellowship, a woman must have by the time of her application: a bachelor's degree in a qualifying area of science or engineering closely related to advanced studies in aerospace-related science or aerospace-related engineering; a superior academic record and evidence of potential at a recognized institute of higher learning, as demonstrated by transcripts, recommendations, and acceptance or verification by an institute of higher learning with accredited courses in aerospace-related studies; evidence of a well-defined research program in aerospace-related sciences or engineering; and completion of one year of aerospace-related graduate studies.
Grant amount: The scholarship award of $6,000 may be used for tuition, books and fees, or living expenses. Awards may be renewed for an additional year by a current fellow.
Deadline: November 15. Announcement of awards will be made by May 15.
Application information: Zonta International Foundation, 557 W. Randolph St., Chicago, IL 60661-2206; tel: 312-930-5848; fax: 312-930-0951; email: Zontafdtn@Zonta.org; website: http://www.Zonta.org/.

Postdoctoral Support

Air Force Office of Scientific Research

Research Contracts and Grants

Description: Mathematicians and computer scientists are encouraged to submit through their organizations proposals for research support. Research areas include mathematics of dynamics and control, physical mathematics and applied analysis, computational mathematics, optimization and discrete mathematics, signal processing, probability and statistics, software and systems, intelligent software agents, information fusion, and electromagnetics.
Application information: Research proposals should be forwarded to the Mathematics and Space Sciences Directorate, Air Force Office of Scientific Research (AFOSR/NM), 875 North Randolph Street, Suite 325, Room 3112, Arlington, VA 22203; http://www.afosr.af.mil.

American Mathematical Society Centennial Fellowships

Postdoctoral Fellowships

Description: The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Society supplements contributions as needed. At most, two fellowships will be awarded for the 2006–07 academic year. A list of previous fellowship winners can be found at http://www.ams.org/prizes-awards.
Eligibility: 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 (that is, received between September 1, 1994, and September 1, 2003). 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. 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.
Grant amount: The stipend for fellowships awarded for 2006–07 is expected to be $64,000, with an additional expense allowance of about $3,250. Acceptance of the fellowship cannot be postponed.
Deadline: The deadline for receipt of applications is December 1, 2005. Awards will be announced in February 2006 or earlier if possible.
Application information: Application forms are available via the Internet at http://www.ams.org/employment/centflyer.html. For paper copies of the form write to the Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; or send electronic mail to prof-serv@ams.org; or call 401-455-4107. Please note that completed applications and references should be sent to the AMS at the address given above, marked "Centennial Fellowships".

American Philosophical Society

Franklin Research Grants

Description: Postdoctoral research grants to aid specific research projects. The purpose of the program is to connect scholars with the objects of their research. Tenable abroad and in the U.S. The Committee on Research meets in January and in March.
Eligibility: For candidates with Ph.D. for at least one year.
Grant amount: Up to $6,000. Grants contribute toward travel expenses, food and lodging, and photoduplication. No funds are available for attending conferences or consulting with colleagues.
Deadline: October 1, December 1.
Application information: For application forms please consult the website at http://www.amphilsoc.org/. If electronic access is denied, briefly describe your project and proposed budget in a letter to: Committee on Research, American Philosophical Society, 104 South Fifth Street, Philadelphia, PA 19106; or to lmusumeci@amphilsoc.org.

California Institute of Technology

Harry Bateman Research Instructorships in Mathematics

Description: Appointments are normally for two years. The academic year runs from approximately October 1 to June 1. Instructors are expected to teach one course per quarter for the full academic year and to devote the rest of their time to research. During the summer months there are no duties except research.
Eligibility: Open to persons who have recently received their doctorates in mathematics.
Grant amount: The annual salary for academic year 2006–07 is $51,000.
Deadline: January 1, 2006.
Application information: Please send applications to Search Committee, 253-37 Sloan Laboratory, California

Institute of Technology, Pasadena, CA 91125. Include a C.V. and a statement of anticipated research. The candidate is requested to ensure that at least three letters of recommendation be sent to Caltech. To avoid duplication of paperwork, your application may also be considered for an Olga Taussky and John Todd Instructorship. Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

California Institute of Technology

Olga Taussky and John Todd Instructorships in Mathematics

Description: Appointments are for three years. There are three terms in the Caltech academic year, and instructors are expected to teach one course in all but two terms of the total appointment. These two terms will be devoted to research. During the summer months there are no duties except research.
Eligibility: Offered to persons within three years of having received the Ph.D. who show strong research promise in one of the areas in which Caltech's mathematics faculty is currently active.
Grant amount: The annual salary for 2006–07 is $54,000 plus a $2,000 per year research fund.
Deadline: January 1, 2006.
Application information: Apply to the Search Committee, 253-37 Sloan Laboratory, California Institute of Technology, Pasadena, CA 91125. Include a C.V. and a statement of anticipated research. Please ensure that at least three letters of recommendation are sent to Caltech. To avoid duplication of paperwork, your application may also be considered for the Harry Bateman Research Instructorship. Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

Fields Institute

Postdoctoral Fellowships

Description: Applications are invited for postdoctoral fellowship positions at the Fields Institute in Toronto for the 2006–07 academic year. The thematic program on Cryptography will take place at the Institute from August-December 2006, while the thematic program on Geometric Applications of Homotopy Theory will run from January-June 2007. The fellowships provide for a period of engagement in research and participation in the activities of the Institute. They may be offered in conjunction with partner universities, through which a further period of support may be possible. One recipient will be awarded the Institute's prestigious Jerrold E. Marsden Postdoctoral Fellowship. Applicants seeking postdoctoral fellowships funded by other agencies (such as NSERC or international fellowships) are encouraged to request the Fields Institute as their proposed location of tenure, and should apply to the Institute for a letter of invitation.
Eligibility: Qualified candidates who will have recently completed a Ph.D. in a related area of the mathematical sciences are encouraged to apply.
Deadline: December 9, 2005, although late applications may be considered.
Application information: Please consult `http://www.fields.utoronto.ca/proposals/postdoc.html`.

Ford Foundation Postdoctoral Fellowships for Minorities

Description: Approximately 30 postdoctoral fellowships will be awarded in a national competition sponsored by the Ford Foundation and administered by the National Research Council.
Eligibility: U.S. citizens or nationals who are Native American Indian, Mexican American/Chicana/Chicano, Alaska Native (Eskimo or Aleut), Native Pacific Islander (Polynesian or Micronesian), Black/African American, or Puerto Rican and who are currently in or planning a career in teaching and research at the college or university level.
Application information: For further information and applications, contact: Fellowship Office, GR 346A, National Research Council of the National Academies, 550 Fifth Street, NW, Washington, DC 20001; tel: 202-334-2872; fax: 202-334-3419; email: `infofell@nas.edu`; website: `http://national-academies.org/fellowships`.

John Simon Guggenheim Memorial Foundation Fellowships

Description: Fellowships are on an advanced professional level. Approximately 221 awards are made.
Eligibility: U.S. or Canadian citizenship or permanent residence is required. Fellowships are also offered to citizens or permanent residents of Latin America and the Caribbean.
Grant amount: Approximately $38,236 in 2004.
Deadline: Application deadline: October 1 for the U.S. and Canada competition, December 1 for the Latin American and Caribbean competition.
Application information: For more information write to John Simon Guggenheim Memorial Foundation, 90 Park Avenue, New York, NY 10016; tel: 212-687-4470; fax: 212-697-3248; email: `fellowships@gf.org`; World Wide Web: `http://www.gf.org/`.

IBM Herman Goldstine Postdoctoral Fellowship in Mathematical Sciences

Description: The fellowship provides scientists of outstanding ability an opportunity to advance their scholarship as resident department members at the research center. The department provides an atmosphere in which basic research is combined with work on technical problems arising in industry. Close interaction with permanent department members is expected, but fellows will be free to pursue their own research interests. The fellowship has a period of one year and may be extended

by another year by mutual agreement. One fellowship will be awarded yearly. Please see http://www.research.ibm.com/math/goldstine.html for further information.
Eligibility: Candidates must have a doctorate and no more than five years of postdoctoral professional experience (with a preference for less) when the fellowship commences.
Grant amount: Salary: $87,000 to $107,000, depending on experience, plus an allowance for moving expenses.
Deadline: December 2005 (check website above).
Application information: Please visit website above.

Institute for Advanced Study Memberships

Description: The School of Mathematics will grant a limited number of memberships, some with financial support, for research in mathematics at the Institute during the academic year 2006–07.
Eligibility: Candidates must give evidence of ability in research comparable at least with that expected for the Ph.D. degree.
Deadline: December 1, 2005.
Application information: Application blanks may be obtained from The School of Mathematics, Institute for Advanced Study, Princeton, NJ 08540, and should be returned (whether or not funds are expected from some other source) by December 1. Forms may also be downloaded but not submitted via Web connection at http://www.math.ias.edu/. An Equal Opportunity/Affirmative Action Employer.

Institute for Mathematics and its Applications (IMA)

General Memberships

Description: The Institute for Mathematics and its Applications at the University of Minnesota announces the availability of general memberships in connection with its 2006–07 thematic program on *Applications of Algebraic Geometry*. General memberships provide an excellent opportunity for mathematicians and scientists employed elsewhere to spend a period of one month to one year in residence at the IMA and to participate in the 2006–07 thematic program. The program runs from September 2006 through June 2007. IMA members are provided with an excellent and extremely stimulating research environment within a large community of researchers.
Eligibility: Candidates must be recipients of a doctoral degree and have research interests related to the thematic program. Preference will be given to supplementary support for persons with sabbatical leaves, fellowships, or other stipends.
Grant amount: Local expenses and travel costs may be requested.
Deadline: Applications will be accepted continuously through the end of the program or until funds are exhausted.
Application information: Application forms and instructions are available at http://www.ima.umn.edu/docs/membership/current/. The IMA website is http://www.ima.umn.edu. Questions should be directed to applications@ima.umn.edu or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

Institute for Mathematics and its Applications (IMA)

Industrial Postdoctoral Memberships

Description: The Institute for Mathematics and its Applications at the University of Minnesota announces the availability of several industrial postdoctoral memberships. IMA industrial postdoctoral positions are funded jointly by the IMA and an industrial sponsor, and holders devote 50% effort to their own research and the IMA program and 50% effort working with industrial scientists. Industrial postdoctoral memberships run one or two years at the option of the holder, starting September 5, 2006. The 2005–06 thematic program at the IMA is on *Imaging*, and the 2006–07 program is on *Applications of Algebraic Geometry*. Industrial Postdoctoral positions are designed to prepare mathematicians for research careers in industry or involving industrial interaction.
Eligibility: Candidates must have completed the Ph.D. in mathematics or a related area by the start of the appointment and within the last three years.
Grant amount: The annual salary for 2006 will be approximately $50,000, and a travel stipend will be furnished.
Deadline: January 5, 2006.
Application information: Application forms and instructions are available at http://www.ima.umn.edu/docs/postdocapp.html. The IMA website is http://www.ima.umn.edu. Questions should be directed to applications@ima.umn.edu or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

Institute for Mathematics and its Applications (IMA)

New Directions Visiting Professorships

Description: The Institute of Mathematics and its Applications at the University of Minnesota, provide an extraordinary opportunity for established mathematicians—typically mid-career faculty at U.S. universities—to branch into new directions and increase the impact of their research by spending the 2006–07 academic year immersed in the thematic program at the IMA. Visiting professors will enjoy an excellent research environment and stimulating scientific program connecting algebraic geometry and related areas of mathematics with a broad range of fields of application. New Directions Visiting Professors are expected to be resident and active participants in the program but are not assigned formal duties.

Eligibility: Established mathematical scientists with permanent U.S. university employment.
Grant amount: The New Directions program will supply 50% of academic year salary up to $50,000 maximum.
Deadline: November 1, 2005.
Application information: Application forms and instructions are available at http://www.ima.umn.edu/docs/newdirapp.html. The IMA website is http://www.ima.umn.edu. Questions should be directed to ndprof@ima.umn.edu or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

Institute for Mathematics and its Applications (IMA)

Postdoctoral Fellowships

Description: The Institute for Mathematics and its Applications at the University of Minnesota announces the availability of postdoctoral memberships in connection with its 2006–07 thematic program on *Applications of Algebraic Geometry*. Postdoctoral fellowships provide an excellent opportunity for mathematical scientists near the beginning of their career who have background in and/or a strong interest in learning about the applied and computational aspects of algebraic geometry. IMA postdoctoral memberships run for one or two years, at the option of the holder, starting September 1, 2006. In the second year of the appointment there are a variety of options to enhance career development, including teaching, working on an industrial project, and participation in the 2007–08 academic year program on the *Mathematics of Molecular and Cellular Biology*.
Eligibility: Candidates must have completed the Ph.D. in mathematics or a related area by the start of the appointment and within the last three years.
Grant amount: The annual salary for 2006–07 will be approximately $50,000, and a travel stipend will be furnished.
Deadline: January 5, 2006.
Application information: Application forms and instructions are available at http://www.ima.umn.edu/docs/postdocapp.html. The IMA website is http://www.ima.umn.edu. Questions should be directed to applications@ima.umn.edu or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

Los Alamos National Laboratory

Postdoctoral Appointments and Fellowships

Description: Research opportunities are granted in many areas of chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Appointments are available for two years, subject to renewal for a third year. A postdoctoral committee meets to review candidates for postdoctoral fellowships in February, May, August, and November.
Eligibility: Candidates must be recipients of a doctoral degree within the past five years.
Grant amount: Starting salary: $63,200–$74,000.
Application information: Los Alamos National Laboratory is an Equal Opportunity Employer. For more information: email: postdoc-info@lanl.gov; tel: 505-667-0872; fax: 505-665-5419; see details and apply online at: http://www.hr.lanl.gov/postdoc/.

Los Alamos National Laboratory

J. Robert Oppenheimer, Richard P. Feynman, and Frederick Reines Distinguished Fellowships

Description: Research opportunities are granted in many areas of chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Appointments are for three years.
Eligibility: Candidates must be recipients of a doctoral degree within the past five years and must show clear and definite promise of becoming outstanding leaders in scientific research.
Grant amount: Starting salary: $93,000–98,000.
Deadline: Submission deadline for sponsored candidates: mid-October each year.
Application information: Los Alamos National Laboratory is an Equal Opportunity Employer. See details and apply online at: http://www.hr.lanl.gov/postdoc/.

Mathematical Sciences Research Institute (MSRI)

General Memberships

Description: The Institute will invite about 60 general members for stays of 1 month or more during 2006–07, when three programs will be featured. Two will be half year: *Computational Applications of Algebraic Topology* (August 14 to December 18, 2006), and *Dynamical Systems* (January 8 to May 21, 2007). One will be the full academic year: *Geometric Evolution Equations* (August 14, 2006, to May 21, 2007). Some invitations will be made in other areas, so applications from candidates in all fields are welcome.
Eligibility: For mathematicians postdoctoral and above.
Grant amount: While there is no stipend for general members, MSRI may offer partial support toward living and travel expenses. It is expected that General Members will visit MSRI with partial or full support from other sources.
Deadline: Files must be complete by December 16, 2005.
Application information: Please complete online application form at: http://www.mathjobs.org. Further information: http://www.msri.org.

Mathematical Sciences Research Institute (MSRI)

Microsoft Research Postdoctoral Grant

Description: The Mathematical Sciences Research Institute announces the availability of a postdoctoral

fellowship combined with an internship at Microsoft Research in Redmond, Washington. Because of the variety of mathematical work done at Microsoft Research, no particular fields of mathematics have been specified. However, an essential prerequisite is a strong interest in the applications of mathematics as well as in the research environment at MSRI. This postdoctoral fellowship is normally a two-year award, with the recipient spending one year at MSRI and the second year at Microsoft Research.
Eligibility: For new and recent Ph.D.s (Ph.D. earned in 2001 or later). Applicants should apply through the usual process for MSRI Postdoctoral Fellowships, indicating their interest in this internship/fellowship and adding relevant documentation. Applications indicating interest in this program will be reviewed by Microsoft Research as well as by MSRI.
Deadline: Application files must be completed by December 16, 2005. Further information: `http://www.msri.org`.
Application information: Please complete online application form at: `http://www.mathjobs.org`.

Mathematical Sciences Research Institute (MSRI)

Postdoctoral Fellowships

Description: The Institute will award about 20 postdoctoral fellowships during 2006–07, when three programs will be featured. Two will be half year: *Computational Applications of Algebraic Topology* (August 14 to December 18, 2006), and *Dynamical Systems* (January 8 to May 21, 2007). One will be the full academic year: *Geometric Evolution Equations* (August 14, 2006, to May 21, 2007). Some awards will be made in other areas, so applications from candidates in all fields are welcome.
Eligibility: For mathematicians with Ph.D.s earned in 2001 or later.
Grant amount: The stipend will be $4,000/month for 5 months for the two one-semester programs, ten months for the year-long program.
Deadline: Application files must be complete by December 16, 2005.
Application information: Please complete online application form at: `http://www.mathjobs.org`. Further information: `http://www.msri.org`.

Mathematical Sciences Research Institute (MSRI)

Research Professorships

Description: The Institute will award about ten research professorships for stays of 3 months or more during 2006–07, when three programs will be featured. Two will be half year: *Computational Applications of Algebraic Topology* (August 14 to December 18, 2006), and *Dynamical Systems* (January 8 to May 21, 2007). One will be the full academic year: *Geometric Evolution Equations* (August 14, 2006, to May 21, 2007). Some awards will be made in other areas, so applications from candidates in all fields are welcome.
Eligibility: For mathematicians with Ph.D.s earned in 2000 or earlier.
Grant amount: The stipend will be $5,000/month up to five months for the two one-semester programs, ten months for the year-long program.
Deadline: Application files must be complete by October 7, 2005. Further information: `http://www.msri.org`.
Application information: Please complete online application form at: `http://www.mathjobs.org`.

The Michigan Society of Fellows

Horace H. Rackham School of Graduate Studies, The University of Michigan

Description: The Michigan Society of Fellows was founded in 1970 through grants from the Ford Foundation and Horace H. Rackham Graduate School for the purpose of promoting academic and creative excellence in the arts, sciences, and professions. The objective of the program is to support individuals selected for outstanding achievement, professional promise, and interdisciplinary interests. We invite applications from qualified candidates for three-year postdoctoral fellowships at the University of Michigan. Fellows are appointed as assistant professors/postdoctoral scholars with departmental affiliations. They spend the equivalent of one academic year teaching; the balance of time is devoted to their own scholarly research and creative work. Applications will be screened by faculty in relevant University of Michigan departments. Final selections will be made by the senior fellows of the society. New fellows will be selected for three-year terms beginning September 2005.
Eligibility: Candidates must have received the Ph.D. degree between June 1, 2003, and September 1, 2006.
Grant amount: The annual stipend will be $47,271.
Deadline: Completed applications due September 30, 2005.
Application information: Please see the application on our website or send requests for application materials to: Michigan Society of Fellows, 3572 Rackham Building, University of Michigan, 915 E. Washington St., Ann Arbor, MI 48109-1070; tel: 734-763-1259; email: `society.of.fellows@umich.edu`; Web: `http://www.rackham.umich.edu/Faculty/society.html`.

Michigan State University

MSU Postdoctoral Instructorships

Description: Several two-year positions will be available beginning fall 2006 for new or recent Ph.D.'s who show strong promise in research and teaching. The teaching load is four semester courses per year, and participation in the research activities of the department is expected.
Grant amount: A starting salary of $42,000 per year. Additional income from summer teaching is usually available if desired.
Deadline: Completed applications (including letters of recommendation) received by November 15, 2005, are assured of consideration.

Application information: An applicant should send a vita as well as a brief statement of research interests and arrange for at least four letters of recommendation to be sent, one of which must specifically comment on the applicant's ability to teach. Application via email is strongly encouraged. To receive an electronic application and information, send an email to: jobs@math.msu.edu with the message "send application info". Application materials can also be mailed to The Hiring Committee, Department of Mathematics, Michigan State University, East Lansing, MI 48824-1027. Application should be made as soon as possible. Women and minorities are strongly encouraged to apply. MSU is an Affirmative Action/Equal Opportunity Institution.

National Center for Atmospheric Research

Advanced Study Program

Description: Postdoctoral fellowships are offered for highly qualified atmospheric scientists and scientists from related disciplines who wish to continue basic research in the atmospheric sciences. Appointments are for a one-year period with a possible extension for an additional year.
Eligibility: For recent recipients of the Ph.D. with no more than 4 years' experience past their Ph.D.
Grant amount: Stipends are $47,000 and are adjusted annually in June.
Deadline: The application deadline is January 6, 2006.
Application information: http://www.asp.ucar.edu; email: paulad@ucar.edu; phone: 303-497-1328; or Paula Fisher, NCAR, ASP, P.O. Box 3000, Boulder, CO 80307-3000.

National Science Foundation

Mathematical Sciences Postdoctoral Research Fellowships (with Research Instructorship Option)

Description: The stipend portion of the awards will consist of support for eighteen academic-year months or their equivalent and six summer months. Awardees have two options for academic year stipends, subject to the constraints that their academic-year support begin by October 1 of the award year and be configured in intervals no shorter than three consecutive months. An awardee may have full-time support for any eighteen academic-year months in a 3-year period (the Research Fellowship Option) or have a combination of full-time and half-time support over a period of three academic years, usually as one academic year full-time and two academic years half-time (the Research Instructorship Option). Summer month stipends are limited to two per calendar year.
Grant amount: Stipend amounts are $4,000 per full-time month and $2,000 per half-time month, plus institutional and special allowances, for a total award of $108,000 to be used within 48 months.
Deadline: Deadline for applications is October 19, 2005; applicants will be notified of decisions on or about February 8, 2006.
Application information: For further details write to the Mathematical Sciences Infrastructure Program, Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; call 703-306-1870; send an inquiry to email: msprf@nsf.gov; or under "Postdoctoral Fellowships" and other Programs at http://www.fastlane.nsf.gov/.

The NSA Mathematical Sciences Program

Grants for Research in Mathematics

Description: The National Security Agency (NSA) awards grants to universities in support of self-directed research in the following areas of the mathematical sciences (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 proposals are designed principally to provide summer salary for professors and limited support for their graduate students in areas of interest listed above.
Deadline: When to submit: October 15 each year is the deadline for all grant and conference proposal submissions. Grants awarded from this funding can expect to incur expenses in the fall of the following year.
Application information: For further information about the program, please visit our website, http://www.nsa.gov/msp/index.cfm or call 301-688-0400. All correspondence should be addressed to Department of Defense, National Security Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557. Queries can also be made by email to: The Director of the Mathematical Sciences Program, Dr. Michelle D. Wagner, mdwagn4@nsa.gov or the Program Administrator, Ms. Rosalie J. Smith (Jackie), rjsmit2@nsa.gov.

National Security Agency

Sabbatical Program

Description: The National Security Agency (NSA) offers the nation's leading mathematicians and computer scientists an opportunity to serve a sabbatical tour for a minimum of 9 months to a maximum of 24 months.
Eligibility: U.S. citizenship is required for the sabbatical applicant and his or her immediate family members. Applications should be submitted at least 8 months in advance of the desired starting date. A complete background investigation is required.
Grant amount: NSA pays half the cost of the sabbatical employee's salary and benefits during academic months and 100% of salary and benefits during the summer months. The employee may also choose either an allowance for moving expenses or a monthly housing supplement.
Application information: Please contact Dr. Michelle D. Wagner, Director, Mathematical Sciences Program,

mdwagn4@nsa.gov, or the Program Administrator, Rosalie (Jackie) Smith, rjsmit2@nsa.gov. All correspondence should be mailed to Department of Defense, National Security Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557. Please visit our website, http://www.nsa.gov/msp/index.cfm or call 301-688-0400.

Radcliffe Institute Fellowship Program

Description: The Radcliffe Institute for Advanced Study is a scholarly community where individuals pursue advanced work across a wide range of academic disciplines, professions, or creative arts. Within this broad purpose, and in recognition of Radcliffe's historic contributions to the education of women, the Radcliffe Institute sustains a continuing commitment to the study of women, gender, and society.
Eligibility: Radcliffe Institute Fellowships are designed to support scholars and scientists of exceptional promise and demonstrated accomplishment who wish to pursue independent work in academic and professional fields and in the creative arts. Applications are judged on the quality and significance of the proposed project and on the applicant's record of accomplishment and promise. Women and men from across the United States and throughout the world, including developing countries, are encouraged to apply. Proposals are accepted from applicants in any field with the receipt of a doctorate or appropriate terminal degree at least two years prior to appointment or with comparable professional achievement in the area of the proposed project.
Grant amount: Stipends are funded up to $55,000 for one year, with additional funds for project expenses.
Deadline: Applications must be postmarked by December 1, 2005.
Application information: For more information visit http://www.radcliffe.edu/. Write, call, or e-mail for an application: Application Office, 34 Concord Avenue, Cambridge, MA 02138; tel: 617-496-3048; fax: 617-496-5299; or e-mail: science@radcliffe.edu.

Rice University

Griffith Conrad Evans Instructorships

Description: Postdoctoral appointments for two to three years for promising research mathematicians with research interests in common with the active research areas at Rice. Rice University encourages applications from women and minority group members.
Deadline: Applications received by December 15, 2005, will receive thorough consideration.
Application information: Inquiries and applications should be addressed to: Chairman, Evans Committee, Department of Mathematics, Rice University, 6100 Main St.-MS 136, Houston, TX 77005.

Sloan Foundation

Research Fellowships

Description: Unrestricted grants made to selected university scientists in chemistry, physics, mathematics, computer science, economics, neuroscience or computational and evolutionary molecular biology, or in a related interdisciplinary field. Candidates do not apply, but are nominated by their department chairman or other senior scientists.
Eligibility: Candidates must be members of the regular (i.e., tenure-track) faculty, in the early stage of their academic career, at a recognized college or university in the United States or Canada.
Deadline: Nominations are due by September 15 for awards to begin the following September.
Application information: For information write to the Sloan Research Fellowships, Alfred P. Sloan Foundation, Suite 2550, 630 Fifth Ave., New York, NY 10111; email: stanley@sloan.org; Web: http://www.sloan.org/.

Trinity College

Harold L. Dorwart Visiting Assistant Professorship

Description: The Department of Mathematics solicits applications for the seventh Harold L. Dorwart Visiting Assistant Professorship. This three-year, nonrenewable position offers a competitive salary and monetary support for research-related travel. The normal teaching load is five semester courses per year ("3/2"), one of which is a research seminar to be taught with a senior member of the faculty.
Eligibility: We are seeking applicants with a Ph.D. in mathematics and a specialization in functional analysis. Anticipated fields in future years include continued fractions and special functions, geometric group theory, harmonic analysis, and microlocal analysis and spectral theory.
Deadline: There is no closing date for applications; however, the department will begin to read applications in early December, and those completed by December 1, 2005, will be assured full consideration.
Application information: Please send a letter of application; curriculum vitae; a statement of teaching philosophy; and three letters of reference, one of which addresses teaching, to: Search Committee, Department of Mathematics, Trinity College, 300 Summit Street, Hartford, CT 06106. Be sure to include email contact information. Representatives of the Search Committee will be at the Joint Mathematics Meetings in San Antonio, Texas, to participate in the Employment Center. Trinity College is an Affirmative Action/Equal Opportunity Employer. Women and members of minority groups are encouraged to apply. Applicants with disabilities should request in writing any needed accommodations in order to participate more fully in the application process.

University of Michigan, Ann Arbor

Assistant Professorships, VIGRE Assistant Professorships, and T. H. Hildebrandt Research Assistant Professorships

Description: These positions for up to three years are designed to provide mathematicians with favorable circumstances for academic career development in research

and teaching. Assistant professorships have a teaching responsibility of two courses per semester; the VIGRE and T. H. Hildebrandt positions have a responsibility of one course per semester. These positions may be combined with other postdoctoral fellowships, giving additional reductions in teaching responsibility.

Eligibility: Preference is given to candidates who receive the Ph.D. degree in 2003 or later and who submit a completed application by December 15, 2004.

Grant amount: Salary is competitive, and there are opportunities for supplemental summer salary.

Application information: An application form for these positions, along with a list of current tenured mathematics faculty, is available for download in *Microsoft Word* or *PDF* format. Please provide evidence of teaching excellence. This form may also be obtained by email from `math-fac-search@umich.edu`; or by mail to: Hiring Committee, Department of Mathematics, University of Michigan, 2074 East Hall, 525 E. University, Ann Arbor, MI 48109-1109. The University of Michigan is an equal opportunity, affirmative action employer. Women and minorities are encouraged to apply. The University is responsive to the needs of dual career couples.

University of Wisconsin-Madison

Van Vleck Assistant Professorship

Description: The Department of Mathematics invites applications for possible Van Vleck assistant professorships to begin on August 28, 2006. Appointments are for a fixed term of two or three years. The usual teaching load is two courses per semester.

Eligibility: Ordinarily only those applicants who have received their doctorates since 2003 will be considered. Promise of excellence in research and teaching is important. Preference will be given to candidates who are likely to interact well with other members of the department.

Deadline: The application deadline is December 15, 2005, although applications will continue to be considered until all available positions are filled.

Application information: Applicants should send a completed AMS Standard Cover Sheet, a curriculum vitae that includes a publication list, and a brief statement of research plans to: 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 three or four letters of recommendation sent to the above address. At least one of these letters must discuss the applicant's teaching experience and capabilities. Other evidence of good teaching will be helpful. The University of Wisconsin is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities.

Yale University

Josiah Willard Gibbs Instructorships/Assistant Professorships

Description: Offered to men and women with the doctorate who show definite promise in research in pure mathematics. Applications from women and members of minority groups are welcome. Appointments are for two/three years. The teaching load is kept light to allow ample time for research. This will consist of 3 one-semester courses. Part of the teaching duties over the term of the appointment may consist of a one-semester course at the graduate level in the general area of the instructor's research.
Grant amount: The 2006–07 salary will be at least $58,800.
Deadline: January 1, 2006.
Application information: Applications are available at `http://www.math.yale.edu/`. Inquiries and application supporting documents should be sent to the Gibbs Committee, Department of Mathematics, Yale University, via email: `gibbs.committee@math.yale.edu`. Yale University is an Affirmative Action/Equal Opportunity Employer.

Travel and Study Abroad

Alexander von Humboldt Foundation

Research Fellowships

Description: The Humboldt Foundation grants up to 600 Humboldt Research Fellowships annually to highly qualified scholars under the age of 40 holding doctorates, enabling them to undertake long-term periods of research (6–12 months) in Germany. Applications are decided upon by a selection committee which is composed of eminent German scholars from all disciplines. Candidates' academic attainments are the only criterion for selection; there are no limitations in respect to specific countries or subjects.
Eligibility: Application requirements include high academic qualifications, academic publications, a specific research plan, and for humanities scholars a good command of the German language. As part of the Humboldt Research Fellowship Program, U.S. citizens and residents from all disciplines may also apply for these variations: Summer Research Fellowship for U.S. Scientists and Scholars (3 months per year in 3 consecutive years), `http://www.humboldt-foundation.de/en/programme/stip_aus/tshp2.htm`; 2-year Post-Doctoral Fellowship for U.S. Scientists and Scholars (24 consecutive months), `http://www.humboldt-foundation.de/en/programme/stip_aus/tshp1.htm`.
Grant amount: Monthly stipends range from 2,100 to 3,000 euros. Family allowances, travel expenses, and language courses are covered by the fellowship.
Deadline: Applications may be submitted at any time; however, the actual selection committees meet in March,

July, and November. Applications should be submitted 5 months before the meeting at which the candidate wishes to be considered.
Application information: Interested scholars may contact the Alexander von Humboldt Foundation, Jean-Paul-Str. 12, D-53173 Bonn, Germany; tel: +49-228-833-0; fax: +49-228-833-212; email: select@avh.de; homepage: http://www.humboldt-foundation.de; or, U.S. Liaison Office, 1012-14th Street, NW, Suite 1015, Washington, DC 20005; tel: 202-783-1907; fax: 202-783-1908; email: avh@verizon.net.

Fulbright Teacher Exchange Program

Description: Sponsored by the United States Department of State, this program offers international exchange opportunities for two-year college faculty members and elementary and secondary school teachers and administrators. Currently the program conducts exchanges with over 30 countries in Eastern and Western Europe, Latin America, Africa, and Canada. (The list of countries is subject to change.) Most exchanges are for the full academic year; however, some are for a semester or six weeks. In most cases both the U.S. and international teacher remain on the payroll of their respective home institutions. The Fulbright Teacher Exchange Program also offers six- to eight-week summer seminars in Italy and Greece which are open to four-year and two-year college faculty and teachers (grades 9–12) of Latin, Greek, and the Classics.
Eligibility: Eligibility requirements are U.S. citizenship, fluency in English, a bachelor's degree or higher, three years' full-time teaching/administrative experience, a current full-time teaching/administrative position, approval of school administration, and no participation in a Fulbright Program longer than eight weeks in the last two years. In addition to the general eligibility requirements, each applicant must meet the specific subject, level, and language fluency requirements for the countries to which he/she applies; these requirements are detailed in the application booklet.
Deadline: The application deadline is October 15 for the following year's program.
Application information: The application booklet should be requested from the Fulbright Teacher Exchange Program, 600 Maryland Ave., SW, Room 320, Washington, DC 20024-2520; tel: 800-726-0479.

Marshall Scholarships

Description: Marshall Scholarships finance young Americans of high ability to study for a degree in the United Kingdom. The scholarships are tenable at any British university and cover two years of study in any discipline, at either undergraduate or graduate level, leading to the award of a British university degree.
Eligibility: Open only to United States citizens who (by the time they take up their scholarship) hold a first degree from an accredited four-year college or university in the United States with a minimum GPA of 3.7. To qualify for awards tenable from September 2006, candidates must have graduated from their undergraduate college or university after April 2003 (although this restriction may be waived in the case of those wishing to read business studies or an allied subject). N.B. Persons already studying for or holding a British degree or degree-equivalent qualification are **not** eligible to apply for a Marshall Scholarship.
Deadline: October 5, 2005 (although some universities might have earlier internal application deadlines), to commence the following September.
Application information: The application process is all online, interested parties should visit: http://www.marshallscholarship.org. For further information please contact your local British Consulate General: Atlanta, 404-954-7708; Boston, 617-245-4513; Chicago, 312-970-3811; Houston, 713-659-3275, ext. 2118; Los Angeles, 310-996-3028; New York, 212-745-0252; San Francisco, 415-617-1340; Washington, DC, 202-588-7844.

U.S. Department of State Fulbright U.S. Student Program

Fulbright and Related Grants for Graduate Study, Research, and Teaching Assistantships Abroad

Description: For graduate study or research in any field in which the project can be profitably undertaken abroad, or English teaching assistantships in many countries. If an applicant is already enrolled in a U.S. university, he must apply directly to the Fulbright Program adviser on his campus. Unenrolled students may apply to the Institute of International Education.
Eligibility: Applicant must be a U.S. citizen, hold a B.A. degree or the equivalent, and have language proficiency sufficient to carry out the proposed study and to communicate with the host country.
Deadline: Application deadline is October 21.
Application information: Further details may be obtained from the U.S. Department of State Fulbright U.S. Student Program, U.S. Student Programs Division, Institute of International Education, 809 United Nations Plaza, New York, NY 10017; tel: 212-984-5330; website: http://www.fulbrightonline.org.

Winston Churchill Foundation of the United States

Description: A scholarship program for graduate work for one year in engineering, mathematics, and science at Churchill College, Cambridge University.
Grant amount: Tuition and living allowance worth approximately $40,000, depending upon course of study.
Application information: Application forms are available from representatives on campuses of colleges and universities participating in the program. For further information write to the Winston Churchill Foundation, P. O. Box 1240, Gracie Station, New York, NY 10028; or see foundation homepage, http://www.thechurchillscholarships.com/.

Study in the U.S. for Foreign Nationals

American Association of University Women (AAUW) Educational Foundation

International Fellowships

Description: These are awarded to women of outstanding academic ability who are not citizens or permanent residents of the U.S. for full-time graduate or postgraduate study in the U.S. Six of the 57 awards are available to members of the International Federation of University Women to study in any country other than their own. Upon completion of studies, fellowship recipients are expected to return to their home countries to pursue professional careers. Previous and current recipients of AAUW fellowships are not eligible.
Eligibility: Applicants must hold the equivalent of a U.S. bachelor's degree by December 31.
Grant amount: The fellowships provide $18,000 for master's/first professional degree, $20,000 for predoctoral study, and $30,000 for postdoctoral study.
Deadline: The deadline is December 15 (postmark deadline). *If an application postmark deadline falls on a weekend or holiday, applications may be postmarked the next business day.
Application information: For more information contact: AAUW Educational Foundation, P.O. Box 4030, Iowa City, IA 52243-4030; tel: 319-337-1716; fax: 319-337-1204.

Kennedy Scholarships

Description: These grants are for postgraduate study at Harvard University or the Massachusetts Institute of Technology.
Eligibility: For citizens of the United Kingdom.
Deadline: Application deadline is October 22, 2004.
Application information: Write to Secretary, Kennedy Memorial Trust, 3 Birdcage Walk, Westminster, London SWIH 9JJ, England.

SPECIAL SECTION

2005 American Mathematical Society Election

CONTENTS

2005 AMS Elections

Special Section

List of Candidates–2005 Election

President
(one to be elected)
James G. Glimm
Ronald J. Stern

Vice President
(one to be elected)
Ruth M. Charney
Carlos E. Kenig

Board of Trustees
(one to be elected)
John B. Conway
James A. Donaldson

Member at Large of the Council
(five to be elected)
William M. Goldman
Craig L. Huneke
Judy Anita Kennedy
William McCallum
Ken Ono
Freydoon Shahidi
Christina Sormani
Ravi Vakil
Dan-Virgil Voiculescu
Judy L. Walker

Nominating Committee for 2005
(three to be elected)
William K. Allard
Michael G. Crandall
Henri Gillet
Richard M. Kane
M. Susan Montgomery
Lisa M. Traynor

Editorial Boards Committee for 2005
(two to be elected)
Robert L. Bryant
Allan L. Edmonds
Stephen Lichtenbaum
Maciej Zworski

Ballots

AMS members will receive either a traditional paper ballot or e-mail with instructions for voting online by September 20. If you do not receive this information by that date, please contact the AMS (preferably before October 1) to request a ballot. Send e-mail to `ballot@ams.org` or call the AMS at 800-321-4267 (within the U.S. or Canada) or 401-455-4000 (worldwide) and ask to speak with Member Services. The deadline for receipt of ballots is November 4, 2005.

Write-in Votes

It is suggested that names for write-in votes be given in exactly the form that the name occurs in the *Combined Membership List* (`http://www.ams.org/cml`). Otherwise the identity of the individual for whom the vote is cast may be in doubt and the vote may not be properly credited.

Replacement Ballots

For those who wish to vote by paper ballot, the following replacement procedure has been devised: A member who has not received a ballot by September 20, 2005, or who has received a ballot but has accidentally spoiled it, may write to `ballot@ams.org` or Secretary of the AMS, 201 Charles Street, Providence, RI 02904-2294, USA, 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. Although a second ballot will be supplied on request and will be sent by first class or airmail, the deadline for receipt of ballots cannot be extended to accommodate these special cases.

Nominations for President Elect and Biographies of Candidates The next several pages contain the nominations for president elect and biographical information about all candidates. All candidates were given the opportunity to provide a statement of not more than 200 words to appear at the end of their biographical information.

Description of Offices

The **president** of the Society (whom you elect every other year) is the most important officer. The president strongly influences, either directly or indirectly, most of the scientific policies of the Society. A direct effect comes through the president's personal interactions both with members of the Society and with outside organizations, for example, in testimony before Congressional committees. In addition, 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. Indirect influence occurs as the president appoints chairs and members of almost all committees of the Society, including the policy committees. 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 Society affairs.

The **vice president** and the **members at large of the AMS Council** serve for three years on the Council. That body determines all scientific policy of the Society, creates and oversees numerous committees, appoints the treasurers and members of the Secretariat, makes nominations of candidates for future elections, and determines the chief editors of several key editorial boards. Typically, each of these new members of the Council also will serve on one of the Society's five policy committees.

The **Board of Trustees**, of whom you will be electing one member for a five-year term, has complete fiduciary responsibility for the Society. 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 person you select will serve as chair of the Board of Trustees during the fourth year of the term.

The candidates for president elect, vice president, members at large, and trustee were suggested to the Council either by the Nominating Committee or by petition from members. While the Council has the final nominating responsibility, the groundwork is laid by the **Nominating Committee**. The candidates for election to the Nominating Committee were nominated by the current president, James G. Arthur. 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 spring Council, which makes the final nominations.

The **Editorial Boards Committee** is responsible for the staffing 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 eight specific journals named in the AMS bylaws are officially appointed by the Council, upon recommendation of the Editorial Boards Committee; in virtually all other cases, the editors are appointed by the president, again upon recommendation by the Editorial Boards Committee.

Elections to the Nominating Committee and the Editorial Boards Committee are conducted by the method of approval voting. In the approval voting method, you can vote for as many or as few of the candidates as you wish. The candidates with the greatest number of the votes win the election.

A Note from AMS Secretary Robert J. Daverman

The choices you make in these elections directly affect the direction the Society takes. If the past election serves as a reliable measure, about 16 percent of you will vote in the coming election, which is comparable with voter participation in other professional organizations which allow an online voting option. This is not mentioned as encouragement for you to throw the ballot in the trash; instead, the other officers and Council members join me in urging you to take a few minutes to review the election material, fill out your ballot, and submit it by some means, either by regular mail or electronically. The Society belongs to its members. You can influence the policy and direction it takes by voting.

Also, let me urge you 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 through an online form (`http://www.ams.org/committee-nominate`) or sent directly to the secretary (`secretary@ams.org` or Office of the Secretary, American Mathematical Society, 312D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330, USA.

PLEASE VOTE.

Nominations for President Elect

Nomination for James G. Glimm

Richard V. Kadison, Dusa McDuff, and I. M. Singer

Richard V. Kadison

As attested to by his recent (2002) National Medal of Science, and a host of other honors, James Glimm is one of this country's leading mathematical scientists. The citation for Jim's Medal of Science states:

"To James G. Glimm, Distinguished Leading Professor of Applied Mathematics and Statistics, State University of New York at Stony Brook and Brookhaven National Laboratory. For his original approaches and creative contributions to an array of disciplines in mathematical analysis and mathematical physics, which are fundamental to the theory of operator algebras, shock-wave theory, advanced quantum field theory, quantum statistical mechanics, applied mathematics, and scientific computation."

I join my two colleagues in nominating James G. Glimm for the presidency of the American Mathematical Society for his extraordinary contributions to an array of disciplines in mathematical analysis and mathematical physics and for his impressive leadership qualities and experience. His work has been fundamental to the theory of operator algebras, has revolutionized shock-wave theory, and has advanced quantum field theory and quantum statistical mechanics to levels that were previously unimagined.

Jim has made outstanding contributions to the theory of operator algebras, mathematical physics, with special emphasis on quantum field theory and quantum statistical mechanics, shock-wave theory (hyperbolic conservation laws), applied mathematics and scientific computation. In the theory of operator algebras, Glimm's earliest work, his accomplishments are seminal. The penetrating analysis of the most fundamental class of operator algebras, now called "Glimm algebras" in his honor, that he carried out, remains the cornerstone of one of the deepest and most vibrant aspects of the theory. He proved one of the first and most basic results in non-commutative approximation theory, his non-commutative "Stone-Weierstrass Approximation Theorem." He proved the Mackey conjecture on the equivalence of "smooth dual" and "type I structure," among several other important results.

Throughout his long-term collaboration with Arthur Jaffe in the subject of quantum field theory they were leaders in the subject. They helped and guided their fellow researchers as well, training many of the best workers in the area. In shock-wave theory, Glimm solved the most important and previously unapproachable problems by completely original methods that continue to resonate in the research being done in the subject decades later.

In years past, Glimm has played a leadership role in both the Society for Industrial and Applied Mathematics (SIAM) and the International Association of Mathematical Physics (IAMP). It is hard for me to imagine a more suitable and capable candidate for the AMS presidency.

Dusa McDuff

I am happy to write in support of Jim Glimm's nomination for President of the AMS. For many years now, Glimm has been the chair of the Department of Applied Mathematics and Statistics at Stony Brook. He reinvigorated its existing groups in fluid dynamics and statistics, unifying them around the core theme of computation, and started new groups in computational geometry and, more recently, computational biology. As a result the Department plays a greatly enhanced role both in the Engineering College at Stony Brook and nationally. In the past few years Glimm has also been a key participant in the establishing of a Center for Data Intensive Computing at Brookhaven National

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Dusa McDuff is a professor of mathematics at the State University of New York at Stony Brook. Her email address is dusa@math.sunysb.edu.

Lab, providing essential scientific direction for this new and successful unit.

Glimm's outstanding leadership abilities are shown in his talent for spotting mathematical topics that are ripe for development and then for assembling interdisciplinary teams of researchers to focus on specific problems in the area, with participants ranging from the most theoretical mathematicians to the end users in engineering. He has extensive experience in interfacing with the wider community of mathematical scientists.

His talent for strategic thinking and experience in building bridges between mathematics and its applications should prove very important assets in helping the AMS find its way forward.

I. M. Singer

I am pleased to join Dusa McDuff and Richard V. Kadison in nominating James Glimm for President of the American Mathematical Society.

Even among distinguished mathematicians, Glimm stands out because of his original, seminal work in several distinctly different branches of mathematics.

In his thesis he studied certain limits of matrix algebras, and later proved an important approximation theorem for algebras of operators on a Hilbert space. His results and insights are central features of every textbook on operator algebras.

Arthur Jaffe and Jim Glimm founded the subject of constructive quantum field theory. They demonstrated the existence of scalar quantum field theories in two and three dimensions above and beyond free field theories. The concepts and techniques they invented are now standard tools in this branch of mathematical physics.

The study of hyperbolic differential equations is important because so many natural phenomena are governed by such equations. Using his intuition from quantum field theory, Glimm proved a remarkable conservation law, by methods that are very fruitful in many other applied areas.

Glimm is a new kind of American mathematician. Focused on applied mathematics and keenly interested in practical solutions, he is not averse to inventing and using powerful conceptual ideas when they are relevant. For him there are no barriers between pure and applied mathematics.

Mathematics aside, Jim has a rare gift that I believe would make him a very effective AMS president. He has the ability to isolate a problem (be it in administration, science policy, personality conflict, etc.), focus on the means available to solve the problem, and then act decisively.

I enthusiastically support the nomination of James Glimm for the presidency of the AMS.

I. M. Singer is a professor of mathematics at the Massachusetts Institute of Technology.

Nomination for Ronald J. Stern

Rob Kirby and Don Saari

Rob Kirby and Don Saari

It is a true delight to nominate Ronald Stern to be President of the AMS. Ron has the vision, background, experience, and other traits needed to be an outstanding President of our Society. He will be an excellent spokesperson in representing us, and he will provide leadership.

This article has two parts: Rob Kirby describes Ron's mathematical accomplishments and Don Saari discusses his service to the mathematical sciences community.

Rob Kirby

I've been a fan of Ron Stern's math since the days of his Ph.D. at UCLA in 1973. His work is characterized by wonderfully complicated and deep topological constructions and a broad knowledge of manifold topology and geometry.

Ron's first major result, joint with David Galewski, was a triangulation theorem for topological manifolds. Recall that an n-manifold has a piecewise linear (PL) structure (or equivalently a combinatorial triangulation) if it is covered by charts that overlap by piecewise linear homeomorphisms (or equivalently, it is homeomorphic to a simplicial complex with the property that the star of each vertex is isomorphic to a subdivision of the n-simplex).

PL structures were sorted out by Kirby and Siebenmann in 1968-69, but it was possible that non-PL manifolds had non-combinatorial triangulations. These were shown to exist when Edwards proved the Double Suspension Theorem, that, for example, a 3-dimensional manifold H with the homology of S^3, is homeomorphic to S^5 after being suspended twice (the simplices suspend to simplices but the resulting triangulation of S^5 is not combinatorial).

Galewski and Stern now showed in a beautiful *Annals* paper [gs] that all manifolds of dimension ≥ 5 have non-combinatorial triangulations iff there exists an H (as above) with Rohlin invariant one and the property that the connected sum $H\#H$ bounds an acyclic 4-manifold. Whether there is such an H has still not been settled. In dimension 4, non-PL manifolds are also not triangulable if Perelman's proof of the Poincaré Conjecture is verified.

In another lovely *Annals* paper [fs1], Ron and his now long time collaborator, Ron Fintushel, gave the first example of an exotic involution on the 4-sphere, in the sense that the quotient by the involution is not even s-cobordant to real projective 4-space, RP^4.

Beginning in 1982, Simon Donaldson and gauge theory revolutionized the subject of 4-manifolds, and Fintushel and Stern became leading players in the development of this subject. They wrote many substantial papers (e.g.

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[fs1a], [fs1b]) where they introduced topological operations that simplified the computation of these gauge theoretic invariants, culminating in the "Blow up formula" for the Donaldson invariants [fs3] which introduced an elliptic curve that was a precursor to the developments of the Seiberg-Witten equations.

However their masterpiece [fs4] involves the introduction of the Alexander polynomial of a knot into the subject of the Seiberg-Witten invariants of a 4-manifold. The Seiberg-Witten invariants of a 4-manifold X can be expressed as a finite Laurent polynomial SW_X in the basic classes in $H^2(X:Z)$.

For most elliptic surfaces, e.g. $K3$, one can remove the neighborhood of a non-singular fiber, $T^2 \times B^2$, whose boundary is the 3-torus, and glue back in the complement of a knot K in S^3 crossed with a circle (in a sense, the disk B^2 is replaced by the Seifert surface of the knot K). Fintushel and Stern exploit this surgery plus a rough relationship between gluing theorems in gauge theory and skein theory in knot theory, to prove that the new manifold X_K has Seiberg-Witten Laurent polynomial equal to the old one multiplied by the Alexander polynomial of the knot K.

This remarkable result shows that the smooth structures on, for example, $K3$, are as rich as the Alexander polynomials of knots.

Stern continues active to this day, most recently discovering (along with others) the smallest closed exotic smooth 4-manifold. His work, with his collaborators, is among the most beautiful in the field of manifold theory.

Don Saari

Before writing this part of our nomination, I thought about what we want and need from a president of the AMS. Then I thought about why I believe Ron will do a superb job.

A main responsibility of our president is to be our spokesperson. It is important to have a president who can comfortably and effectively represent us at congressional committees, with funding organizations and corporations, with other professional societies, and with the general public. But as we know from our personal experiences of trying to explain what it is that we do to our dean, or colleagues from another department, this is not easy. For success, we need someone who has the experience and special ability to work with these other groups; we need someone who can promote and describe mathematics to non-mathematicians.

Ron is such a person; for years he has been promoting mathematics on statewide panels, as the chair of his department, and currently as a highly successful dean. A way to illustrate his abilities is to point out the obvious: mathematics does not have as many endowed academic chairs as we should. The reason is clear; it is very difficult to communicate the excitement and importance of mathematics to non-mathematicians. But Ron can: a measure of his success is that he is in the process of bringing in several chairs for the UCI math department. Another indication of his unique ability to communicate is the long list of community boards on which he serves—this ranges from the Red Cross to housing authorities, to statewide efforts in promoting science. By electing Ron, we can enlist his special talents to work and influence non-mathematicians for the benefit of the AMS.

What we need from our president is leadership. In particular, we want a president with leadership skills, the willingness to listen, the talent to work with people and varied groups, the ability to appreciate different sides and achieve compromise—and someone who understands the broad and varied needs within our mathematical community. This describes Ron: he has demonstrated his leadership skills within his university and the mathematical community. We see this with his service on the MSRI Board of Trustees, where, as a member of the Steering Committee and as Secretary, he played a central role in advancing MSRI to its current level. We see this with his service to the Joint Policy Board for Mathematics and the AMS on numerous committees. Ron's professional taste and understanding have been recognized and used by many, such as the Sloan Foundation in selecting prize winners, or by the NSF in selecting new young investigators, or panels on the mathematical research institutes, or in exploring intellectual opportunities in the mathematical sciences, or in NSF site visits. Probably because of Ron's deep insights about how organizations can and should improve, Ron frequently serves on review committees for departments across the U.S. and even several in Turkey. Ron understands the needs and problems of the mathematical community.

Research is the backbone of the AMS: combining Rob's above description of Ron's valued research contributions with Ron's ability to communicate, it is understandable why Ron has been invited to be the principal speaker at so many different research conferences. But of particular relevance for our selection of Ron as president is what he can do for us; here information comes from his many contributions designed to promote the research of others. Research journals, of course, are important, and while Ron has served on several boards, what is more indicative of what we can expect from him is his willingness to invest time and energy. For instance, since its inception, Ron has been one of the most active editors of *Geometry & Topology*, and for several years he has been on the G&T executive committee. Since 1995, while serving as President and Chair of the Board of Governors for the *Pacific Math Journal*, Ron has led the journal in innovative directions. Beyond journals, Ron has played an absolutely crucial role in the formation of Mathematical Sciences Publishers, a new exciting non-profit company dedicated to high quality, low cost math publishing. This is the kind of venture that will help all of us AMS members.

Increasingly, we are discovering that it is important for AMS members to take an active role in how mathematics

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is taught in our K-12 system. But rather than just talking about it, Ron has assumed responsibility by serving on a University of California system-wide advisory council on K–12 math education and by being the PI on a large NSF science partnership grant that promotes collaborative interaction between university and K–12 faculty and students in urban areas. In another direction, Ron also is the PI for a program to encourage the brightest of the next generation. When doing my homework for this nomination, I interviewed people who know about these programs. The typical response was how Ron is "an extraordinary academic leader who epitomizes the academic missions of research, training, and service." We agree with this high praise.

Without question, Ron has the interest, knowledge, talents, leadership abilities, experience, and vision to be a successful president of the AMS. We can have these talents work for our advantage by electing Ron as President of the AMS.

Bibliography

[gs] DAVID E. GALEWSKI and RONALD J. STERN, Classification of simplicial triangulations of topological manifolds. *Ann. of Math.* (2) 111 (1980), no. 1, 1–34. MR 0558395 (81f:57012).

[fs1] RONALD FINTUSHEL and RONALD J. STERN, An exotic free involution on S^4. *Ann. of Math.* (2) 113 (1981), no. 2, 357–365. MR 0607896 (84q:57036).

[fs1a] ____, Donaldson invariants of 4-manifolds with simple type. *J. Differential Geom.* 42 (1995), no. 3, 577–633. MR 1367403 (96k:57028).

[fs1b] ____, Rational blowdowns of smooth 4-manifolds. *J. Differential Geom.* 46 (1997), no. 2, 181–235. MR 1484044 (98j:57047).

[fs3] ____, The blowup formula for Donaldson invariants. *Ann. of Math.* (2) 143 (1996), no. 3, 529–546. MR 1394968 (97i:57036).

[fs4] ____ Knots, links, and 4-manifolds. Invent. Math. 134 (1998), no. 2, 363–400. MR 1650308 (99j:57033).

Biographies of Candidates 2005

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.

Candidates have 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 their research papers.

Candidates have had the opportunity to supply a photograph to accompany their biographical information.

Candidates with an asterisk (*) beside their names were nominated in response to a petition.

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 for Advanced Study (IAS), Institute of Mathematical Statistics (IMS); International Mathematical Union (IMU); London Mathematical Society (LMS); Mathematical Association of America (MAA); Mathematical Sciences Research Institute (MSRI); 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); Society for Industrial and Applied Mathematics (SIAM).

President

James G. Glimm

Applied Mathematics and Statistics and Distinguished Professor, Stony Brook University.

Born: March 24, 1934, Peoria, Illinois, USA.

Ph.D.: Columbia University, 1959.

AMS Committees: *Electronic Research Announcements* Editorial Board, 1995–2001; Committee to Select the Winner of the Bôcher Prize, 1998–1999.

Selected Addresses: International Congress of Mathematicians Invited Addresses, Nice 1970 and Vancouver 1974; International Congress of Mathematical Physics Invited Addresses, 1972 and 1975; Plenary Address, SIAM Annual Meeting, San Diego, 2001.

Additional Information: National Science Foundation Fellowship, 1959–1960; Guggenheim Fellowships, 1963–1964 and 1965–1966; New York Academy Prize in the Physical and Mathematical Sciences, 1979; Dannie Heineman Prize for Mathematical Physics, 1980; Member, National Academy of Sciences, 1984; SIAM Board of Trustees, 1984–1992; SIAM Science Policy Committee, 1985–1999 (chair, 1988–1992); Steele Prize for a Paper of Fundamental Importance, 1993; Chair, Engineering 2000 (Stony Brook 5 year plan); Chair, Engineering 2010 (Stony Brook 5 year plan); Chair, Stony Brook Five Year Plan Coordinating Committee; National Medal of Science, 2002.

Selected Publications: 1. Type I C^*-algebras, *Ann. of Math. (2)* **73** (1961), 572–612. MR **0124756 (23:A2066)**; 2. Solutions in the large for nonlinear hyperbolic systems of equations, *Comm. Pure Appl. Math.* **18** (1965), 697–715. MR **0194770 (33:2976)**; 3. with A. Jaffe, A $\lambda\phi^4$ quantum field theory without cutoffs, I, *Phys. Rev. (2)* **176** (1968), 1945–1951. MR **0247845 (40:1106)**; 4. with E. Isaacson, D. Marchesin, and O. McBryan, Front tracking for hyperbolic systems, *Adv. in Appl. Math.* **2** (1981), 91–119. MR **0612514 (82i:76097)**; 5. with B. Cheng and D. H. Sharp, A three-dimensional renormalization group bubble merger model for Rayleigh-Taylor mixing, *Chaos* **12** (2002), 267–274. MR **1907639 (2003d:76098)**.

Statement: Our shared beliefs are in the importance of fundamental research in mathematics; our shared concerns are for the renewal of our profession, attracting the next generation of mathematical talent to their place among us. For the young, for women and for minorities, we must make an extra effort, because they will play a large role in our future. As mathematicians occupy new roles in our society, we must take advantage of the resulting new opportunities to recruit talent to our profession.

As President of the American Mathematical Society, I would work for cooperation among the mathematical organizations, with a goal to speak to the world with a common message and voice. Generally, we also gain by forming common cause with our researchers in the sciences, and so the building of bridges is important. The AMS can promote a welcoming atmosphere for mathematical research, including an awareness of its profound importance and its sense of excitement.

The meetings of the AMS require the constant injection of energy and excitement, an issue to which the Society leadership must contribute. Publications are another fundamental service of the AMS. This is not a static issue, but a changing one, as new technologies find their way into our world. But whether with new or old technologies, we need to assure the quality of our journals and their service to our members.

We must share among ourselves and across department and university barriers the best practices for building our communities, for governing our departments, for communicating with our colleagues and our administrations, for entering into a new research area, and for reaching our students.

Fundamental advances in mathematical reasoning have seldom been as pervasively important to society as they are today, and at the same time they are more at risk of being compromised. We can welcome cautiously the new opportunities this brings, while avoiding the dangers.

Ronald J. Stern

Dean, School of Physical Sciences and Professor of Mathematics, University of California, Irvine.

Born: January 20, 1947, Chicago, Illinois, USA.

Ph.D.: University of California at Los Angeles, 1973.

AMS Committees: Western Section Speaker Selection Committee (Chair), 1986–1988, 1992–1993; *Proc. Amer. Math. Soc.* Editorial Committee, 1992–1996; Subcommittee on Prizes (CoProf), 1993–1998; Committee on the Profession, 1993–1999; Working Group on Public Awareness of Mathematics, 1996–1997; Subcommittee on Membership (CoProf), 1997–1998; AMS-SMM Joint Program Committee, Denton Meeting, May 1999, 1998–2000; LAC-UCLA Mathematical Challenges of the 21st Century, 1999–2000; Committee on Publications, 1999–2002; Graduate Studies in Mathematics, 1999–2002; Committee on Committees (Chair), 2000–2005; AMS Fellows Program Subcommittee, 2002–2005; *Mathematical Reviews* Editorial Committee, 2002-2008.

Selected Addresses: MAA Invited Address, Eugene, August 1984; AMS Invited Address, Laramie, August 1985; Joint AMS-SMM Invited Address, Oaxaca, 1997; Invited Speaker, International Congress of Mathematicians, Berlin, 1998; Plenary address, DMV Jahrestagung, Heidelberg, 2004.

Additional Information: Secretary, MSRI Board of Trustees, 1992–1996; President and Chair of the Board of Governors of the *Pacific Journal of Mathematics*, 1995–; Sloan Foundation, Mathematics Selection Committee, 2000-2005; Editor, *Geometry and Topology*, 2001–; Distinguished Alumnus, Knox College, 2002; Board of Directors, Mathematical Sciences Publishers, 2004–.

Selected Publications: 1. with D. E. Galewski, Classification of simplicial triangulations of topological manifolds, *Ann. of Math. (2)* **111** (1980), no. 1, 1–34. MR **0558395 (81f:57012)**; 2. with R. Fintushel, The blowup formula for Donaldson invariants, *Ann. of Math. (2)* **143** (1996), no. 3, 529–546. MR **1394968 (97i:57036)**; 3. with R. Fintushel, Knots, links, and 4-manifolds, *Invent. Math.* **134** (1998), no. 2, 363–400. MR **1650308 (99j:57033)**; 4. with R. Fintushel, Families of simply-connected 4-manifolds with the same Seiberg-Witten invariants, *Topology* **43** (2004), 1449–1467. MR **2081432 (2005d:57044)**; 5. with R. Fintushel, Invariants for Lagrangian tori, *Geom. Topol.* **8** (2004), 947–968. MR **2087074**.

Statement: Mathematics permeates all aspects of our lives. Every science, technology, business, and government thirsts for mathematics and mathematicians to help understand complex physical and biological systems, to advance economic development, to model and predict how humans behave and interact, and to establish secure systems. For most of us there is an internal beauty that has hooked us for life and that also holds the awe of many outside of science and mathematics. However, despite this universal need for mathematics and its underlying logic and structure, as mathematicians we often feel that we are second cousins to the other sciences, are often overlooked by government agencies and private foundations, and are underappreciated by society. In its role as the largest professional organization devoted to communicating and advocating for the interests of mathematicians, the AMS has gone a long way towards communicating our research efforts and publicizing our distinguished, dedicated, and leadership role as professionals. If elected as President of the AMS it will be an honor, as well as exciting, to continue this long and successful tradition to represent and promote mathematics.

During my many years as dean I have often felt like a graduate student learning the many interrelated aspects of science, engineering and the social sciences, as well as dealing with the inter-workings of government agencies and foundations. The consistent message given to me from those outside of mathematics is their enthusiastic respect for mathematics. I have also learned that the most efficient way for mathematics to continue to earn and enhance this high regard is for us to work together with the other sciences, technologies, businesses, and government agencies over long periods of time to advance all of our mutually dependent interests (as well as prove good theorems). However, in many arenas we have allowed others to do this work. For example, large publicly traded enterprises profit from our newly discovered and hard fought knowledge through high access fees that are threatening the future of our research libraries. Many academic math depart-

ments have not done the best job to significantly influence and resonate with institutional goals. We need to continue to actively and effectively communicate to the general public, corporations, and funding agencies the importance of and our enthusiasm for mathematics. And we need to better engage our expertise to recapture and rebuild excellence at all levels of mathematics education. As President of the AMS I hope, at worst, to enthusiastically represent the mathematical community and, at best, to actively engage all of you to place mathematics in a leadership role in the research, educational, and public spheres.

Vice President

Ruth M. Charney

Professor of Mathematics, Brandeis University.

Born: December 30, 1950, New York, New York, USA.

Ph.D.: Princeton University, 1977.

AMS Offices: Member at Large of the Council, 1992–1995.

AMS Committees: Committee on the Profession, 1993–1995; Centennial Fellowship Committee, 1995–1997; Nominating Committee, 2000–2003; Central Section Program Committee, 2002–2004 (chair, 2004); Committee on the Profession, 2004–.

Selected Addresses: AMS Invited Address, Anaheim, CA, 1984; Cornell Topology Festival, 1994; Workshop on Groups and Geometry (3 lectures), Montreal, 2001; Symposium on Geometry and Topology in Group Theory, Durham, UK, 2003; AMS Invited Address, Nashville, TN, 2004.

Additional Information: Member, AWM, 1984–; Executive Committee, AWM, 1990–1993; Board of Trustees, Mathematical Sciences Research Institute, 1993–1995; Editorial Board, *Algebraic and Geometric Topology*, 2000–; Member, U.S. National Committee for Mathematics, 2005–.

Selected Publications: 1. Homology stability for GL_n of a Dedekind domain, *Invent. Math.* **56** (1980), 1–17. MR **0557579 (81h:18010)**; 2. with M. Davis, The $K(\pi, 1)$-problem for hyperplane complements associated to infinite reflection groups, *J. Amer. Math. Soc.* **8** (1995), 597–627. MR **1303028 (95i:52011)**; 3. with M. Davis, When is a Coxeter system determined by its Coxeter group?, *J. London Math. Soc. (2)* **61** (2000), 441–461. MR **1760693 (2001i:20078)**; 4. with A. Lytchak, Metric characterizations of spherical and Euclidean buildings, *Geom. Topol.* **5** (2001), 521–550 (electronic). MR **1833752 (2002h:51008)**; 5. with D. Peifer, The $K(\pi, 1)$-conjecture for the affine braid groups, *Comment. Math. Helv.* **78** (2003), 584–600. MR **1998395 (2004f:20067)**.

Statement: There are several issues facing the mathematical community that require continued attention. These include the under-representation of women and minorities, the need to encourage and support talented young people, and the challenge of improving mathematics education for children and teachers. The AMS must continue to seek creative solutions to these problems. Newer trends that affect the community, such as changes in the nature of mathematics publication, should also be monitored. The AMS plays a crucial role in communicating the importance of mathematics to the general public, to university administrators, and to government and funding agencies. Strengthening ties with other fields and assuring that we are providing the appropriate mathematical preparation for their students will enhance the position of mathematics in this regard. At the same time, the AMS must continue to celebrate pure mathematics and to highlight its centrality in the scientific endeavor.

Carlos E. Kenig

Louis Block Distinguished Service Professor, University of Chicago.

Born: November 25, 1953, Buenos Aires, Argentina.

Ph.D.: University of Chicago, 1978.

AMS Offices: Member at Large of the Council, 1984–1986; Representative of *J. Amer. Math. Soc.*, 2000–2002.

AMS Committees: Editorial Boards Committee, 1989–1992; Committee on Cooperation with Latin American Mathematicians, 1990–1992; Committee on Accessibility for the Handicapped, 1993–1997; *Bulletin*, Associate Editor for Research Reports, 1994–1997; AMS-MAA Committee on Mathematicians with Disabilities, 1997–2000; *J. Amer. Math. Soc.* Editorial Board, 1998–2002; Committee on Committees, 1999–2001; AMS-RSME Program Committee, June 2003, 2001–2003; *Electronic Research Announcements* Editorial Board, 2005–.

Selected Addresses: AMS Invited Address, Columbia, MO, 1985; ICM Invited Address, Berkeley, 1986; CBMS-AMS Lectures on Harmonic Analysis and Partial Differential Equations, St. Louis, MO, 1991; AMS Invited Address, Detroit, MI, 1997; ICM Invited Address, Beijing, 2002.

Additional Information: Alfred P. Sloan Research Fellow, 1981–1983; Salem Prize, 1984; John Simon Guggenheim Fellowship, 1986; Editor, *Internat. Math. Res. Notices*, 1991–; Organizing Committee, ICMS Program in Harmonic Analysis and PDE, Edinburgh, 1994; Chair, Organizing Committee, MSRI program in Harmonic Analysis and PDE, Berkeley, 1997; Executive Editor, JFAA, 1998–; Editor, *Math. Ann.*, 1998–; Managing Editor, *J. Amer. Math. Soc.*, 2000–2002; Fellow, American Academy of Arts and Sciences, 2002; Co-Organizer, PCMI Graduate Course in Harmonic Analysis and PDE, Park City, Utah, 2003; Co-Organizer, Special Year on Analysis and PDE, IAS, 2003–2004; Co-Organizer, Harmonic Analysis Trimester, Scuola Normale, Pisa, 2004; Co-Organizer, MSRI program on Nonlinear Dispersive Equations, Berkeley, 2005. Editorial boards of 14 additional journals and book series.

Selected Publications: 1. *Harmonic Analysis Techniques for Second Order Elliptic Boundary Value Problems*, CBMS Regional Conference Series in Mathematics, vol. 83, Amer. Math. Soc., Providence, 1994. MR **1282720 (96a:35040)**; 2.

with L. A. Caffarelli and D. Jerison, Global energy minimizers for free boundary problems and full regularity in three dimensions, *Noncompact Problems at the Intersection of Geometry, Analysis, and Topology*, Contemporary Mathematics, vol. 350, Amer. Math. Soc., Providence, 2004, pp. 83–97. MR **2082392 (2005e:35258)**; 3. with G. Ponce and L. Vega, The Cauchy problem for quasi-linear Schrödinger equations, *Invent. Math.* **158** (2004), 343–388. MR **2096797 (Review)**; 4. with A. Ionescu, L^p Carleman inequalities and uniqueness of solutions of nonlinear Schrödinger equations, *Acta Math.* **193** (2004), 193–239; 5. with J. Bourgain, On localization in the continuous Anderson-Bernoulli model in higher dimensions, *Invent. Math.*, Online First, March 1, 2005.

Statement: I would strive to strengthen the AMS in its role as the major organization fostering research in mathematics in the USA. In connection with this, I feel that it is vital that every effort be made to ensure the full participation in mathematical research and in the AMS, of all underrepresented groups, including minorities, persons with disabilities and women. We also need to ensure that graduate and undergraduate students, postdocs and young researchers are properly nurtured and mentored, in order to maintain and expand the current very successful research enterprise. Because of my own extensive research experience and because I have trained and mentored a number of students, postdocs and young researchers, many of them women, I feel that I would be able to make a useful contribution towards these goals.

Trustee

John B. Conway

Professor of Mathematics, University of Tennessee, and Program Officer, National Science Foundation.

Born: September 22, 1939, New Orleans, Louisiana, USA.

Ph.D.: Louisiana State University, 1965.

AMS Offices: Member at Large of the Council, 1996–1999; Executive Committee, 1997–2001; Board of Trustees, 2001–2006.

AMS Committees: Committee on Publications, 1995–1997; Committee to Review the Book Publishing Program, 1999; Committee on Meetings and Conferences, 2001–2002; Committee on Education, 2002–2005.

Selected Addresses: Principal speaker at conference on operator theory; 3 lectures at the University of North Carolina, 1977; Special session on operator theory at AMS national meeting in Biloxi, 1979; Special session on operator theory at AMS national meeting in Cincinnati, 1981; Special session in operator theory at AMS national meeting in Louisville, 1984; One of the principal speakers (4 lectures) at NATO Conference "Operators and Function Theory" held at University of Lancaster, England, 1984; Invited Lecturer at American Mathematical Society Summer Institute in Operator Theory, 1988; Special session of the AMS national meeting, San Diego, 1997.

Additional Information: I was born, raised, and received my predoctoral education in New Orleans. I got a Ph.D. from Louisiana State University in 1965 and went to Indiana University, where I stayed until 1990. In 1990 I became head of the mathematics department at the University of Tennessee, a position I held for 13 years. In 2003 I accepted a position as a rotator at the National Science Foundation, where I remain today. I have published several papers, mainly on function theoretic operator theory, written seven books, and had 19 Ph.D. students.

Selected Publications: 1. with R. F. Olin, A functional calculus for subnormal operators. II, *Mem. Amer. Math. Soc.* **10** (1977), no. 184. MR **0435913 (55:8864)**; 2. with B. B. Morrel, Roots and logarithms of bounded operators on a Hilbert space, *J. Funct. Anal.* **70** (1987), 171–193. MR **0870760 (87m:47044)**; 3. with D. A. Herrero and B. B. Morrel, Completing the Riesz-Dunford functional calculus, *Mem. Amer. Math. Soc.* **82** (1989), Number 417. MR **0974999 (90m:47023)**; 4. Towards a functional calculus for subnormal tuples: the minimal normal extension, *Trans. Amer. Math. Soc.* **326** (1991), 543–567. MR **1005077 (91k:47048)**; 5. *On Being a Department Head, a Personal View*, Amer. Math. Soc., Providence, 1996.

Statement: The purpose of the Society is to promote research and education in mathematics. This is accomplished in a variety of ways. The role of the Board of Trustees in this endeavor is to help maintain the fiscal health of the Society, work with the officers to promote the furtherance of mathematics, and to help make sure the pursuit of the Society's goals is never subjugated to distracting considerations.

James A. Donaldson

Professor of Mathematics and Dean of the College of Arts and Sciences, Howard University.

Born: April 17, 1941, Madison County, Florida, USA.

Ph.D.: University of Illinois at Urbana-Champaign, 1965.

AMS Offices: Member at Large of the Council, 1978–1980.

AMS Committees: Committee on Opportunities in Mathematics for Disadvantaged Groups, 1978–1982 (chair, 1980–1982); Committee on Committees, 1979–1980; Committee on Science Policy, 1992–1994; Committee on Service to Mathematicians in Developing Countries, 1987–1993.

Selected Addresses: AMS Special Sessions: Washington, DC, January 1975, San Antonio, TX, January 1976, Washington, DC, October 1979, New Orleans, LA, January 1986; SAMS-AMS-LMS Conference, Pretoria, South Africa, June 1997; Invited Talks: Symposium on Mathematics and Computations, Ho Chi Minh City, Vietnam, April 1988, First CAARMS, MSRI, Berkeley, 1995, Third Pan African Congress of Mathematicians, Nairobi, Kenya, August 1991.

Additional Information: Chair, Department of Mathematics, Howard University, 1972–1990; Second Vice President, MAA, 1994–1995; Electorate Nominating Committee of the Mathematics Section (Section A) of AAAS, 1994–1997; Interim President, Lincoln University (PA), 1998–1999; Dean, College of Arts and Sciences, Howard University, 1999–. Visiting Positions: Courant Institute of Mathematical Sciences, University of Victoria, Universita degli Studi di Ferrara, and Duke University. Member: AAAS, AWM, CAARMS, MAA, NAM, SIAM.

Selected Publications: 1. with A. G. Gibson and R. Hersh, On the invariance principle of scattering theory, *J. Functional Anal.* **14** (1973), 131–145. MR **50:2949**; 2. The Cauchy problem for a first order system of abstract operator equations, *Bull. Amer. Math. Soc.* **81** (1975), 576–587. MR **54:7985**; 3. with J. A. Goldstein, Some remarks on uniqueness for a class of singular abstract Cauchy problems, *Proc. Amer. Math. Soc.* **54** (1976), 149–153. MR **52:11234**; 4. The abstract Cauchy problem, *J. Differential Equations* **25** (1977), 400–409. MR **57:12470**; 5. with D. A. Williams III, The linear shallow water theory: A mathematical justification, *SIAM J. Math. Anal.* **24** (1993), 892–910. MR **94j:35143**.

Statement: The American Mathematical Society, through its publications and many activities, has served mathematics well by fostering research and scholarship and disseminating new mathematical ideas and results to its members and the wider community. In the present climate of economic constraints, it is imperative that current resources are used optimally in fulfilling the mission of AMS and that new sources of support are identified and pursued aggressively. As a trustee, I will work to ensure that the fiscal foundation of the Society remains strong, and to participate in AMS initiatives to expand its membership to include greater numbers of mathematicians from all groups, especially from those traditionally underrepresented in the discipline.

Member at Large of the Council

William M. Goldman

Professor of Mathematics, University of Maryland.

Born: November 17, 1955, Kansas City, Missouri, USA.

Ph.D.: University of California, Berkeley, 1980.

AMS Committees: AMS Representative to Committee on Summer Research Conferences, 2003–.

Selected Addresses: AMS Invited Address, University of Massachusetts, October 1990; "Complex Geometry," commemorating the fiftieth anniversary of Osaka University, December 1990; "Discrete groups, Geometry and Arithmetic," commemorating the sixtieth birthday of M. S. Raghunathan, Tata Institute of Fundamental Research, Mumbai, December 2001; "Complex Geometry and Dynamical Systems," commemorating the sixtieth birthday of Alberto Verjovsky, Cuernavaca, January 2003; "Bounded cohomology, harmonic maps and Higgs bundles," Strasbourg and Basel, March 2005.

Additional Information: NSF Graduate Fellow, 1977–1980; NSF Postdoctoral Fellow, 1980–1981; Member, MSRI, 1984–1985; Alfred P. Sloan Foundation Fellow, 1988–1990; Visiting Professor, Oxford University, Spring 1989; Board of Governors, Geometry Center, University of Minnesota, 1993–1995; Associate Chair for Graduate Studies, University of Maryland, 1995–1998; Director and Founder, Experimental Geometry Lab, University of Maryland, 2000–; Departmental Representative, MSRI Committee of Academic Sponsors, 2002–2005; Director, Maryland VIGRE program, 2004–; Editor-in-chief, *Geometriae Dedicata*, 2004–.

Selected Publications: 1. with D. Fried, Three-dimensional affine crystallographic groups, *Adv. in Math.* **47** (1983), 1–49. MR **0689763 (84d:20047)**; 2. Invariant functions on Lie groups and Hamiltonian flows of surface group representations, *Invent. Math.* **85** (1986), 263–302. MR **0846929 (87j:32069)**; 3. with J. Millson, The deformation theory of representations of fundamental groups of compact Kähler manifolds, *Inst. Hautes Études Sci. Publ. Math.* no. 67 (1988), 43–96. MR **0972343 (90b:32041)**; 4. with S. Choi, The classification of real projective structures on compact surfaces, *Bull. Amer. Math. Soc. (N.S.)* **34** (2) (1997), 161–171. MR **1414974 (97m:57020)**; 5. Ergodic theory on moduli spaces, *Ann. of Math. (2)* **146** (1997), 475–507. MR **1491446 (99a:58024)**.

Statement: The mathematical research community faces serious challenges.

Resources are needed to cultivate mathematics, especially to better involve younger mathematicians and under-represented groups. Training should emphasize versatility since the current supply of academic positions cannot keep pace with the rate we produce Ph.D.s.

Clarifying and communicating the role mathematics plays in our culture is necessary for its promotion. Mathematics differs fundamentally from experimental sciences. Fierce competition with other disciplines for research funding demands articulating our unique needs and characteristics. We must resist having our well-established and successful research practices forced into unsuitable molds. We cannot let ourselves become hostage to publishing companies who may be tempted to view us as a helplessly captive market. Publications need both the sincere commitment of researchers as well as a competent infrastructure. In particular our means of dissemination must adapt to ever-advancing technology.

Major advances in mathematics occur at a breathtaking pace. Through teaching and outreach, we can communicate the fascination and wonder which initially attracted us. The American Mathematical Society is the leading organization to ensure that mathematics continues to be vibrant and exciting. I am honored to be considered to serve on its Council.

Craig L. Huneke

Professor of Mathematics, University of Kansas.
Born: August 27, 1951, Norman, Oklahoma, USA.
Ph.D.: Yale University, 1978.
AMS Committees: Contemporary Mathematics Editorial Committee, 1991–1995 (Managing Editor, 1993–1995); *Bull. Amer. Math. Soc.* Editorial Committee, 1999–2002; Committee on Meetings and Conferences, 2002–2005; Committee to Select Steele Prize, 2003–2006; Committee to Select the Winner of the Cole Prize (in Algebra) for 2006, 2005–2006.
Selected Addresses: AMS Invited Address, Knoxville, 1988; Invited Speaker in Algebra, International Congress of Mathematicians, Kyoto, 1990; CBMS Principal Lecturer, North Dakota State, 1995; Mid-Atlantic Algebra Conference, Main Speaker, George Mason University, 2000; Howard-Hayden Speaker, University of Kentucky, 2003; Arkansas Spring Lecture Series, 2005.
Additional Information: Michigan Jr. Fellow, 1978–1981; NSF Postdoctoral Fellowship, 1981–1982; Sloan Postdoctoral Fellowship, 1984; Fulbright Scholar, 1998; Scientific Advisory Committee, Banff International Research Station, 2001–2003. Other Editorial Boards: *Math. Research Letters*, 1993–, *J. Algebra*, 1996–2005, *Collect. Math.*, 2000–, *Ann. Fac. Sci. Toulouse Math.*, 2003–.
Selected Publications: 1. with B. Ulrich, The structure of linkage, *Ann. of Math. (2)* **126** (1987), 277–334. MR **0908149 (88k:13020)**; 2. with M. Hochster, Tight closure, invariant theory, and the Briançon-Skoda theorem, *J. Amer. Math. Soc.* **3** (1990), 31–116. MR **1017784 (91g:13010)**; 3. Uniform bounds in Noetherian rings, *Invent. Math.* **107** (1992), 203–223. MR **1135470 (93b:13027)**; 4. with M. Hochster, Comparison of symbolic and ordinary powers of ideals, *Invent. Math.* **147** (2002), 349–369. MR **1881923 (2002m:13002)**; 5. with D. Eisenbud and B. Ulrich, Heights of ideals of minors, *Amer. J. Math.* **126** (2004), 417–438. MR **2045507 (2005b:13022)**.
Statement: The AMS is the main public face of mathematical research in the United States. As I grow older I feel more indebted to the AMS. I am impressed by the number of activities it supports, and by the level of thought and effort which go into its decisions. It seems to me the main problems the AMS faces don't change much over time: making our profession attractive to young people, and finding ways to increase support for research are two constant challenges. I appreciate the increased attention the AMS is giving to all levels of mathematics, although I feel a partly neglected group in our profession are mid-career mathematicians. I hope to contribute to the vitality of mathematics through serving on the Council.

Judy Anita Kennedy

Professor, Department of Mathematical Sciences, University of Delaware.
Born: July 24, 1947, Mobile, Alabama, USA.
Ph.D.: Auburn University, 1975.
Additional Information: Conference Organization: Organized or Co-organized 2 NSF-supported Conferences (at UD), 3 AMS Special Sessions, 3 SIAM Mini-Symposia, 4 Special Sessions at various topology conferences. Conference Committees: Served on Executive, Steering, and Advisory Committees for the Summer Topology Conference and Spring Topology/Dynamics Conference over a period of 6 or so years. Editorships: Editor for *Topology Proceedings* and Guest Editor for *Topology and Applications*. Reviewing: Refereed for numerous journals and grant proposals, served on 5 NSF panels.
Selected Addresses: Invited Speaker, Joint Summer Research Conference in the Mathematical Sciences: Relationships Between Continuum Theory and the Theory of Dynamical Systems, Humboldt State University, Arcata, California, June 1989; Ralph Bennett Memorial Lecture, Auburn University, Alabama, May 1992; Lecture, Dinner Meeting, New York Academy of Sciences (Mathematics Section), January 1994; Invited Speaker, 8th Prague Topological Symposium, Prague, Czech Republic, August 1996; Plenary Talk, 2002 Annual Spring Topology/Dynamics Conference, University of Texas at Austin, Austin, Texas, March 2002.
Selected Publications: 1. Stable extensions of homeomorphisms on the pseudo-arc, *Trans. Amer. Math. Soc.* **310** (1988), 167–178. MR **0939804 (89d:54023)**; 2. with J. A. Yorke, Pseudocircles in dynamical systems, *Trans. Amer. Math. Soc.* **343** (1994), 349–366. MR **1187029 (94g:58166)**; 3. with J. A. Yorke, Bizarre topology is natural in dynamical systems, *Bull. Amer. Math. Soc. (N.S.)* **32** (1995), 309–316. MR **1307903 (95j:58107)**; 4. with S. Koçak and J. A. Yorke, A chaos lemma, *Amer. Math. Monthly* **108** (2001), 411–423. MR **1837861 (2002f:37057)**; 5. with E. Akin and M. Hurley, Dynamics of topologically generic homeomorphisms, *Mem. Amer. Math. Soc.* **164** (2003), no. 783. MR **1980335 (2004j:37024)**.
Statement: Mathematicians in academia are increasingly under pressure (1) to give "popular" courses rather than more challenging, thought-provoking ones, and (2) to do research that brings in large amounts of funding rather than follow their own hearts, both often at the expense of their own integrity and more important long-term goals. While staying relevant in our fast-changing world is important, so are the instincts (as to what is important) of the people doing the teaching and research in our institutions today. The AMS should address these problems.

William McCallum

Professor of Mathematics, University of Arizona.
Born: August 31, 1956, Sydney, New South Wales, Australia.
Ph.D.: Harvard University, 1984.
AMS Committees: Committee on Education, 2002– (chair, 2004–).
Selected Addresses: Barrett Lectures, University of Tennessee, 2002; Canadian Number Theory Association, VII Meeting, Montreal, 2002; Mathematics Education and Mathematics in the 21st Century, University of Arizona, 2003; Congrès Iwasawa, Besançon, 2004 (all invited addresses).
Additional Information: AMS Centennial Fellowship, 1995–1996.
Selected Publications: 1. with R. Coleman, Stable reduction of Fermat curves and Jacobi sum Hecke characters, *J. Reine Angew. Math.* 385 (1988), 41–101. MR **0931215 (89h:11026)**; 2. On the Shafarevich-Tate group of the Jacobian of a quotient of the Fermat curve, *Invent. Math.* **93** (1988), 637–666. MR **0952286 (90b:11059)**; 3. On the method of Coleman and Chabauty, *Math. Ann.* **299** (1994), 565–596. MR **1282232 (95c:11079)**; 4. with R. T. Sharifi, A cup product in the Galois cohomology of number fields, *Duke Math J.* **120** (2003), 269–310. MR **2019977 (2004j:11136)**; 5. Promoting work on education in mathematics departments, *Notices Amer. Math. Soc.*, October, 2003.
Statement: The AMS is run by its members, and our common task is to affirm the position of mathematics as central to human knowledge, necessary for informed participation in society, and fundamental to scientific progress. This requires effort on many fronts: nurturing basic research, improving the quality of education, ensuring equal opportunity, and promoting public awareness. I bring to this task my experience in these areas, which includes organizing international conferences in both research and education, fostering at a national level productive discussions between mathematicians and educators, and working at my own institution to promote diversity in the sciences and public awareness of mathematics.

Ken Ono

Manasse Professor of Letters and Science, University of Wisconsin, Madison.
Born: March 20, 1968, Philadelphia, Pennsylvania, USA.
Ph.D.: University of California at Los Angeles, 1993.
Selected Addresses: Recent trends in analytic number theory, Clay Mathematics Institute Conference at the Institute for Advanced Study, April 2000; AMS Invited Address, Central Sectional Meeting, March 2001; Invited Address, 5th Annual Chinese-American Frontiers of Sciences Symposium, U.S. National Academy of Sciences, October 2002; CBMS Distinguished Conference Lecturer (10 lectures), Urbana, Illinois, June 2003; Gauss-Dirichlet Conference, Göttingen, Germany, June 2005.
Additional Information: NSF Postdoctoral Fellowship, 1995; NSA Young Investigator, 1997; NSF CAREER Award, 1998; Alfred P. Sloan Foundation Research Fellowship, 1999; David and Lucile Packard Research Fellowship, 1999; Presidential Early Career Award (PECASE, Awarded by Pres. Clinton), 1999; Romnes Fellowship, 2002; NSF-CBMS Conference Lecturer, 2003; John S. Guggenheim Foundation Fellowship, 2003; NSF FRG Grant: Arakelov theory of modular forms (PI), 2004–2007; University of Wisconsin VIGRE Grant (Co-PI), 2004–2009; NSF Director's Distinguished Teaching Scholar Award, 2005; Editor: *Integers, International Journal of Number Theory, Ramanujan Journal, International Journal of Mathematics and the Mathematical Sciences, Proceedings of the Amer. Math. Soc.*
Selected Publications: 1. with K. Soundararajan, Ramanujan's ternary quadratic form, *Invent. Math.* **130** (1997), 415–454. MR **1483991 (99b:11036)**; 2. with C. Skinner, Fourier coefficients of half-integral weight modular forms modulo *l*, *Ann. of Math. (2)* **147** (1998), 453–470. MR **1626761 (99f:11059a)**; 3. with W. Kohnen, Indivisibility of class numbers of imaginary quadratic fields and orders of Tate-Shafarevich groups of elliptic curves with complex multiplication, *Invent. Math.* **135** (1999), 387–398. MR **666783 (2000c:11087)**; 4. Distribution of the partition function modulo *m*, *Ann. of Math. (2)* **151** (2000), 293–307. MR **1745012 (2000k:11115)**; 5. *The Web of Modularity: Arithmetic of the Coefficients of Modular Forms and q-Series*, CBMS Regional Conference Series in Mathematics, no. 102, Amer. Math. Soc., Providence, 2004. MR **2020489 (2005c:11053)**.
Statement: The AMS plays many important roles in promoting mathematics and mathematicians. If elected, I will assume leadership roles in both policy and outreach. If elected, I look forward to working closely with John Ewing (Executive Director of the AMS) and Samuel Rankin (Assoc. Executive Director) and the AMS Policy Committee to advocate for federal investment in the mathematical sciences. In terms of outreach, I will work to amplify efforts in K-12 outreach. I have already raised funds to help support the "Who wants to be a mathematician?" AMS program for high school students, and as a Council member I would work to cultivate further sources of financial support. I would be honored to serve the mathematical community as a member of the AMS Council, and I look forward to challenges that membership presents.

Freydoon Shahidi

Distinguished Professor of Mathematics, Purdue University.
Born: June 19, 1947, Tehran, Iran.
Ph.D.: The Johns Hopkins University, 1975.
AMS Committees: AMS/NSA Advisory Panel, 1994–1997.
Selected Addresses: AMS Invited Address, Boston, 1995; IAS/Park City Summer School, 2002; ICM Invited Address, Beijing, 2002; Special Session at India-AMS Meeting, Ban-

galore, 2003; Joseph Fels Ritt Lectures, Columbia University, 2005.
Additional Information: Member: IAS, 1975–1976, 1983–1984, 1990–1991; Editorial Boards: *Iranian International J. Science*, 2000–; *Canadian J. Math.*, 2001–; *Canadian Math. Bull.*, 2001–; *Internat. Math. Res. Notices*, 2002–; *American J. Math.*, 2003–; *Bull. Iranian Math. Soc.*, 2004–. Honors: Clay Math. Institute Prize Fellow, 2000; Honorary Member of Iranian Math. Society, 2000–; Guggenheim Fellow, 2001.
Selected Publications: 1. A proof of Langlands' conjecture on Plancherel measures; complementary series for p-adic groups, *Ann. of Math. (2)* **132** (1990), 273–330. MR **1070599 (91m:11095)**; 2. with S. Gelbart, Boundedness of automorphic L-functions in vertical strips, *J. Amer. Math. Soc.* **14** (2001), 79–107 (electronic). MR **1800349 (2003a:11056)**; 3. with H. H. Kim, Cuspidality of symmetric powers with applications, *Duke Math. J.* **112** (2002), 177–197. MR **1890650 (2003a:11075)**; 4. with H. H. Kim, Functorial products for $GL_2 x GL_3$ and the symmetric cube for GL_2, *Ann. of Math. (2)* **155** (2002), 837–893. MR **1923967 (2003m:11075)**; 5. with J. Cogdell, H. H. Kim, and I. I. Piatetski-Shapiro, Functoriality for classical groups, *Publ. Math. Inst. Hautes Études Sci.* no. 99 (2004), 163–233. MR **2075885**.
Statement: What has brought all of us together, whether as educators, researchers or administrators, is our passion for mathematics. With many striking recent developments, enriching both core and interdisciplinary mathematics, AMS is now in a strong position to emphasize the significance of mathematical research to the public as well as the community. I believe a genuine effort in this direction will attract more membership and make a stronger AMS. The issue of employment for our students and the younger members of our community is a serious matter that all of us face as either job seekers or mentors and teachers every year. The AMS has been very important in providing us with many resources in this matter, but in this day and time as many departments are losing their hiring independence, more aggressive solutions may be needed. Similar efforts should be made in dealing with funding agencies, which with all their good intentions, lack the resources to fund but the very top proposals. The AMS has been very successful in organizing conferences and forums for bringing the community together. We should try to encourage the participation of our younger members as well as women and minorities with whatever means we have. Serving at the AMS Council is a privilege and I would be honored, given the chance.

Christina Sormani
Associate Professor of Mathematics, CUNY Graduate Center and Lehman College.
Born: September 23, 1969, New York, New York, USA.
Ph.D.: Courant Institute, New York University, 1996.

Selected Addresses: Differential Geometry Seminars at Harvard, MIT, Brown, U. Pennsylvania, Johns Hopkins, U. Maryland, Columbia, and IUPUI, 1999–2004; Invited Speaker, AWM Meeting, 2000; Stony Brook Colloquia, 2001; Invited Speaker, AIM General Relativity, 2002; Invited Speaker, CRM Spectral Geometry, 2004; Dartmouth Colloquia, 2004.
Additional Information: NSF Fellow, 1991–1996; Moderator, AWM web forum, How to Increase the Number of Tenured Women in Mathematics, 1999–2000; Co-organizer, four AMS Special Sessions, 2000–2004; NSF Research Grant, 2001–2004; PSC CUNY Grant Review Board, 2003; Moderator, AWM web forum, Diverse Personal Lives of Mathematicians, 2003–2004; Coorganized CUNY Geometric Analysis Conferences, 2004 and 2005.
Selected Publications: 1. Busemann functions on manifolds with lower bounds on Ricci curvature and minimal volume growth, *J. Differential Geom.* **48** (1998), no. 3, 557–585. MR **1638053 (2000e:53041)**; 2. Nonnegative Ricci curvature, small linear diameter growth, and finite generation of fundamental groups, *J. Differential Geom.* **54** (2000), no. 3, 547–559. MR **1823314 (2003a:53047)**; 3. with Z. Shen, The codimension one homology of a complete manifold with nonnegative Ricci curvature, *Amer. J. Math.* **123** (2001), no. 3, 515–524. MR **1833151 (2002i:53048)**; 4. with G. Wei, Universal covers for Hausdorff limits of noncompact spaces, *Trans. Amer. Math. Soc.* **356** (2004), no. 3, 1233–1270 (electronic). MR **2021619**; 5. Friedmann cosmology and almost isotropy, *Geom. Funct. Anal.* **14** (2004), no. 4, 853–912. MR **2084982**; 6. with G. Wei, The covering spectrum of a compact length space, *J. Differential Geom.* **66** (2004), 647–689.
Statement: One of the primary goals of the American Mathematical Society is to enable mathematicians to conduct their research and disseminate it. Due to an increasingly tight job market, many research mathematicians are now located at universities and colleges which do not recognize their research. These mathematicians are subjected to high teaching loads, little opportunity for grant funding, decreasing access to increasingly expensive journals, and paper-counting deans that veto tenure. While MathSciNet, the arXiv and regional AMS meetings have provided significant research assistance to these mathematicians, there is a serious need to adequately recognize their contribution to mathematics.
I propose an AMS award for the top one thousand papers published each year consisting of a simple annotation next to the MathSciNet review. Unlike the "featured reviews", these papers would be nominated by the editors of journals and reviewed by panels of experts in each field. Naturally, most papers in very selective journals would get such rewards and this would become a competition between journals, allowing new online journals the opportunity to rise in prestige.

If elected to the AMS Council, I would push for the implementation of this award and other AMS services which support mathematicians in all departments.

Ravi Vakil

Assistant Professor of Mathematics, Stanford University.
Born: February 22, 1970, Toronto, Ontario, Canada.
Ph.D.: Harvard University, 1997.
AMS Committees: Representative to the MAA Committee on Mathematical Competitions, 2004–.
Selected Addresses: Hong Kong Geometry Colloquium, 2003; Berkeley Colloquium, 2004; Park City Mathematical Institute, 2004; Invited Plenary Lecture, Joint AMS-MAA Meetings, Atlanta, 2005; Andre-Aisenstadt Award Lecture, Centre de Recherches Mathématiques, 2005.
Additional Information: Trevor Evans Award for expository writing, 1999; G. de B. Robinson Award, 1999; AMS Centennial Fellow, 2001–2003; Sloan Research Fellowship, 2002–2005; Terman Fellow, 2003–2006; Presidential Early Career Award for Scientists and Engineers (PECASE) and NSF CAREER award, 2003–2008; Alden H. and Winifred Brown Faculty Fellow, 2004–2005; Andre-Aisenstadt Award, CRM, 2005; Associate Editor, *Canadian Journal of Mathematics* and *Canadian Mathematical Bulletin*, 2005–.
Selected Publications: 1. with K. Hori, S. Katz, A. Klemm, R. Pandharipande, R. Thomas, C. Vafa, and E. Zaslow, *Mirror Symmetry*, Amer. Math. Soc., Providence; Clay Math. Institute, Cambridge, 2003. MR **2003030 (2004g:14042)**; 2. A geometric Littlewood-Richardson rule, *Ann. of Math.*, to appear; 3. with T. Graber, Relative virtual localization, and vanishing of tautological classes on moduli spaces of curves, *Duke Math. J.*, to appear; 4. Schubert induction, *Ann. of Math.*, to appear; 5. Murphy's Law in algebraic geometry: Badly-behaved deformation spaces, submitted.
Statement: It is essential that the AMS continue to provide a strong voice for mathematics and mathematicians. Young mathematicians in particular should be convinced of the benefits of joining the AMS—both to themselves, and more important, to the health of mathematics. Conversely, the AMS should represent newer members of our community by being responsive to the challenges mathematicians face at the start of their careers.

Dan-Virgil Voiculescu

Professor of Mathematics, University of California at Berkeley.
Born: June 14, 1949, Bucharest, Romania.
Ph.D.: University of Bucharest, 1977.
AMS Committees: Committee on National Meetings, 1997–1999; *Transactions* and *Memoirs* Editorial Committee, 2002–2003.
Selected Addresses: Invited Address, International Congress of Mathematicians, Warsaw, 1983; Invited Address, European Congress of Mathematics, Paris, 1992; Invited Plenary Address, International Congress of Mathematicians, Zurich, 1994; Invited Plenary Address, AMS Meeting and Scandinavian Math Congress, Odense, 2000; Invited Plenary Address, International Congress Mathematical Physics, Lisbon, 2003.
Additional Information: Aisenstadt Chair, CRM Montreal, Spring 1991; Co-chair, Organizing Committee, MSRI Program on Operator Algebras, academic year 2000–2001; International Blaise Pascal Research Chair, Paris, Spring 2003 and 2004; NAS Award in Mathematics, 2004.
Selected Publications: 1. A non-commutative Weyl-von Neumann theorem, *Rev. Roumaine Math. Pures Appl.* **21** (1976), 97–113. MR **0415338 (54:3427)**; 2. with M. Pimsner, K-groups of reduced crossed products by free groups, *J. Operator Theory* **8** (1982), 131–156. MR **0670181 (84d:46092)**; 3. Limit laws for random matrices and free products, *Invent. Math.* **104** (1991), 201–220. MR **1094052 (92d:46163)**; 4. Circular and semicircular systems and free product factors, in *Operator Algebras, Unitary Representations, Enveloping Algebras, and Invariant Theory (Paris, 1989)*, Progr. Math., vol. 92, Birkhäuser Boston, Boston, MA, 1990, pp. 45–60. MR **1103585 (92e:46124)**; 5. Free entropy, *Bull. London Math. Soc.* **34** (2002), 257–278. MR **1887698 (2003c:46077)**.
Statement: A permanent role of the AMS is to help mathematicians and nonmathematicians keep a perspective of where mathematics is going. With the increase of publications and specialization, there is also an increased need for communication of essential ideas in simple form and for connecting with other fields and sciences. If elected I would emphasize the continuation of the work which the AMS has been doing in this direction.

Judy L. Walker

Associate Professor of Mathematics, University of Nebraska.
Born: April 29, 1969, Chicago, Illinois, USA.
Ph.D.: University of Illinois, 1996.
AMS Committees: Arnold Ross Lecture Series Committee, 2001–2004; Committee on the Morgan Prize for Outstanding Research in Mathematics by an Undergraduate Student, 2005–2008.
Selected Addresses: Nine AMS Special Session Invited Talks, 1997–2004; Institute for Advanced Study Program for Women (eight hour lecture series), 1999; Colloquia and/or Seminars at Wisconsin, Penn State, Notre Dame, Illinois, Colorado, 2002–2005; "Reconnect" Workshop (15 hour lecture series), Salem, MA, 2003; AMS Invited Address, Lincoln, October 2005.
Additional Information: Co-founder and co-organizer, All Girls/All Math Program, 1997–; Co-founder and co-organizer, Nebraska Conference for Undergraduate Women in Mathematics, 1999–; Editor for Rose-Hulman Under-

graduate Mathematics Journal, 1999–; Editor for *J. Pure Appl. Algebra*, 2001–; AWM Executive Committee, 2002–2004; MAA Sectional Award for Distinguished Teaching, 2003; AWM Workshop Committee, 2004–. Member: AWM, IEEE, MAA.

Selected Publications: 1. with R. Koetter, W. Li, and P. Vontobel, Pseudo-codewords of cycle codes via zeta functions, Proceedings of the IEEE Information Theory Workshop, San Antonio, TX, October 24–29, 2004; 2. with A. Silverberg and J. Staddon, Applications of list decoding to tracing traitors, *IEEE Trans. Inform. Theory* **49** (2003), 1312–1318. MR **1984829 (2004f:94075)**; 3. *Codes and Curves*, Student Mathematical Library, vol. 7, IAS/Park City Mathematical Subseries, Amer. Math. Soc., Providence, RI; Institute for Advanced Study (IAS), Princeton, NJ, 2000. MR **1768485 (2001f:14046)**; 4. with J.-F. Voloch, Euclidean weights of codes from elliptic curves over rings, *Trans. Amer. Math. Soc.* **352** (2000), 5063–5076 (electronic). MR **1778505 (2001i:94083)**; 5. Algebraic geometric codes over rings, *J. Pure Appl. Algebra* **144** (1999), 91–110. MR **1723194 (2001k:94075)**.

Statement: This is an exciting time to be a mathematician. Mathematics is the basis of breakthroughs being made across the sciences and the need for fundamental research, both for its own sake and as it relates to other areas, is becoming recognized by the public. The AMS does an excellent job of promoting mathematics. It provides a connection from the mathematics community to the government to influence legislative issues which have an impact on mathematics. Its public relations work builds support for mathematics among the general population. Its various outreach activities help to develop the next generation of mathematicians. And, of course, its work in organizing meetings and conferences, in publishing journals and books, and in providing MathSciNet is invaluable to researchers. I was pleased to be asked to stand for election to the AMS Council, and, if elected, I will be honored to serve.

Nominating Committee

William K. Allard

Professor of Mathematics, Duke University.

Born: October 29, 1941.

Ph.D.: Brown University, 1968.

Selected Addresses: Invited Speaker, 1973 AMS Annual Meeting; Invited Speaker, 1974 International Congress of Mathematicians.

Additional Information: Alfred P. Sloan Foundation Fellowship, 1970–1972; Managing Editor, *Duke Math. J.*, 1983–1985; Co-chair, 1984 AMS Summer Institute.

Selected Publications: 1. On the first variation of a varifold, *Ann. of Math. (2)* **95** (1972), 417–491. MR **0307015 (46:6136)**; 2. with F. J. Almgren, Jr., On the radial behavior of minimal surfaces and the uniqueness of their tangent cones, *Ann. of Math. (2)* **113** (1981), no. 2, 215–265. MR **0607893 (83k:49069)**; 3. An integrality theorem and a regularity theorem for surfaces whose first variation with respect to a parametric elliptic integrand is controlled, *Geometric Measure Theory and the Calculus of Variations (Arcata, CA, 1984)*, Proc. Sympos. Pure Math., vol. 44, Amer. Math. Soc., Providence, RI, 1986, pp. 1–28. MR **840267 (87j:49077)**; 4. Introduction to the Deferred Execution Tool, Proceedings of the 9th SIAM Conference on Parallel Processing for Scientific Computing, 1999; 5. On the regularity and curvature properties of level sets of minimizers for denoising models using total variation regularization, preprint, May 2005.

Statement: For too long now many in traditional academic mathematics departments have been unaware of scientific developments involving mathematics outside their narrow area of expertise. This has resulted not only in the isolation of mathematics departments but also in the unfortunate situation that many scientists do not have the mathematical collaborators they need to carry out their work.

For this reason, I would if elected to the Nominating Committee look for candidates for positions in the AMS with some breadth of scientific knowledge and the predisposition to consider new ways of looking at the position of mathematics within the sciences.

Michael G. Crandall

Professor of Mathematics, University of California at Santa Barbara.

Born: November 29, 1940, Baton Rouge, Louisiana, USA.

Ph.D.: University of California at Berkeley, 1965.

AMS Offices: Member at Large of the Council, 1984–1986; Trustee, 1996–2001.

AMS Committees: Committee to Select Hour Speakers for Far Western Sectional Meetings, 1974–1975; Committee on Committees, 1985–1986; *Notices* Editorial Committee, 1989–1992; Far Western Section Program Committee, 1990, and Western Section Program Committee, 1991 (chair, 1991); Progress in Mathematics Committee, 1993–1995 (chair, 1995); AMS-MAA Committee on Cooperation, 1995; Committee to Review Operation of Journals, 1996; AMS Policy Committee on Publications, 1996–1998; Science Policy Committee, 1999; Steele Prize Committee, 2000–2003 (chair, 2003).

Selected Addresses: International Congress of Mathematicians, Vancouver, Canada, 1974; SIAM Annual Meeting, Troy, New York, 1975; AMS Invited Address, Madison, WI, 1982; University of Arkansas Lectures in Mathematics, 1986; AMS Progress in Mathematics Lecture, 1990; Plenary address, SIAM Annual Meeting, San Juan, Puerto Rico, 2000.

Additional Information:

Professor, University of California at Los Angeles, 1973–1976; Professor, Department of Mathematics and

Mathematics Research Center, University of Wisconsin, 1974–1988 (Houses Professor, 1984–1988); Professor, University of California at Santa Barbara, 1988– (director, IAC/Nonlinear Science Program, 1988–1991; chair of department, 1993–1996); Managing Editor, *Communications in Partial Differential Equations*, 1989–1993 (Editorial Board, 1994–); Miller Research Professor, University of California at Berkeley, Fall 1996; U.S. National Committee on Mathematics, 1996–2000; Distinguished Visitor, University of Wisconsin, Fall 1997; Steele Prize for Seminal Research, 1999; Docteur Honoris Causa, University of Paris-Dauphine, 1999; Trustee, Institute for Pure and Applied Mathematics, UCLA, 1999–2003; Fellow of the American Academy of Arts and Sciences (elected 2000). Editorial Boards: *Analyse non linéaire, Annales de IHP*, 1989–; *Evolution Equations*, 2000–; Various periods: *Nonlinear Analysis: Theory, Methods, Applications*; *Applicable Analysis*; *Differential and Integral Equations*; *Advances in Differential Equations*; *Electronic Journal of Differential Equations*.

Selected Publications: 1. Two families of periodic solutions of the plane four-body problem, *Amer. J. Math.* **89** (1967), 275–318. MR **0215599 (35:6439)**; 2. with P. Rabinowitz, Nonlinear Sturm-Liouville eigenvalue problems and topological degree, *J. Math. Mech.* **19** (1969/1970), 1083–1102. MR **0259232 (41:3874)**; 3. with T. Liggett, Generation of semi-groups of nonlinear transformations on general Banach spaces, *Amer. J. Math.* **93** (1971), 265–298. MR **0287357 (44:4563)**; 4. with P.-L. Lions, Viscosity solutions of Hamilton-Jacobi equations, *Trans. Amer. Math. Soc.* **277** (1983), 1–42. MR **0690039 (85g:35029)**; 5. with G. Aronsson and P. Juutinen, A tour of the theory of absolutely minimizing functions, *Bull. Amer. Math. Soc. (N.S.)* **41** (2004), 439–505 (electronic). MR **2083637**.

Statement: The success of the AMS in promoting the welfare and vitality of mathematics depends on the active participation of its members in many different roles. We are blessed in that there is a wealth of very able people among us, such as the others who are standing for election to this committee. However, it is not an easy matter to make good matches between individuals and the offices to be filled, nor is everyone willing to stand for election if asked. The task of the committee is just that, to generate potential candidates for the various offices to be filled who are willing, exceptionally able and otherwise well-qualified. If elected, I will do my part in this important effort, with a particular interest in looking broadly for candidates from our marvelous community.

Henri Gillet

Professor of Mathematics, University of Illinois at Chicago.

Born: July 8, 1953, Tangiers, Morocco.

Ph.D.: Harvard University, 1978.

AMS Offices: Member at Large of the Council, 2002–2005.

AMS Committees: *American Journal of Mathematics*, Society's Representative, 1994 (chair); Member, CoProf, 2002–2005.

Selected Addresses: AMS Invited Address, Chicago, May 1989; Number Theory Section, International Congress of Mathematicians, Kyoto, 1990.

Additional Information: Organizer, AMS Special Session on K-Theory, Chicago, March 1985; Alfred P. Sloan Foundation Fellow, 1986–1989; Organizer, AMS Special Session on Arithmetic Geometry and Intersection Theory, Chicago, May 1989; Editor, *Amer. J. Math.*, 1994–1999; Head of Department of Mathematics, Statistics and Computer Science, Univ. of Illinois at Chicago, 1994–2001; Organizing Committee, AMS Summer Research Institute on Algebraic Geometry, University of California, Santa Cruz, July 9–29, 1995; Editor, *Internat. Math. Res. Notices*, 1995–1997; Organizing Committee, AMS-IMS-SIAM Joint Summer Research Conference on Algebraic K-Theory, Seattle, July 1997; Organizing Committee, Workshop on Learning Stacks and Computational Methods through Problem-Solving, University of Illinois at Urbana-Champaign, June 12–15, 2002; Editor, *Illinois J. Math.*, 2003–; Member, Search Committee for the 16th President of the University of Illinois, February 2004–December 2004.

Selected Publications: 1. Riemann-Roch theorems for higher algebraic K-theory, *Adv. in Math.* **40** (1981), 203–289. MR **0624666 (83m:14013)**; 2. with C. Soulé, Intersection theory using Adams operations, *Invent. Math.* **90** (1987), 243–277. MR **0910201 (89d:14005)**; 3. with J.-M. Bismut and C. Soulé, Analytic torsion and holomorphic determinant bundles I,II,III, *Comm. Math. Phys.* **115** (1988), 49–78, 79–126, 301–351. MR **0929146 (89g:58192a)**, **0929147 (89g:58192b)**, **0931666 (89g:58192c)**; 4. with P. Shalen, Dendrology of groups in low Q-ranks, *J. Differential Geom.* **32** (1990), 605–712. MR **1078160 (92b:57003)**; 5. with C. Soulé, Descent, motives and K-theory, *J. Reine Angew. Math.* **478** (1996), 127–176. MR **1409056 (98d:14012)**.

Statement: The Society plays a vital role in promoting mathematics, through its journals, its meetings and conferences, and its advocacy for the profession with government and the public at large. This requires the efforts not only of the Society's excellent professional staff, but also the contributions of numerous mathematicians as members of committees and officers of the Society. As a member of the Nominating Committee I would seek to find the best people, representing the full diversity of the mathematical community, who are willing (or can be cajoled) into contributing their time and energy to the Society.

Richard M. Kane

Professor, Department of Mathematics, University of Western Ontario.

Born: June 27, 1944, Danbury, Connecticut, USA.

Ph.D.: University of Waterloo, 1973.

Additional Information: Canadian Mathematical Society: Chair, Research Committee, 1988–1990; Member, Executive Committee, 1993–1995, 1997–2001; Chair, Finance Committee, 1995–1997; President, 1998–2000. Fellow, Royal Society of Canada, 1988; Member, NSERC Grants Committee for Mathematics, 1988–1991; Chair, Department of Mathematics, University of Western Ontario, 1989–1993,

2003–2006; Scientific Convenor, NSERC Review of Canadian Mathematics, 1996; Program Director, The Fields Institute Emphasis Year in Homotopy Theory, 1996; Chair, Mathematics Steering Committee for NSERC Reallocation Exercises, 1997–1998, 2001–2002.

Selected Publications: 1. The BP homology of H-spaces, *Trans. Amer. Math. Soc.* **241** (1978), 99–119. MR **0478143 (57#17632)**; 2. Operations in connective K-theory, *Mem. Amer. Math. Soc.* **34** (1981), no. 254. MR **0634210 (82m:55025)**; 3. Implications in Morava K-theory, *Mem. Amer. Math. Soc.* **59** (1986), no. 340. MR **0823444 (87e:57045)**; 4. *The Homology of Hopf Spaces*, North-Holland Mathematical Library, vol. 40, North-Holland Publishing Co., Amsterdam, 1988. MR **0961257 (90f:55018)**; 5. *Reflection Groups and Invariant Theory*, CMS Books in Mathematics/Ouvrages de Mathématiques de la SMC, vol. 5, Springer-Verlag, New York, 2001. MR **1838580 (2002c:20061)**.

Statement: Over the past fifteen years I have had the opportunity to serve the Canadian mathematical community in a wide variety of roles. That experience has left me with a strong sense of the challenges and of the opportunities being presented to mathematics at the current moment. It has also left me with a sense of the vitality and direction which is required of our professional bodies to creatively respond to their particular challenges. To meet its many challenges and opportunities the AMS requires the active participation of its membership, more particularly it requires the presence of thoughtful, committed people in positions of responsibility. It is the mandate of the Nominating Committee to seek such participation and such people. If chosen for the Nominating Committee I would work as actively as possible to fulfil this mandate.

M. Susan Montgomery

Professor of Mathematics, University of Southern California.

Born: April 2, 1943, Lansing, Michigan, USA.

Ph.D.: University of Chicago, 1969.

AMS Offices: Member at Large of the Council, 1981–1984; Board of Trustees, 1986–January 1996 (Chair, 1989 and 1994).

AMS Committees: Member, Subcommittee to write rules for CAFTES (Committee on Academic Freedom, Tenure, and Employment Security), 1978–1979; Editorial Committee, *Notices Amer. Math. Soc.*, 1979–1982; Selection Committee for Research Fellow, 1982–1984 (Chair, 1983–1984); Editorial Committee, AMS Mathematical Surveys and Monographs, 1983–1990 (Chair, 1989–1990); Coordinating Editor for Algebra and Number Theory, *Proc. Amer. Math. Soc.*, 1992–January 1996; Policy Committee on Publications, 1994–1995 (Chair, Subcommittee on Books), 1996–1999 (Chair of the Committee, 1996–1998).

Selected Addresses: AMS Invited Hour Address, January 1984; Principal Lecturer, CBMS Conference on Hopf Algebras and their Actions on Rings, Chicago, 1992; Invited Hour Address, AMS-Israel Math Union Joint Meeting, Jerusalem, Israel, 1995; AMS-SMM Invited Hour Address, Annual Meeting of the Sociedad Matemática Mexicana, Aguas Calientes, Mexico, 1997; AMS Invited Hour Address, March 2005.

Additional Information: John S. Guggenheim Memorial Foundation Fellow, 1984–1985; Editorial Boards, *J. Algebra*, 1988– and *Adv. Math*, 1995–2002; Board on Mathematical Sciences (BMS) of the NRC, 1995–1998; Organizing Committee, Non-Commutative Algebra Year, MSRI, 1999–2000; USC Provost's Committee on Women in Science and Engineering (WiSE), 2000–2005. Member: AWM, LMS.

Selected Publications: 1. *Hopf Algebras and Their Actions on Rings*, CBMS Regional Conference Series in Mathematics, vol. 82, Amer. Math. Soc., Providence, RI, 1993. MR **1243637 (94i:16019)**; 2. with D. Fischman and H.-J. Schneider, Frobenius extensions of subalgebras of Hopf algebras, *Trans. Amer. Math. Soc.* **349** (1997), 4857–4895. MR **1401518 (98d:16049)**; 3. with H.-J. Schneider, Prime ideals in Hopf Galois extensions, *Israel J. Math.* **112** (1999), 187–235. MR **1715517 (2001e:16075)**; 4. with Y. Kashina and G. Mason, Computing the Frobenius-Schur indicator for abelian extensions of Hopf algebras, *J. Algebra* **251** (2002), 888–913. MR **1919158 (2003f:16061)**; 5. with V. Linchenko and L. W. Small, Stable Jacobson radicals and semiprime smash products, *Bull. London Math. Soc.*, to appear.

Statement: Although the primary mission of the AMS is to support research in mathematics, it also has important secondary missions in education (especially in encouraging promising young students) and in public policy (such as maintaining a Washington presence and providing a conduit between the mathematics community and government agencies, as well as other scientific societies). The Nominating Committee must find people who will serve the AMS well in all these endeavors, as well as provide a broad representation of the Society's diverse membership. In working for the Society and the wider mathematical community in past years, I met many different people who could serve the AMS themselves, as well as suggest others. Thus I believe I could do a good job in this important position.

Lisa M. Traynor

Associate Professor, Mathematics Department, Bryn Mawr College.

Born: September 23, 1964, Ironwood, MI, USA.

Ph.D.: State University of New York at Stony Brook, 1992.

AMS Committees: Member at Large of the Council, 2000–2003; Committee on Education, 2000–2003; Associate Editor, *Notices Amer. Math. Soc.*, 2000–.

Selected Addresses: AMS Special Sessions: Symplectic Geometry and Mechanics, Corvallis, April 1997; Symplectic Topology and Quantum Cohomology, Milwaukee, October 1997; Symplectic Geometry and Topology, Urbana,

March 1999; Integrable Systems, Buffalo, April 1999; Symplectic and Contact Geometry, New York, April 2003.

Additional Information: Alfred P. Sloan Doctoral Dissertation Fellowship, 1991–1992; MSRI Postdoc, 1992–1993 and Member, 1996–1997; NSF Postdoctoral Fellow, 1993–1997; Member, Centre Emile Borel, Institut Henri Poincaré, Paris, 1994; Member, Isaac Newton Institute, Cambridge, Fall 1994; Member, Organizing Committee, Institute for Advanced Study/Park City Mathematics Institute Women's Program, 1996–; Coorganizer with Y. Eliashberg of the Research Program for the Institute for Advanced Study/Park City Mathematics Institute on Symplectic Geometry and Topology, 1997; AIM Visitor 2000; IAS Member 2001–2002. Member: AMS, AWM, MAA.

Selected Publications: 1. Symplectic embedding trees for generalized camel spaces, *Duke Math. J.* **72** (1993), no. 3, 573–594. MR **1253616 (95a:58014)**; 2. Symplectic homology via generating functions, *Geom. Funct. Anal.* **4** (1994), no. 6, 718–748. MR **1302337 (96a:58049)**; 3. Legendrian circular helix links, *Math. Proc. Cambridge Philos. Soc.* **122** (1997), no. 2, 301–314. MR **1458235 (98f:58085)**; 4. with F. M. Maley and J. Mastrangeli, Symplectic packings in cotangent bundles of tori, *Experiment. Math.* **9** (2000), no. 3, 435–455. MR **1795876 (2002a:53111)**; 5. Generating function polynomials for Legendrian links, *Geom. Topol.* **5** (2001), 719–760 (electronic). MR **1871403 (2002i:57035)**.

Statement: The task of the Nominating Committee is to find candidates for election to various offices in the AMS. If elected, I would work hard to find candidates from a broad spectrum of career levels and employment situations. I believe that by including people with a variety of backgrounds, we can best keep the AMS vibrant and in tune with the concerns of the mathematical community. From my experiences from serving on the Council, the Committee on Education, and as an associate editor for the *Notices*, I have gained a great appreciation for the role the AMS plays in supporting mathematical research and mathematical education and in fostering general awareness and appreciation of mathematics. My motivation for serving on this committee comes from my dedication to mathematical research and my appreciation of the AMS.

Editorial Boards Committee

Robert L. Bryant

J. M. Kreps Professor of Mathematics, Duke University.

Born: August 30, 1953, Harnett County, North Carolina, USA.

Ph.D.: University of North Carolina at Chapel Hill, 1979.

AMS Committees: Member, AMS Task Force on Membership, 1998–2000; Chair, AMS Committee on Publications, 1998–2004; Member at Large of the Council, 1999–2004; Executive Committee Member, AMS Council, 2000–2004.

Selected Addresses: The Idea of Curvature for Differential Equations, Invited Address, AMS Annual Meeting, Baltimore, MD, January 8, 1998; Finsler metrics of constant flag curvature, Seventh Annual Kemeny Lectures, Dartmouth University, May 15, 2003; Closed G_2 structures, AMS-MSRI von Neumann Symposium, MSRI, September 2, 2003; Gradient Kähler Ricci solitons, Second Yamabe Memorial Symposium (U-Minn), September 18, 2004; Calibrations in Geometry and Topology, Second Ruth and Irving Adler Expository Lecture, Institute for Advanced Study, Princeton, NJ, October 22, 2004.

Additional Information: Editorial Board Member: *Trans. Amer. Math. Soc.*, 1992–1997; *Duke Mathematical J.*, July 1997; *Differential Geom. Appl.*, May 1999; *Communications in Analysis and Geometry*, November 2002. Associate Editor, *J. Amer. Math. Soc.*, February 2005. Chair, Board of Trustees, MSRI, 1999–2004; MAA Southeastern Section Lecturer, 2001–2003; Fellow of the American Academy of Arts and Sciences, 2002.

Selected Publications: 1. Classical, exceptional, and exotic holonomies: a status report, in *Actes de la Table Ronde de Géométrie Différentielle (Luminy, 1992)*, Sémin. Congr., vol. 1 (1996), pp. 93–165, Soc. Math. France, Paris. MR **1427757 (98c:53037)**; 2. On surfaces with prescribed shape operator. Dedicated to Shiing-Shen Chern on his 90th birthday, *Results Math.* **40** (2001), no. 1–4, 88–121. MR **1860364 (2002i:53010)**; 3. Bochner-Kähler metrics, *J. Amer. Math. Soc.*, **14** (2001), no. 3, 623–715 (electronic). MR **1824987 (2002i:53096)**; 4. with P. Griffiths and D. Grossmann, *Exterior Differential Systems and Euler-Lagrange Partial Differential Equations*, Chicago Lectures in Mathematics, University of Chicago Press, Chicago, IL, 2003. MR **1985469 (2004g:58001)**; 5. with D. Bao, S.-S. Chern, Z. Shen, eds., *A Sampler of Riemann-Finsler Geometry*, Mathematical Sciences Research Institute Publications, vol. 50, Cambridge Univ. Press, Cambridge, MA, 2004.

Statement: The AMS has a long-standing tradition of excellence in publishing for the benefit of the mathematical community, both in research and exposition. To maintain this tradition while the world of publishing is changing so rapidly is a great challenge. It absolutely requires the engagement of our best researchers and expositors if we are to continue to be responsive to the needs and practices of mathematicians as they evolve in response to changes in the ways we communicate and disseminate our mathematics. I will do my best to seek out individuals to nominate for editorial board service who are not only knowledgeable in their research areas but who are also committed to helping increase the efficiency with which the AMS editorial boards perform their editorial services, thereby lessening the burden on all of us.

Allan L. Edmonds

Professor of Mathematics, Indiana University.

Born: November 4, 1946, Bartlesville, Oklahoma, USA.

Ph.D.: University of Michigan, 1973.

Selected Addresses: Approximately 50 invited lectures over 32 years.

Additional Information: Member, MAA; Book Review Co-editor, *American Math. Monthly*, 1982–1987.

Selected Publications: 1. with J. Ewing, Topological realization of equivariant intersection forms, *Amer. J. Math.* **114** (1992), 1103–1126; 2. Systems of curves on a closed orientable surface, *Enseign. Math. (2)* **42** (1996), 311–339. MR **1426442 (97j:57018)**; 3. Automorphisms of the E_8 four-manifold, *Geometric Topology (Athens, GA, 1993)*, AMS/IP Stud. Adv. Math., vol. 2.1, Amer. Math. Soc., Providence, RI, 1997, pp. 282–299. MR **1470733 (98i:57066)**; 4. Tori in certain aspherical four-manifolds, *Proc. Amer. Math. Soc.* **126** (1998), 1253–1255. MR **1443382 (98f:57034)**; 5. Periodic maps of composite order on positive definite 4-manifolds, *Geom. Topol.* **9** (2005), 315–339.

Statement: Publishing is a core activity of the Society. The usefulness, reliability, and success of its journals and other publications depend in significant measure on the quality of its editorial boards. I will strive to recommend knowledgeable, wise, and efficient editors, who will represent the broad interests of the full membership of the AMS.

Stephen Lichtenbaum

Professor of Mathematics, Brown University.

Born: August 24, 1939, Brooklyn, New York, USA.

Ph.D.: Harvard University, 1964.

AMS Committees: Colloquium Publications Committee, 1997–2000.

Selected Addresses: Abraham Robinson Memorial Lectures, Yale University, April 1997; Plenary Lecture, AMS Conference on Algebraic K-Theory, Seattle, July 1997; Distinguished Lecture Series, University of Waterloo, March 2000; Kuwait Foundation Lecture, Cambridge University, October 2000; Colloquium, University of Paris, June 2003.

Additional Information: Guggenheim Fellow, 1973–1974; Member, Editorial Board, *Documenta Mathematica*.

Selected Publications: 1. On the values of zeta and L-functions, I, *Ann. of Math. (2)* **96** (1972), 338–360. MR **0360527 (50:12975)**; 2. with J. Coates, On l-adic zeta functions, *Ann. of Math. (2)* **98** (1973), 498–550. MR **0330107 (48:8445)**; 3. The construction of weight-two arithmetic cohomology, *Invent. Math.* **88** (1987), 183–215. MR **0877012 (88d:14011)**; 4. with T. Goodwillie, A cohomological bound for the h-topology, *Amer. J. Math.* **123** (2001), 425–443. MR **1833147 (2002h:14029)**; 5. The Weil-étale topology on schemes over finite fields, *Compositio Math.* **141** (2005), 689–702.

Statement: I hope to be able to aid in appointing people to editorial boards who have both excellent taste in mathematics and sufficient organizational skills to assure speedy publication of articles.

Maciej Zworski

Professor of Mathematics, University of California at Berkeley.

Born: October 8, 1963, Wrocław, Poland.

Ph.D.: Massachusetts Institute of Technology, 1989.

Selected Addresses: Coxeter-James Lecture, CMS Meeting, Montreal, 1999; ICM, Beijing, PDE section invited talk, 2002; Hommage à la mémoire de Laurent Schwarz, invited talk, 2003.

Additional Information: Experience: Benjamin Peirce Lecturer, Assistant Professor of Mathematics, Harvard University, 1989–1992, Associate Professor of Mathematics, The Johns Hopkins University, 1992–1993, Professor of Mathematics, The Johns Hopkins University, 1994–1996, Professor of Mathematics, University of Toronto, 1995–2000, Professor of Mathematics, University of California, Berkeley, 1998–; Professional Activities: Associate Editor, *Duke Math. J.*, 1992–2000, Editor, *Internat. Math. Res. Notices*, 1998–, Editor, *Amer. J. Math.*, 2000–, Editor, *Methods and Applications of Analysis*, 2001–, Associate Editor, *Canad. J. Math.*, 2001–; Fellowships and Honors: Jon A. Bucsela Prize in Mathematics, MIT, 1985, Alfred P. Sloan Doctoral Dissertation Fellow, 1988–1989, Alfred P. Sloan Research Fellow, 1991–1993, Coxeter-James Prize of the Canadian Mathematical Society, 1999, Fellow of the Royal Society of Canada, 1999–; Visiting Positions: Université de Paris-Sud, Institute des Hautes Études Scientifiques, Université de Paris-Nord, Institut Fourier, Université de Nantes, CNRS, École Polytechnique, Université de Bourdeaux I, Erwin Schrödinger Institute, MSRI.

Selected Publications: 1. Distribution of poles for scattering on the real line, *J. Funct. Anal.* **73** (1987), no. 2, 277–296. MR **0899652 (88h:81223)**; 2. with J. Sjöstrand, Complex scaling and the distribution of scattering poles, *J. Amer. Math. Soc.* **4** (1991), no. 4, 729–769. MR **1115789 (92g:35166)**; 3. with C. Robin Graham, Scattering matrix in conformal geometry, *Invent. Math.* **152** (2003), no. 1, 89–118. MR **1965361 (2004c:58064)**; 4. with W. Lu and S. Sridhar, Fractal Weyl laws for chaotic open systems, *Phys. Rev. Lett.* **91** (2003), 154101; 5. with N. Burq, Geometric control in the presence of a black box, *J. Amer. Math. Soc.* **17** (2004), no. 2, 443–471 (electronic). MR **2051618 (2005d:47085)**.

CALL FOR Suggestions

Your suggestions are wanted by:

The Nominating Committee, for the following contested seats in the 2006 AMS elections:
vice president, trustee,
and five members at large of the Council

Deadline for suggestions: November 5, 2005

The President, for the following contested seats in the 2006 AMS elections:
three members of the Nominating Committee
two members of the Editorial Boards Committee

Deadline for suggestions: February 26, 2006

The Editorial Boards Committee, for appointments to various editorial boards of AMS publications

Deadline for suggestions: Can be submitted any time

Send your suggestions for any of the above to:

Robert J. Daverman, Secretary
American Mathematical Society
312D Ayres Hall
University of Tennessee
Knoxville, TN 37996-1330 USA
email: secretary@ams.org

AMS
AMERICAN MATHEMATICAL SOCIETY
www.ams.org

2006 AMS Election

Nominations by Petition

Vice President or Member at Large

One position of vice president and member of the Council *ex officio* for a term of three years is to be filled in the election of 2006. The Council intends to nominate at least two candidates, among whom may be candidates nominated by petition as described in the rules and procedures.

Five positions of member at large of the Council for a term of three years are to be filled in the same election. The Council intends to nominate at least ten candidates, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

Petitions are presented to the Council, which, according to Section 2 of Article VII of the bylaws, makes the nominations. The Council of 23 January 1979 stated the intent of the Council of nominating all persons on whose behalf there were valid petitions.

Prior to presentation to the Council, petitions in support of a candidate for the position of vice president or of member at large of the Council must have at least fifty valid signatures and must conform to several rules and operational considerations, which are described below.

Editorial Boards Committee

Two places on the Editorial Boards Committee will be filled by election. There will be four continuing members of the Editorial Boards Committee.

The President will name at least four candidates for these two places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Nominating Committee

Three places on the Nominating Committee will be filled by election. There will be six continuing members of the Nominating Committee.

The President will name at least six candidates for these three places, among whom may be candidates nominated by petition in the manner described in the rules and procedures.

The candidate's assent and petitions bearing at least 100 valid signatures are required for a name to be placed on the ballot. In addition, several other rules and operational considerations, described below, should be followed.

Rules and Procedures

Use separate copies of the form for each candidate for vice president, member at large, or member of the Nominating and Editorial Boards Committees.

1. To be considered, petitions must be addressed to Robert J. Daverman, Secretary, American Mathematical Society, 312 D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330 USA, and must arrive by 25 February 2006.
2. The name of the candidate must be given as it appears in the *Combined Membership List* (`www.ams.org/cml`). If the name does not appear in the list, as in the case of a new member or by error, it must be as it appears in the mailing lists, for example on the mailing label of the *Notices*. If the name does not identify the candidate uniquely, append the member code, which may be obtained from the candidate's mailing label or by the candidate contacting the AMS headquarters in Providence (amsmem@ams.org).
3. The petition for a single candidate may consist of several sheets each bearing the statement of the petition, including the name of the position, and signatures. The name of the candidate must be exactly the same on all sheets.
4. On the next page is a sample form for petitions. Petitioners may make and use photocopies or reasonable facsimiles.
5. A signature is valid when it is clearly that of the member whose name and address is given in the left-hand column.
6. The signature may be in the style chosen by the signer. However, the printed name and address will be checked against the *Combined Membership List* and the mailing lists. No attempt will be made to match variants of names with the form of name in the *CML*. A name neither in the *CML* nor on the mailing lists is not that of a member. (Example: The name Robert J. Daverman is that of a member. The name R. Daverman appears not to be.)
7. When a petition meeting these various requirements appears, the secretary will ask the candidate to indicate willingness to be included on the ballot. Petitioners can facilitate the procedure by accompanying the petitions with a signed statement from the candidate giving consent.

Nomination Petition for 2006 Election

The undersigned members of the American Mathematical Society propose the name of

_____

as a candidate for the position of (check one):

- ☐ **Vice President**
- ☐ **Member at Large of the Council**
- ☐ **Member of the Nominating Committee**
- ☐ **Member of the Editorial Boards Committee**

of the American Mathematical Society for a term beginning 1 February, 2007

Return petitions by 25 February 2006 to:
Secretary, AMS, 312 D Ayers Hall, University of Tennessee, Knoxville, TN 37996-1330 USA

Name and address (printed or typed)	Signature

MATHEMATICAL REVIEWS

ASSOCIATE EDITOR

Applications and recommendations are invited for a full-time position as an Associate Editor of Mathematical Reviews (MR), to commence as soon as possible after January 1, 2006, and no later than July 1, 2006.

The Mathematical Reviews division of the American Mathematical Society (AMS) is located in Ann Arbor, Michigan, not far from the campus of the University of Michigan. The editors are employees of the AMS; they also enjoy many privileges at the University. At present, MR employs fourteen mathematical editors and a further sixty nonmathematicians. MR's mission is to develop and maintain the AMS databases covering the published mathematical literature. The chief responsibility is the development and maintenance of the MR Database, from which all MR-related products are produced: MathSciNet, the journals *Mathematical Reviews* and *Current Mathematical Publications*, and MathSciDisc. The responsibilities of an Associate Editor fall primarily in the day-to-day operations of selecting articles and books suitable for coverage, classifying these items, determining the type of coverage, assigning those selected for review to reviewers, and editing the reviews when they are returned.

An early career mathematician is sought who has mathematical breadth with an interest in current developments and is willing to learn new topics in pure and applied mathematics; the ability to write good English is essential and the ability to read mathematics in major foreign languages is an advantage. It is required that the applicant have at least two years' relevant academic (or equivalent) experience beyond the Ph.D. Persons nearing the end of a postdoctoral appointment are especially encouraged to apply.

The twelve-month salary will be commensurate with the experience the applicant brings to the position. Interested applicants are invited to write (or telephone) for further information.

Applications (including curriculum vitae; bibliography; and name, address, phone number, and email of at least three references) and recommendations should be sent to

Dr. Kevin F. Clancey
Executive Editor
Mathematical Reviews
P. O. Box 8604
Ann Arbor, MI 48107-8604

e-mail: kfc@ams.org
Tel: (734) 996-5257
Fax: (734) 996-2916

The closing date for applications is November 1, 2005.

The American Mathematical Society is an Equal Opportunity Employer.

Mathematics Calendar

The most comprehensive and up-to-date Mathematics Calendar information is available on e-MATH at http://www.ams.org/mathcal/.

August 2005

Mathematical Modeling of Infectious Diseases: Dynamics and Control, Institute for Mathematical Sciences, National University of Singapore, Singapore 118402. (May 2005, p. 568)
Information: KP Chua, Administrative Officer, Institute for Mathematical Sciences, National University of Singapore, 3 Prince George's Park, Singapore 118402; tel: (+65) 6874 1893; Facsimile: (+65) 6873 8292; http://www.ims.nus.edu.sg.

1-5 **14th USENIX Security Symposium**, Baltimore, Maryland. (May 2005, p. 568)
Description: The USENIX Security Symposium brings together researchers, practitioners, system administrators, system programmers, and others interested in the latest advances in security of computer systems.
Information: Contact: Conference Department, email: conference@usenix.org; tel: 510-528-8649; http://www.usenix.org/sec05/.

1-9 **XVI Coloquio Latinoamericano de Algebra**, Colonia, Uruguay. (Apr. 2005, p. 475)
Description: This biannual event is the premier conference linking algebraists and algebraic geometers from all of Latin America.
Topics: Besides the plenary talks and general courses this meeting will have seven thematic parallel sessions on the following topics: Commutative Algebra and Algebraic Geometry, Non-associative Algebras and Ring theory, Group Theory, Hopf Algebras and Algebraic Combinatorics, Homological Methods and Representation Theory, Number Theory, Operator Algebras. A special session on Applications of Algebra will also be held.
Speakers: A list of a few of the confirmed speakers is the following: Nicolas Andruskiewitsch, Raymundo Bautista, Michel Brion, Ken Brown, Antonio Campillo, Max Karoubi, Jean-Louis Loday, Susan Montgomery, Adrian Ocneanu, Jose Antonio de la Peña, Vladimir Popov, Hans-Jurgen Schneider, Aron Simis, Frank Sottile, Richard Stanley, Boris Tsygan, Mariusz Wodzicki.
Organizing and Scientific Committee: Walter Ferrer Santos (Coord.), Gerardo Gonzalez-Sprinberg, Alfredo Jones, Alvaro Rittatore, Andrea Solotar.
Deadline: May 1st, 2005.
Information: http://www.cmat.edu.uy/cmat/eventos/16cla/en; Walter Ferrer: email: wrferrer@cmat.edu.uy

1-December 23 **Pattern Formation in Large Domains**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 834)
Organizers: J.H.P. Dawes (Cambridge), M. Golubitsky (Houston), P.C. Matthews (Nottingham), A.M. Rucklidge (Leeds).
Information: http://www.newton.cam.ac.uk/programmes/PFD/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +ds44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

2-6 **Eighth IMS North American New Researchers Conference**, Minneapolis, Minnesota. (Jan. 2005, p. 81)
Description: These conferences were/are organized by the IMS to promote interaction among new researchers primarily by introducing them to each other's research in an informal setting. As part of the conference, participants will present talks and posters on their research and discuss interests and professional experiences over meals and social activities organized through the meeting as well as by the participants themselves. The relationships established in this informal collegiate setting among junior researchers are ones

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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 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 **eight 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/July, 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://www.ams.org/.

that may last a career (lifetime?!).
Eligibility: The New Researchers Conference is a meeting of recent Ph.D. recipients in Statistics and Probability. A new researcher is defined as anyone who has received a Ph.D. since 2000.
Applications: Those interested in attending the conference will be requested to submit the following information to the Committee: a letter of intent a curriculum vitae an abstract for a talk or poster. Electronic mail is preferred for abstract submission. Deadline for receipt of applications is February 15, 2005. Please apply promptly since the number of participants is limited. Priority will be given to first time participants. Women and minorities are encouraged to apply. Also, contingent on the availability of funds, support to defray travel and housing costs will be offered.
Information: Galin Jones, School of Statistics, University of Minnesota, 313 Ford Hall, 224 Church Street S.E., Minneapolis, MN 55455; email: galin@stat.umn.edu; fax: 612.624.8868; http://pages.pomona.edu/~jsh04747/NRC/NRC.htm.

2-17 **International Workshop on Representation Theory in Differential Geometry and Physics**, Country Institut de Mathematiques et de Sciences Physiques (IMSP), PortoNovo, Benin Republic, West Africa.
Organisers: K. Brown (University of Glasgow, UK); J. P. Ezin, (IMSP, PortoNovo, Benin Republic); A. O. Kuku (Ohio State University, Columbus, USA).
Major speakers: Will each give six expository lectures: I. Gordon (University of Glasgow, UK); A. Kirillov (University of Pennsylvania, USA); S. Majid (Queen Mary College, Univ. of London, UK); J. Rawnsley, (University of Warwick, Coventry, UK).
Information: Jean-Pierre Ezin, Director, IMSP, BP 613, PortoNovo, Benin Republic; Phone/fax (229) 222455 or Phone: (229) 925959; email: jpezin1@yahoo.fr.

3-5 **DIMACS Workshop on Yield Management and Dynamic Pricing**, DIMACS Center, CoRE Bldg, Rutgers University, Piscataway, New Jersey. (Dec. 2004, p. 1379)
Organizers: James Dana, Northwestern University, email: j-dana@kellogg.northwestern.edu; Brenda Dietrich, IBM Watson Labs, email: dietric@watson.ibm.com.
Local Arrangements: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
Information: http://dimacs.rutgers.edu/Workshops/Yield/.

3-5 **30th Sapporo Symposium on Partial Differential Equations**, Sapporo, Japan. (Apr. 2005, p. 475)
Description: The Sapporo Symposium on Partial Differential Equations (PDE) has been held annually to present the latest developments on PDE with a broard spectrum of interests not limited to the methods of a particular school.
Organizers: T. Ozawa, G. Nakamura, S. Jimbo, Y. Giga, K. Tsutaya, Y. Tonegawa.
Information: email: cri@math.sci.hokudai.ac.jp; http://coe.math.sci.hokudai.ac.jp/sympo/sapporo/program050803_en.html.

3-6 **XV Capricornio Mathematical Congress**, Universidad de Antofagasta, Antofagasta, Chile. (Jun/Jul. 2005, p. 669)
Topics: Algebra, Physical Mathematical,Control Theory,Partial Differential Equation, Matrix Theory, Numerical Analisis,Differential Geometry , Industrial Statictics, Educational Mthematical and others.
Deadline: May 31, 2005.
Speakers: Justin Peters, Iowa State University; Gustavo Perla Menzala, LNCC, Brazil; Carlos Marijuan, Universidad de Valladolid, Spain; Miriam Pisonero, Universidad de Valladolid, Spain; Juan Carlos Gutierrez, Universidad de Sao Paulo, Brazil; Juan Rivera, Universidad Catòlica del Norte, Chile; Oscar Rojo, Universidad Catòlica del Norte, Chile; Carlos Conca, CMM Universidad de Chile; Roberto Cominetti, CMM Universidad de Chile; Rodolfo Rodriguez, Universidad de Concepciòn, Chile; Claudio Fernàndez, Pontificia Universidad Catòlica de Chile; Hèctor Gòmez, Universidad de Atacama, Chile; Rolando Rebolledo, Pontificia Universidad Catòlica de Chile.
Information: http://www.uantof.cl/comca2005.

*4 **2005 Duke-Berlin Geometry and Physics Festival**, FU-Berlin, Germany.
Speakers: Anda Degeratu (Duke), Geometry from Physics; Daniel Fox (UC, Irvine), Calibrated Geometries and Integrable Systems; Sven Rinke (Duke), Strings, Branes, Supersymmetry and All That; Ilia Zharkov (Harvard), Integral Kähler Affine Structures.
Information: Visit http://www.cgtp.duke.edu/~rinke/Duke-Berlin/.

4-5 **Beyond The Formula IX "Constantly Improving the Teaching of Introductory Statistics"**, Monroe Community College, Rochester, New York. (Jun/Jul. 2005, p. 669)
Program: Beyond the Formula is a two-day conference intended for all teachers of Introductory Statistics (2-yr & 4-yr college and AP & non-AP HS). It is planned for all, the novice as well as the experienced. This year's focus is on teaching techniques and classroom teaching strategies. There will also be sessions on assessment strategies/techniques, use of technology, service learning and writing across the curriculum, to name a few. Please visit our website for a full listing.
Speakers: These sessions are being led by Jessica Utts, UC Davis; Deb Nolan, UC Berkeley; Dick DeVeaux, Williams College; Mark Earley, Bowling Green State, and many others.
Information: http://www.monroecc.edu/go/beyondtheformula; email: BeyondTheFormula@MonroeCC.edu or phone: 585-292-2930.

5-11 **Logic In Hungary, 2005**, Budapest, Hungary. (Apr. 2005, p. 475)
Topics: Set Theory, Foundations of Space-Time, Algebraic Logic, but contributions from all other branches of symbolic logic are welcome.
Organizing Committee: A. Hajnal, J Suranyi (honorary chair), H. Andreka, I. Juhasz, P. Komjath, I. Nemeti (co-chair), G. Sagi (secretary), L. Csirmaz, M. Ferenczi, M. Redei, I. Sain and L. Soukup (members).
Information: Contact: email: lh05@renyi.hu; http://www.renyi.hu/lh05.

7-12 **High-dimensional Partial Differential Equations in Science and Engineering**, Centre de recherches mathématiques, Université de Montréal Montréal, Québec, Canada. (Apr. 2005, p. 475)
Description: High dimensional spatio-temporal partial differential equations are a major challenge to scientific computing of the future. Up to now deemed prohibitive, they have recently become manageable by combining recent developments in numerical techniques, appropriate computer implementations, and the use of computers with parallel and even massively parallel architectures. This opens new perspectives in many fields of applications. Kinetic plasma physics equations, many body Schrödinger equation, Dirac and Maxwell equations for molecular electronic structure and nuclear dynamic computations, options pricing equations in mathematical finance, and Fokker-Planck and fluid dynamics equations for complex fluids, are examples of equations that can now be handled.
Scientific Program Committee and Organizers: André Bandrauk (CRC, Chimie, Université de Sherbrooke); Michel Delfour (CRM/DMS, Université de Montréal, Canada); Claude Le Bris (CERMICS, École Nationale des Ponts et Chaussées, France).

7-12 **International Conference: Mathematics in Finance**, Kruger-National Park, South Africa. (Dec. 2004, p. 1379)
Hosts: Hosted jointly by Potchefstroom University for CHE, The University of Pretoria and The University of the Witwatersrand.
Focus: Topics that would be covered include among others: Stochastic models, Modern methods of risk analysis, Quantitative

and computational models and methods, Methods of financial mathematics; in particular the role of measure theory, functional analysis and modern stochastics in Finance.
Information: email: mfinance@cam.wits.ac.za.

*8-11 **Workshop on Profinite Groups and Applications**, Carleton University, Ottawa, Ontario, Canada.
Overview: The workshop will consist of a series of mini-courses by renowned specialists in profinite groups that should be accessible to graduate students and of use to researchers in group theory, number theory, algebraic geometry and related areas. There will also be some more specialized talks by invited speakers.
Information: http://www.fields.utoronto.ca/programs/scientific/05-06/profinite/.

8-12 **NSF-CBMS Regional Conference on Algebraic and Topological Combinatorics of Ordered Sets**, San Francisco State University, San Francisco, California. (Apr. 2005, p. 475)
Speaker: Anders Bjoörner will give ten lectures to introduce background material, fundamental results, and recent advances in the field of algebraic and topological combinatorics of partially order sets, (oriented) matroids, subspace arrangements, and algebraic shifting etc. Most of the 40-50 participants should expect to obtain funding. Graduate students and postdocs are highly encouraged to apply.
Other Speakers: Alexander Barvinok, Winfried Bruns, Gunnar Carlsson, Persi Diaconis, Isabella Novik, Bernd Sturmfels, Michelle Wachs, Neil White.
Organizers: J. Gubeladze, email: soso@math.sfsu.edu; S. Hosten; email: serkan@math.sfsu.edu.
Information: http://math.sfsu.edu/gubeladze/cbms.html.

8-13 **XX Nevanlinna Colloquium**, ETH Lausanne, Lausanne, Switzerland. (Nov. 2004, p. 1266)
Topics: Geometric invariants of Riemannian surfaces and hyperbolic manifolds, Kleinian groups, arithmetic groups, discrete subgroups of Lie groups. Numerical methods in conformal geometry. Quasiregular maps. Geometric analysis.
Information: (NEW WEB ADDRESS): http://www.nevanlinna.ch.

8-December 23 **Global Problems in Mathematical Relativity**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 834)
Description: General relativity has been around for a long time as a physical theory and an object of mathematical study. It was a subject of intense interest in the 1960s and 1970s, when advances included the discovery of the Kerr solution, the study of black holes and singularity theorems, and the introduction of asymptopia as a framework for studying asymptotic properties, including gravitational radiation. At the same time there were many mathematical problems that resisted mathematical analysis. In recent years there have been significant advances in our understanding of the topological, geometrical, and PDE aspects of general relativity; and progress is once again becoming rapid. New results are being obtained, and older results re-proved in greater generality.
Organizers: P.T. Chrusciel (Tours), H. Friedrich (Golm), P. Tod (Oxford).
Information: http://www.newton.cam.ac.uk/programmes/GMR/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

10-12 **17th Canadian Conference on Computational Geometry**, The Fields Institute for Research in Mathematical Sciences, University of Windsor, Windsor, Ontario, Canada. (Aug. 2005, p. 785)
Information: email: gensci@fields.utoronto.ca.

14-19 **International Conference on Complex Analysis and Related Topics: The 10th Romanian-Finnish Seminar**, "Babes-Bolyai" University, Cluj-Napoca, Romania. (Apr. 2005, p. 475)
Organizers: The Institute of Mathematics "Simion Stoilow" of the Romanian Academy, the Faculty of Mathematics and Informatics of the University of Bucharest, the Faculty of Mathematics and Informatics of the "Babes-Bolyai" University of Cluj-Napoca, the Universities of Helsinki, Joensuu and Jyvaskyla from Finland.
Topics: Analytic functions of one complex variable; Quasiconformal mappings and Teichmuller spaces; Several complex variables; Potential theory; Functional analytical methods in complex analysis.
Registration: A preliminary registration form (including: Name; First name; Institution/Affiliation; Address/E-mail; Sections' participation) should be returned (either by e-mail or by standard mail; see address below).
Information: Complex Analysis and Related Topics c/o Institute of Mathematics "Simion Stoilow" of the Romanian Academy, P.O. Box 1-764, 014700, Bucharest, Romania; fax:+40 21 212 51 26; email: rofinsem@imar.ro.

15-17 **DIMACS Workshop on Machine Learning Approaches for Understanding Gene Regulation**, DIMACS Center, CoRE Bldg, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2005, p. 670)
Description: This three-day workshop is designed to encourage interaction among innovators in computational biology and innovators in machine learning; to illuminate recent successes as well as pressing challenges; and to inspire the development of novel, biologically relevant, and biologically interpretable machine learning approaches to the current problems in biology.
Organizer: Christina Leslie, Columbia University, email: cleslie@cs.columbia.edu; Chris Wiggins, Columbia University, email: chris.wiggins@columbia.edu.
Local Arrangements: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
Information: http://dimacs.rutgers.edu/Workshops/MachineLearning/.

15-19 **Eisenstein Series and Applications**, AIM Research Conference Center, Palo Alto, CA. (May 2005, p. 569)
Organizers: Wee Teck Gan, Steven Kudla, and Yuri Tschinkel.
Workshop Topics: This workshop, sponsored by AIM and the NSF, will consider some recent applications of Eisenstein series to problems in arithmetic geometry and number theory. A central goal of the workshop will be to try to understand the common structural properties of the Eisenstein series occuring in applications.
Application Deadline: May 15, 2005.
Information: http://aimath.org/ARCC/workshops/eisenstein.html.

15-19 **Workshop on PDE and and Mathematical Finance**, Institut Mittag-Leffler, Stockholm, Sweden. (May 2005, p. 569)
List of Speakers: K. H. Karlsen (CMA/Univ. of Oslo), P. Laurence (Univ. of Rome), M. Avellaneda (New York Univ.), B. Oksendal (Univ. of Oslo), J-P. Fouque (North Carolina State Univ.), K. Solna (Univ. of California, Irvine), N. Touzi (ENSEA), C. Schwab (Swiss Fed. inst. of Tech., Zurich), M. Jonsson (Royal Inst. of Tech.), T. Zariphopoulou (Univ. of Texas at Austin), A. Ilhan (Princeton Univ.), D. Talay (INRIA), J. Tysk (Uppsala Univ.), W. Schachermayer (Vienna Univ. of Tech.), I. Karatzas (Columbia Univ.), H. M. Soner (Koch Univ.), H. Pham (Jussieu), J. Teichmann (Vienna Univ. of Tech.), S. Howison (Univ. of Oxford).
Information: Contact: Teitur Arnarson, Dept. of Math. KTH, 100 44 Stockholm, Sweden; email: teitur@math.kth.se.

17-19 **Spatial/Temporal Modelling for Marine Ecological Systems**, The Fields Institute for Research in Mathematical Sciences, Dalhousie University, Halifax, Nova Scotia, Canada. (Aug. 2005, p. 785)
Description: The purpose of the workshop is to bring together researchers in statistics and marine ecology interested in the development of models for the analysis of the complex temporal/spatial data now becoming available. These data include, for example, animal tracking data as well as time series of biological variables

from ocean observing systems. Advancements in marine ecology will be realized using these new observations, but not without the development and application of new statistical analysis techniques. Our over-riding goal is to review and further faciliate the identification of appropriate statistical methods and modeling approaches to address outstanding research questions.
Call for Papers: We invite participants to submit poster presentations. There will also be a limited number of oral presentations possible. Submitted abstracts should address one of the major conference themes.
Information: For Registration and Abstract Submission please contact Joanna Mills Flemming.
Important dates: Abstract Submission deadline: May 31, 2005. Registration deadline: June 15, 2005.
Information: email: gensci@fields.utoronto.ca; http://www.mathstat.dal.ca/.

17-21 **Third Pacific Rim Conference on Mathematics**, Fudan University, Shanghai, China. (Apr. 2005, p. 476)
Topics: All areas of mathematics with focus topics on: Algebra and Combinatorics; Algebraic Aspects of Lie Theory and Geometry; Applied Differential Geometry; Asymptotics and Riemann-Hilbert Problems; Computational Approach to Complex Dynamical Systems; Kinetic Theory; Low Dimensional Topology and Geometry; Nonlinear Analysis Nonlinear Phenomena, Symmetry and Integrable Structures; Partial Differential Equations and Applications.
Plenary Speakers: Gerard Jennhwa Chang (Taiwan), Shuxing Chen (China), Philippe G. Ciarlet (Hong Kong), Konstantin Mischaikow (USA), Colin Rogers (Australia), Minoru Wakimoto, (Japan), Shicheng Wang (China), Roderick Wong (Hong Kong), Shih-Hsien Yu (Hong Kong).
Supporter: Fudan University, Mathematical Center of Ministry of Education of China, National Natural Science Foundation of China, Chinese Mathematical Society, China Society for Industrial and Applied Mathematics, Liu Bie Ju Centre for Mathematical Sciences (City University of Hong Kong), Sino-French Institute of Applied Mathematics
Information: Contact: Zhou Chunlian, Sino-French Institute of Applied Mathematics, Fudan University, Shanghai 200433, China; tel: 81-21-6564 2469; fax: 86-21-6564 8274; email: clzhou@fudan.edu.cn; http://PRCM3.fudan.edu.cn.

20-22 **6th International Pure Mathematics Conference 2005**, Islamabad, Pakistan. (Jun/Jul. 2005, p. 670)
Description: The 6th International Pure Mathematics Conference 2005 (6th IPMC 2005) is a thematic conference on Algebra, Geometry, Analysis, and Mechanics. The entire conference is organized under one roof at a four-star hotel in the modern, peaceful, and beautiful federal capital of Pakistan located at the footsteps of the scenic Margalla Hills. There will be free housing and lodging for foreign participants. Several recreational trips will be organized in and around Islamabad introducing the unique local and multi-ethnic culture.
Information and registration: Please fill in the on-line registration form at http://www.pmc.org.pk and find more information therein. The conference is convened by Qaiser Mushtaq in collaboration with Mathematics Division, Institute of Basic Research (Florida, USA), Higher Education Commission, Pakistan Telecommunication Ltd, and Pakistan Mathematical Society.

20-26 **Algebraic and Geometric Combinatorics**, Anogia Academic Village, Crete, Greece. (Apr. 2005, p. 476)
Organizers: V. Batyrev, M. Henk, F. Santos.
Main speakers: V. Batyrev, L. Billera, A. Bjorner, Sweden, M. Henk, P. McMullen, F. Santos, G. Ziegler.
Support: For young scientists (pre- and post-Ph.D.), especially from EU Member and Associated States.
Deadline: April 20, 2005.
Information: Financial applications: email: euroconf@math.uoc.gr.

22-27 **International Symposium on Analytic Function Theory, Fractional Calculus and their Applications: In Honour of Professor H. M. Srivastava on his 65th Birthday**, University of Victoria, Victoria, British Columbia, Canada. (Jun/Jul. 2005, p. 670)
Organizers: S. Owa (Kinki Univ., Higashi-Osaka, Japan; email: owa@math.kindai.ac.jp; T. Sekine (Nihon Univ., Chiba, Japan); email: tsekine@pha.nihon-u.ac.jp; H. Nishiwaki (Slow Mathematics Incorporated, Kyoto, Japan).
Information: Ms. Merina Brisdon (Univ. of Victoria, Victoria, British Columbia, Canada); email: merina@math.uvic.ca.

27-29 **CCA 2005, Second International Conference on Computability and Complexity in Analysis**, Kyoto University, Kyoto, Japan. (Jun/Jul. 2005, p. 670)
Scope: Theory of computability and complexity over real-valued data.
Deadlines: Submission: May 1, 2005; Notification: June 5, 2005; Camera-ready version: July 3, 2005; Satellite seminars and reception: August 25-26, 2005; Main conference: August 27-29, 2005.
Information: http://cca-net.de/cca2005.

28-September 2 **5th Conference on Differential Geometry**, Mangalia, Romania. (May 2005, p. 569)
Invited Participants: Geometers; Members of BSG-AMS, EMIS.
Institutional Organizers: Balkan Society of Geometers, University Politehnica of Bucharest-Department of Mathematics, University of Bucharest-Faculty of Mathematics and Informatics, Society of Mathematical Sciences from Romania, Callatis High School of Mangalia.
Topics: Differential geometry, dynamical systems, optimization on Riemannian manifolds, Theory of Relativity, celebration of Dan Barbillian (1895-1961), mathematics in High Schools and Universities, BSG elections.
Deadlines: Submission of applications: June 20, 2005. Selected scientific papers will be published in BSG journals.
Coordinators: Constantin Udriste, Gabriel Pripoae.
Information: email: vbalan@mathem.pub.ro. udriste@mathem.pub.ro (scientific); callatis@seanet.ro (educational).

29-31 **Algebraic Methods and Applications in Dynamical Systems - Special session in the 5th IASTED International Conference on Modeling, Simulation, and Optimization (MSO 2005)**, Oranjestad, Aruba. (May 2005, p. 569)
Description: This special session will focus on the algebraic methods and applications in continuous or discrete dynamical systems. In recent years, algebraic techniques are increasingly applied to many real world problems producing dynamic systems. Through the presentations we propose to identify common themes and recent developments regarding algebraic approach to solving dynamical system problems. Furthermore, this session will provide participants opportunities to interact and establish research connections with each other. The deadline to submit your paper to this special session is April 15, 2005. Please send your paper directly to Aihua Li, the organizer. Email submission is preferred. The address is: lia@mail.montclair.edu. Please see the conference web site for instruction.
Organizer: Aihua Li, Department of Mathematical Sciences, Montclair State University, 1 Normal Avenue, Montclair, NJ 07043, USA. Office phone: 973-655-7271.
Information: http://www.iasted.org/conferences/2005/aruba/c471.htm

29-September 2 **International Workshop on Computational Science and its Education (IWCSE-2005 Beijing, China)**, Capital Normal University, Beijing, China. (Jun/Jul. 2005, p. 670)
Description: The event is composed of 45 invited talks in 6 focus areas in computational science and its education and 2 panel

discussions on contemporary research and teaching issues. Online registration, abstract submission for contributed talks and poster presentations are open till July 31, 2005.
Information: http://www.math.ohiou.edu/~shen/workshop/workshop.html; http://www.cnu.edu.cn/guojihuiyi/iwcse2005/.

29-September 2 **Numerical Methods for Optimal Control in High Dimensions**, AIM Research Conference Center, Palo Alto, CA. (May 2005, p. 569)
Organizers: Doron Levy, Ian Mitchell, and Adam Oberman.
Workshop Topics: This workshop, sponsored by AIM and the NSF, will be devoted to problems of optimal control, broadly interpreted to include stochastic control problems and differential games. It is a standard practice to formulate these problems in terms of a multi-dimensional Hamilton-Jacobi-Bellman (HJB) equation. The workshop will focus on computational methods for tackling high dimensional HJB and related equations.
Application Deadline: May 29, 2005.
Information: Visit http://aimath.org/ARCC/workshops/optimalcontrol.html.

29-September 3 **CIME Conference: SPDE in hydrodynamics: recent progress and prospects**, Cetraro (Cosenza), Italy. (Jun/Jul. 2005, p. 670)
Lectures (8 hours each): Sergio Albeverio, Bonn University, Germany, Deterministic and Stochastic models of hydrodynamics; Franco Flandoli, Università di. Pisa, Italy, Statistics of vortex filaments: From the Navier-Stokes equations to the laws of turbolence; Yakov G. Sinai, Princeton University, Mathematics of Navier-Stokes system.
Information: http://www.math.unifi.it/~CIME.

* 30-September 1 **Probability and PDE**, SCIENCE BLD 3-512, Hokkaido University, Sapporo, Japan.
Organizers: Masayoshi Takeda (Tohoku Univ.), Etoshio Mikami (Hokkaido Univ.).
Speakers: Koji Kikuchi (Shizuoka Univ.), Yoshihiro Tonegawa (Hokkaido Univ.), Shuya Kanagawa (Musashi Inst. Tech.), Kazuhiro Kuwae (Kumamoto Univ.), Masayoshi Takeda (Tohoku Univ.), Masaaki Tsuchiya (Kanazawa Univ.), Masatoshi Fujisaki (Hyogo Pref. Univ.), Katsuyuki Ishii (Kobe Univ.), Naoyuki Ichihara (Osaka Univ.), Hideo Nagai (Osaka Univ.), Hidehiro Kaise (Nagoya Univ.), Shuenn-Jyi Sheu (Academia Sinica), Yasuhiro Fujita (Toyama Univ.), Toshio Mikami (Hokkaido Univ.).

September 2005

5-8 **8th International Conference on Logic Programming and Nonmonotonic Reasoning (LPNMR'05)**, Diamante, Cosenza, Italy. (Apr. 2005, p. 476)
Description: LPNMR is a forum for exchanging ideas on declarative logic programming, nonmonotonic reasoning and knowledge representation. The aim of the conference is to facilitate interactions between researchers interested in the design and implementation of logic based programming languages and database systems, and researchers who work in the areas of knowledge representation and nonmonotonic reasoning. Authors are invited to submit papers presenting original and unpublished research on nonmonotonic aspects of logic programming and knowledge representation. We particularly encourage papers on application of LPNMR techniques to build significant applications.
Topics: Development and mathematical studies of logical systems with nonmonotonic entailment relations, Implementation of LPNMR systems, and Applications of LPNMR systems.
Important dates: Abstract Submission Deadline: March 22, 2005; GMT; Paper Submission Deadline: March 25, 2005; Notification (Accept/Reject): May 16, 2005; Conference Schedule: June 6, 2005; Final Conference Papers: June 10, 2005; Early Registration Deadline: July 4, 2005.
Information: http://www.mat.unical.it/lpnmr05/.

5-9 **IVth International Workshop on Functional Analysis**, Liège, Belgium. (May 2005, p. 569)
Description: This Functional Analysis Conference is a joint venture of the University of TRIER (Germany) and of the University of LIEGE (Belgium); it is organized on the occasion of the 65th birthday of Professor Jean Schmets (University of LIEGE).
Organizers: Francoise Bastin (University of LIEGE, Belgium), Susanne Dierolf (University of TRIER, Germany), Jochen Wengenroth (University of TRIER, Germany).
Information: http://www.ulg.ac.be/sectmath/Sept05.html; http://http://www.afo.ulg.ac.be/.

5-9 **Workshop on: Modular Forms, Automorphic Forms and Related Moduli Spaces**, INdAM-institute on the campus of the Università di Roma "La Sapienza", Rome, Italy. (Mar. 2005, p. 371)
Organizers: Riccardo Salvati Manni (Roma) and Bert van Geemen (Milano).
Invited Speakers: F. Andreatta (Padova); S. Böcherer (Mannheim); J. H. Bruinier (Heidelberg) to be confirmed; D. Doud (Provo) to be confirmed; C. Faber (Stockholm) to be confirmed; V. Gritsenko (Lille); S. Grushevsky (Princeton); E. Freitag (Heidelberg); K. Hulek (Hannover); T. Ibukiyama (Osaka); W. Kohnen (Heidelberg); S. Kondo (Nagoya); S. Kudla (College Park) to be confirmed; E. Looijenga (Utrecht); D. Pollack (Middletown); G. K. Sankaran (Bath); R. Schmidt (Oklahoma); N. I. Shepherd-Barron (Cambridge, UK); W. Stein (Cambridge, USA); A. M. Uludag (Bursa); R. Weissauer (Heidelberg) to be confirmed.
Information: http://www.mat.uniroma1.it/modular/; email: modular@mat.uniroma1.it.

5-11 **The Seventh International Workshop on Differential Geometry and its Applications**, Deva, Romania. (Feb. 2005, p. 291)
Program: 50 minute lectures and 25 minute talks. Poster communications are also envisaged.
Main Topics: Riemannian geometry and generalizations, nonassociative algebra methods in (finite- and infinite-dimensional) differential geometry, complex and quaternionic geometry, foliation theory, critical point theory and applications.
Foreign Invited Speakers (confirmed until the end of August 2004): W. Bertram (France), C.-H. Chu (England), J. Dorfmeister (Germany), L. Funar (France), W. Kaup (Germany), O. Kowalski (Czech Republic), E. Macias-Virgos (Spain), S. Marchiafava (Italy), N. Teleman (Italy).
Organizers: D. Andrica, "Babes-Bolyai", Univ.-Cluj-Napoca, email: dandrica@math.ubbcluj.ro; R. Iordanescu, Institute of Mathematics of the Romanian Academy-Bucharest, email: Radu.Iordanescu@imar.ro; I. Mos, Department of Colleges for Teachers of the Univ. of the West from Timisoara in Deva, email: mos@isj.hd.edu.ro; M. Puta, Univ.of the West, Faculty of Mathematics, Timisoara, email: puta@math.uvt.ro.

* 7-9 **Topics in Deformation Quantization and Noncommutative Structures**, CINVESTAV, Mexico City, Mexico.
Description: The Physics and Mathematics departments of the CINVESTAV in the WORLD YEAR OF PHYSICS 2005 around M. Kontsevich's visit to Mexico for the SOLOMON LEFSCHETZ MEMORIAL LECTURES have the pleasure to announce the satellite conference on Deformation Quantization and Noncommutative Structures.
Confirmed lecturers: Ernesto Lupercio (Departamento de Matematicas, Cinvestav, Mexico), Octavio Obregon (Departamento de Fisica, Universidad de Guanajuato, Mexico), Marcos Rosenbaum (ICN-UNAM, MEXICO), Daniel Sternheimer (Institut de Mathematiques de Bourgogne, Dijon, France), Nikolai Vasilevski (Departamento de Matematicas, Cinvestav, Mexico), Carlos Villegas (Instituto de Matematicas, UNAM-Cuernavaca, Mexico), Alan Weinstein (University of California, Berkeley, California).
Organizers: Giuseppe Dito, Institut de Mathématiques de Bourgogne, CNRS UMR 5584, Université de Bourgogne, Dijon, France.

Hugo García-Compeán CINVESTAV, Physics Department, México. Isidoro Gitler, CINVESTAV, Mathematics Department, México. Ernesto Lupercio, CINVESTAV, Mathematics Department, México. Maciej Przanowski, Institute of Physics, Technical University of Lodz, Poland. Francisco Turrubiates, Institut de Mathématiques de Bourgogne, CNRS UMR 5584, Université de Bourgogne, Dijon, France. Carlos Villegas, Institute of Mathematics, UNAM, Cuernavaca, México.

*8-9 **Solomon Lefschetz Memorial Lectures**, CINVESTAV, Mexico city, Mexico.
Description: The Mathematics and Physics department have the pleasure to announce that Prof. Maxim Kontsevich (IHES, France) will deliver the Solomon Lefschetz Memorial Lectures this year. The late Prof. Solomon Lefschetz was closely associated with the development of mathematical research in Mexico. As a tribute to him and in his honor, our Centro de Investigacion has established the Solomon Lefschetz Memorial Lectures. Our practice has been to invite an eminent mathematician to our research center to give a series of lectures. The previous Lefschetz Lectures were given by Prof. J. Hale, M. F. Atiyah, E. Bombieri, S. S. Chern, J. Milnor, P. Mumford, W. Thurston, Y. G. Sinai, V. P. Maslov and S. Albeverio.
Organizers: Giuseppe Dito Institut de Mathématiques de Bourgogne, CNRS UMR 5584, Université de Bourgogne, Dijon, France. Hugo García-Compeán CINVESTAV, Physics Department, México. Isidoro Gitler CINVESTAV, Mathematics Department, México. Ernesto Lupercio CINVESTAV, Mathematics Department, México. Maciej Przanowski Institute of Physics, Technical University of Lodz, Poland. Francisco Turrubiates Institut de Mathématiques de Bourgogne, CNRS UMR 5584, Université de Bourgogne, Dijon, France. Carlos Villegas Institute of Mathematics, UNAM, Cuernavaca, México.

8-10 **Fabes Lectures 2005: First Announcement**, Universita' di Trieste, Trieste, Italy. (Jun/Jul. 2005, p. 670)
Speakers: The following speakers have accepted to contribute with a talk: Russell Brown (University of Kentucky), Luis Escauriaza (EHU, Bilbao), Hyeonbae Kang (Seoul National University), C. Kenig (University of Chicago), R. Magnanini (Firenze), A. Morassi (Udine), L. Paivŕintä (Rolf Nevanlinna-Institute, Helsinki), Alberto Ruiz Gonzalez (Univ. Autonoma, Madrid), J. K. Seo (Yonsei University, Seoul), G. Uhlmann (University of Washington, Seattle).
Organizers: Giovanni Alessandrini, Universita' di Trieste, Italy; Sandro Salsa, Politecnico di Milano, Italy.
Information: The relevant information shall be posted in due time on the web page `http://www.dmi.units.it/~rondi/fabes/`. Those interested in attending are invited may write to: email: `rondi@units.it`.

10-13 **36th Annual Iranian Mathematics Conference**, Department of Mathematics, Yazd University, Yazd, Iran. (Jun/Jul. 2005, p. 670)
Description: The Annual Iranian Mathematics Conference (AIMC) is the oldest scientific gathering which takes place regularly each year at one of Iranian universities.
Sponsors: The Iranian Mathematical Society and Yazd University have jointly sponsored the 36th AIMC. This conference is an international conference and includes invited speakers and presentations of contributed research papers.
Deadlines: June 5, 2005: Registration and extended abstract submission. July 5, 2005: Complete paper submission. Registered participants who wish their paper to be published in the conference proceedings must submit their paper.
Information: If you have any questions and to get the announcement for the AIMC36, please send an email to: B. Davvaz, Chairman of Scientific Committee; email: `aimc36@yazduni.ac.ir`; `davvaz@yazduni.ac.ir`.

12-15 **Third International Workshop Meshfree Methods for Partial Differential Equations**, Rheinische Friedrich-Wilhelms Universität Bonn, Bonn, Germany. (Apr. 2005, p. 476)
Description: The numerical treatment of partial differential equations with meshfree discretization techniques has been a very active research area in recent years. While the fundamental theory of meshfree methods has been developed and considerable advances of the various methods have been made, many challenges in the mathematical analysis and practical implementation of meshfree methods remain.
Sponsor: Sonderforschungsbereich 611.
Deadlines: Abstract: About 300 words (preferably in LaTeX format) to email: `meshfree@ins.uni-bonn.de` by May 1, 2005. Confirmation and program: August 1, 2005.
Information: `http://wissrech.ins.uni-bonn.de/meshfree`.

12-16 **p-Adic Representations**, Centre de recherches mathématiques, Univ. de Montréal, Montréal, Québec, Canada. (Apr. 2005, p. 476)
Topics: The main topics are related to a p-adic Langlands correspondence and its relationship to p-adic families of motives. More precisely the p-adic Langlands correspondence is a correspondence between p-adic Galois representations of dimension n (of the absolute Galois group of Qp) and certain representations of GLn(Qp) on p-adic topological vector spaces. This correspondence is supposed to be compatible with p-adic families on both sides.
Organizers: Adrian Iovita (Concordia); Henri Darmon (McGill).
Information: `http://www.crm.umontreal.ca/Number2005/`.

12-16 **CASC'2005: The 8th International Workshop on Computer Algebra in Scientific Computing, CASC'2005**, Kalamata, Greece. (Apr. 2005, p. 476)
Organizers: CASC General Chairs: V. P. Gerdt (Dubna), E. W. Mayr (Munich) CASC'2005 Conference Chairs: I. Z. Emiris (Athens), I. S. Kotsireas (Waterloo), M. N. Vrahatis (Patras).
Deadlines: For submissions: April 1, 2005. Notification of acceptance: June 30, 2005. Final version due: July 15, 2005.
Information: `http://www.cargo.wlu.ca/casc2005/`; email: `casc2005@in.tum.de`.

12-17 **International Conference on Mathematical Analysis of Random Phenomena**, Hotel Abou Nawas Hammamet, Hammamet, Tunisia. (May 2005, p. 569)
Scientific Programe: Stochastic Analysis, Mathematical Finance, Poisson Analysis, Intersection local times, Hydrodynamics equations, Statistical mechanics, Probability in Quantum Physics.
Invited Speakers: Luigi Accardi, Hélène Airault, Sergio Albeverio, Philippe Blanchard, Eric Carlen, Fernanda Cipriano, Ana Bela Cruzeiro , Custódia Drumond, Diogo Gomes, Hanno Gottschalk, Martin Grothaus, Takeyuki Hida, Yuri Kondratiev, Tobias Kuna, Paul Lescot, Paul Malliavin, Rui Vilela Mendes, Nobuaki Obata, Bernt Oksendal, Maria J. Oliveira, Giulia di Nunno, Habib Ouerdiane, Nicolas Privault, Michael Röckner, Francesco Russo, José L. Silva, Isabel Simão, Ludwig Streit, Jean Claude Zambrini.
Inscription deadline: June 15, 2005.
Information: Ana Bela Cruzeiro, Grupo de Física-Matemática U.L. and Dep. de Matemática I.S.T. Av. Rovisco Pais 1049-001 Lisboa, Portugal; tel: +351 218417063; fax: +351 218417048; email: `abcruz@math.ist.utl.pt` or Habib Ouerdiane, Département de Mathématiques. Faculté des Sciences de Tunis. Campus universitaire-1060 Tunis. Tunisie; tel.: + 216-71-872-020, fax: + 216 1 885 350, email: `habib.ouerdiane@fst.rnu.tn`; `http://www.uma.pt/Investigacao/Ccm/hammamet.html`.

12-19 **Small Deviation Probabilities and Related Topics**, Euler IMI, St. Petersburg, Russia. (Feb. 2005, p. 291)
Organizers: St. Petersburg Department of Steklov Institute of Mathematics, Euler International Mathematical Institute.
Topics: The aim of the conference is to bring together outstanding researchers working on small deviation probabilities and in related fields of probability analysis, and applied mathematics such as stochastic processes, approximation theory, quantization, spectral theory of operators etc.

Information: email: smalldev@euler.pdmi.ras.ru; email: www.pdmi.ras.ru/EIMI/2005/sd/.

13-17 **5th International Conference on Words**, Centre de recherches mathématiques, Université de Montréal, Montréal, Québec, Canada. (Apr. 2005, p. 476)
Organizers: Srecko Brlek (Univ. du Québec à Montréal); Cedric Chauve (Univ. Bordeaux I, UQAM); Annie Lacasse (Univ. du Québec à Montréal); Geneviève Paquin (Univ. du Québec à Montréal).

16-20 **International Conference of Numerical Analysis and Applied Mathematics 2005 (ICNAAM 2005)**, Hotel Esperides, Rhodes, Greece. (Feb. 2005, p. 291)
Organizer: European Society of Computational Methods in Sciences and Engineering (ESCMCE).
Deadlines: Important Dates: Early Registration ends (i.e. fees paid and a bank Slip has arrived fax: (++ 30210 94 20 091, ++ 30 2710 237 397) to the Secretary of ICNAAM or a Visa-Master-American Express Card has been charged): April 30, 2005. Normal Registration ends (i.e. fees paid and a Bank Slip has arrived fax: (++ 30210 94 20 091, ++ 30 2710 237 397) to the Secretary of ICNAAM or a Visa-Master-American Express Card has been charged): May 31, 2005. Late Registration ends (i.e. fees paid and a bank Slip has arrived fax: (++ 30210 94 20 091, ++ 30 2710 237 397) to the Secretary of ICNAAM or a Visa-Master-American Express Card has been charged): June 30, 2005 Submission of Extended Abstract: June 30, 2005 (final date). Notification of acceptance: July 10, 2005. Submission of the source files of the camera ready extended abstracts to Wiley-VCH: July 20, 2005 (final date). Submission of the full paper for consideration for publication in the journals: September 30, 2005–November 30, 2005. The deadline for proposal submission is May 31, 2005. Send to email: icnaam@uop.gr.
Important Information: Papers for Sessions, Workshops or Minisymposia should be submitted directly to the Sessions, Workshops or Minisymposia organizers who also defines the deadline. After the selection, the Sessions, Workshops or Minisymposia organisers must send the final accepted papers to the Secretary of ICNAAM 2005.

18-23 **The 11th Workshop on Graph Theory-Colourings, Independence and Domination**, Karpacz, Poland. (Jun/Jul. 2005, p. 671)
Organizers: Organized by the Faculty of Mathematics, Computer Science and Econometrics of University of Zielona Góra, Poland.
Organizing committee: Mieczyslaw Borowiecki, Alina Szelecka; email: cid@wmie.uz.zgora.pl; http://www.cid.uz.zgora.pl.

18-24 **XII EWM (European Women in Mathematics**, Volgograd, Russia. (Jun/Jul. 2005, p. 671)
Information: Associate secretary: Tatiana Vassilieva; email: ewm@volsu.ru; http://ewm.volsu.ru/.

19-21 **French Moroccan Meeting on Approximation and Optimization**, Faculty of Sciences of Rabat, Morocco. (Jun/Jul. 2005, p. 671)
Scope: Of this meeting covers a range of major topics in Numerical Analysis, Optimization, also in Approximation and Engineering and related disciplines, ranging from theoretical developments to industrial applications and modelling of problems.
Organizer: Faculty of Sciences of Rabat (Morocco), Mohammadia School of Engineers (Morocco), Hassania School Public works (Morocco), National School of Mineral Industry (Morocco), University Paul Sabatier Toulouse (France), National Institut of Applied Sciences Toulouse France). Programme Committee: M-N. Benbourhim (UPS Toulouse, France), M. CHIDAMI (FSR Rabat, Morocco), R. Ellaia (EMI Rabat, Morocco), L. Ghannam (UPS Toulouse, France), A. Hassouni (FSR Rabat, Morocco), A. ISMAIL (EHTP Casablanca, Morocco), K. Najib (ENIM Rabat, Morocco), C. Rabut (INSA Toulouse, France).
Deadline: With abstract: May 19, 2005.
Information: Address: Universite Mohammed V, Faculte Des Sciences, Avenue Ibn Batouta, B.P. 1014, Rabat, Morocco; email: rfmao@fsr.ac.ma; phone: 212 (0) 37775471; http://www.fsr.ac.ma/rfmao/.

19-23 **IMA Tutorial: Radar and Optical Imaging**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: Margaret Cheney (Rensselaer Polytechnic Institute), David Brady (Duke University).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu or; http://www.ima.umn.edu/imaging/fall/T9.19-23.05.html.

20-22 **International Conference: Problems of Modern Mathematics and Mechanics**, Institute of Mathematics, Almaty, Kazakhstan. (May 2005, p. 569)
Topics: Theory of functions and functional analysis. Differential equations and mathematical physics. Algebra and mathematical logic. Computational mathematics. Mechanics of solids & structures. Hydrodynamics, mechanics of gas and plasma. Information technologies. Program of Conference consists of plenary (40 minutes) and sectional (20 minutes) talks. Working languages of Conference are Kazakh, Russian and English.
Important Dates: July 10, 2005–Submission of abstracts. July 20, 2005–The Second announcement.
Organizing Committee: Postal address: Institute of Mathematics, Pushkin str., 125, Almaty, 050010, Kazakhstan; tel: +7(3272)913764; fax:+7(3272)913740; email: im40@math.kz; http://www.math.kz/confen.htm.

20-27 **International Conference Harmonic Analysis and Approximations, III**, Tsahkadzor, Armenia. (Apr. 2005, p. 477)
Deadline for Application: March 31, 2005 .
Description: The program of the conference will consist of invited 40-minutes plenary lectures and contributed 20-minutes talks. The following mathematicians have agreed to give a plenary lecture at the conference: Borislav Bojanov (Bulgaria), Carl de Boor (USA) , Ronald DeVore (USA), Nira Dyn (Israel), Hakop Hakopian (Armenia), Kazaros Kazarian (Spain), Gerard Kerkyacharian (France), Sergey Konyagin (Russia), Michael Lacey (USA), Konstantin Oskolkov (USA), Allan Pinkus (Israel), Gerald Shmieder (Germany), Przemyslaw Wojtaszczyk (Poland).
Contact Information: Artur Sahakian, Institute of Mathematics, Marshal Bagramian ave, 24-B, 375019, Yerevan, Armenia; email: mathconf@ysu.am; http://math.sci.am; fax: (3741) 524801. Online registration is available: http://math.sci.am/conference/sept2005/registration.html.

21-24 **Workshop on Jordan Algebras and Related Fields**, The Fields Institute for Research in Mathematical Sciences, University of Ottawa, Ottawa, Ontario, Canada. (Aug. 2005, p. 785)
Description: The workshop will bring together the leading experts in the theory of Jordan structures (Jordan algebras, Jordan triple systems and Jordan pairs) and researchers from other areas for which Jordan structures play a pivotal role. Its aim is to present some of the many recent advances in the theory of Jordan structures and their applications, to stimulate future work on the outstanding problems in Jordan structures and to foster the interaction between all researchers interested in Jordan theory.
Speakers: The workshop will feature a lecture series by Efim Zelmanov and, in addition, talks by invited speakers. The number of talks is limited, in order to give enough time for informal discussions.
Invited Speakers: T. Cortés (Oviedo), A. Elduque (Zaragoza), J. Faulkner (Virginia), E. Garcia (Madrid), S. Garibaldi (Emory), S. Krutelevich (Ottawa), O. Loos (Innsbruck), C. Martinez (Oviedo), K. McCrimmon (Virginia), H. Petersson (Hagen), I. Shestakov (Saö

Paulo), U. Stenger (Hagen), Y. Yoshii (North Dakota State), E. Zelmanov (UC, San Diego).
Funding: Support for graduate students and postdoctoral fellows: There are limited funds available for graduate students and postdoctoral fellows. If interested please submit an application by June 15, 2005 through the student support application form.
Information: http://www.fields.utoronto.ca/programs/scientific/05-06/jordanalg/;email:gensci@fields.utoronto.ca.

21-26 **International Conference of Computational Methods in Sciences and Engineering 2005 (ICCMSE 2005)**, Hotel Poseidon, Loutraki, Korinthos, Greece. (May 2005, p. 570)
Information: Contact information: Secretary ICCMSE 2005 (Mrs Eleni Ralli-Simou); email: iccmse@uop.gr, Postal Address: 26 Menelaou Street, Amfithea Paleon Faliron, GR-175 64, Athens, Greece, Fax: +30210 94 20 091 or + 30 2710 237397; http://www.uop.gr/~iccmse/.

*23-24 **7th National Conference on Mathematical Analysis and Applications**, University of Craiova, Romania.
Organizers: Center of Nonlinear Analysis and Applications (University of Craiova, Romania) and Romanian Mathematical Society.
Aim: The Conference focuses on various modern trends in Analysis and their applications to Mathematical Physics, Variational Calculus and Optimal Control.
Plenary Speakers: Dumitru Baleanu (Cankaya University, Ankara), Ovidiu Cârjă (Al. I. Cuza University, Iasi), George Dinca (University of Bucharest), Petru Jebelean (West University, Timisoara), Radu Precup (Babes-Bolyai University, Cluj-Napoca), Michel Théra (Université Limoges), Ioan Vrabie (Al. I. Cuza University, Iasi), Michel Willem (Université de Louvain), Constantin Zalinescu (Al. I. Cuza University, Iasi).
Scientific Committee: Viorel Barbu (Romanian Academy), Wolfgang Breckner (Babes-Bolyai University, Cluj-Napoca), Mihail Megan (West University, Timisoara), Petru Mocanu (Babes-Bolyai University, Cluj-Napoca), Nicolae Popa (University of Bucharest), Teodor Precupanu (Al. I. Cuza University, Iasi), Octavian Stanasila (Politehnica University, Bucharest).
Information: Contact: Prof. Constantin Niculescu and Prof. Vicentiu Radulescu, Department of Mathematics, University of Craiova, 200585 Craiova, Romania; fax: +40.251.411688; email: cniculescu@central.ucv.ro;vicentiu.radulescu@ucv.ro;http://inf.ucv.ro/events/CAMA2005/.

26-30 **49th Annual Meeting of the Australian Mathematical Society**, The University of Western Australia, Perth, Australia. (Jan. 2005, p. 82)
Information: http://www.maths.uwa.edu.au/~austms05/.

27-30 **Workshop on Graphs, Morphisms and Applications**, Centre de Recerca Matemàtica, Bellaterra, Spain. (Jun/Jul. 2005, p. 671)
Tentative list of participants: J. Barajas, M. Bodirsky, P. Cameron, V. Dalmau, J. Díaz, J. Fiala, G. Hahn, P. Hell, W. Imrich, J.B. Jensen, A.V. Kostochka, D. Kral, J. Kratochvil, H. Lefmann, A. Lladó, M. Loebl, L. Lovasz, C. McDiarmid, B. Mohar, A. Montejano, J. Moragas, R. Naserasr, M. Noy, P. Ossona, A. Raspaud, V. Rödl, M. Ruszinko, M.J. Serna, E. Sopena, C. Szabo, Cl. Tardif, J.A. Telle, D. Thililós, B. Toft, G.J. Woeginger and X. Zhu.
Information: http://www.crm.es/ or email: WorkshopGraphs@crm.es.

October 2005

3-7 **2nd Workshop on Tutte Polynomials and Applications**, Centre de Recerca Matemàtica, Bellaterra, Spain. (Jun/Jul. 2005, p. 671)
Tentative list of participants: M. Bousquet-Mélou, P Cameron, R. Cordovil, R. Cori, J.E. Ellis-Monaghan, G. Farr, I. Gitler, L. Helme-Guizon, P. Hlíneny, B. Jackson, J.P. Kung, M. Las Vergnas, M. Loebl, J. Makowsky, C. Merino, R. Read, D. Rossin, J. Salas, I. Sarmiento, G. Schaeffer, R. Shrock, A. Sokal and D.G. Wagner.
Information: http://www.crm.es/ or email: WorkshopTutte@crm.es.

*6-8 **Wolfram Technology Conference 2005**, Hawthorn Suites Ltd., Champaign, Illinois.
Description: This intensive three-day event will assemble leaders from around the world in technical computing and other related fields for presentations on the latest advances in Mathematica and other Wolfram technologies. The conference will feature tutorials, hands-on workshops, problem-solving clinics, contributed talks, demo sessions, technology briefings, and one-on-one executive discussions.
Deadline: For abstracts: August 1, 2005.
Information: http://www.wolfram.com/techconf2005/. Phone: 1-800-WOLFRAM (965-3726) or +1-217-398-0700; email: conference-info@wolfram.com. Registration: http://www.wolfram.com/news/events/techconf2005/register.cgi.

7-8 **Twenty-Fifth Annual Southeastern-Atlantic Regional Conference on Differential Equations**, University of Dayton, Dayton, Ohio. (May 2005, p. 570)
Organizer: Muhammad N. Islam.
Principal Speakers: T. A. Burton (Northwest Research Institute, Washington, Retired from Southern Illinois University), Functional Differential Equations; Srdjan Stojanovic (University of Cincinnati, Ohio), Nonlinear Partial Differential Equations - methods in Financial Mathematics; Avner Friedman (Ohio State University, Ohio), Partial Differential Equations. (tentative); Konstantina Trivisa (University Maryland), Nonlinear Partial Differential Equations and Applied Mathematics. (tentative)
In addition to the principal speakers, there will also be sessions of twenty minute contributed talks. Pending funding from the National Science Foundation, travel support funds will be available for advanced graduate students and recent Ph.D. recipients. Women and minority participants are especially encouraged to participate in this conference and to apply for support.
Information: http://academic.udayton.edu/searcde-25/. To get instructions on registration, lodging, submission of abstracts, and application for support. Please pass this announcement along to all who might be interested in participating in the conference. If you have questions about the conference, please send e-mail to searcde25@notes.udayton.edu or call Muhammad Islam (937 229-2109) or Mark Oxley (937 255-3636 Ex 4515).

7-9 **19th Midwest Conference on Combinatorics, Cryptography and Computing**, Department of Mathematics, Rochester Institute of Technology, Rochester, New York. (Jun/Jul. 2005, p. 671)
Keynote speaker: P. Winkler (Dartmouth College).
Invited Speakers: Walter Wallis (Southern Illinois University), Earl Glen Whitehead, Jr., (University of Pittsburgh), Eric Mendelsohn (University of Toronto), Jon Lee (IBM), Ruth Haas (Smith College), Ralph Grimaldi (Rose Hulman Institute of Technology).
Organizers: Hossein Shahmohamad, R.I.T, Ebrahim Salehi, UNLV, Darren Narayan, R.I.T, Carl Lutzer, R.I.T, Bernard Brooks, R.I.T.
Deadline: For submission of contributed talks: September 28, 2005.
Contact person: Hossein Shahmohamad, email: hxssma@rit.edu.
Information: http://www.math.rit.edu/~cvlsma/MCCCC/.

8-9 **AMS Eastern Section Meeting**, Bard College, Annandale-on-Hudson, New York. (Dec. 2004, p. 1379)
Information: http://www.ams.org/amsmtgs/sectional.html.

13-14 (NEW DATE) **DIMACS Workshop on The Epidemiology and Evolution of Influenza**, DIMACS Center, CoRE Bldg, Rutgers University, Piscataway, New Jersey. (Oct. 2004, p. 1096)

13-15 **Workshop on Current Issues in the Analysis of Incomplete Longitudinal Data**, The Fields Institute, Toronto, Ontario, Canada.

(Aug. 2005, p. 786)
Description: This workshop will focus on four main themes: (1) longitudinal data analysis with missing values, (2) measurement errors models, (3) joint modeling of survival and longitudinal data, and (4) models for multi-state data.
For each theme, the workshop will feature an invited overview talk and a few invited talks on some specific topics of current interest. This workshop will be appropriate for university faculty, research staff, data analysts, post-doctoral fellows, and graduate students.
Funding: Send the required information to Professor Peter Song email: song@math.uwaterloo.ca by September 15, 2005.
Information: Registration: The registration fee is $100 for regular participants, $25 for graduate students and post-docs. For further information please visit our website at: http://www.fields.utoronto.ca/programs/scientific/NPCDS/05-06/incomplete/; email: gensci@fields.utoronto.ca.

14–15 **Prairie Analysis Seminar 2005**, Kansas State University, Manhattan, Kansas. (Jun/Jul. 2005, p. 671)
Description: This is the fifth in a series of annual conferences co-organized by Kansas State University and the University of Kansas.
Speakers: Carlos Kenig (University of Chicago) will give two one-hour lectures. James Colliander (University of Toronto) and Alexandru Ionescu (University of Wisconsin) will each give an hour lecture. There will be sessions for contributed talks.
Sponsor: The conference is co-sponsored by the Mathematical Sciences Research Institute, Berkeley, and the National Science Foundation.
Information: There is no registration fee and support is available for participants. See http://www.math.ksu.edu/pas/2005/prairie05-index.html.

15–16 **AMS Southeastern Section Meeting**, East Tennessee State University, Johnson City, Tennessee. (Dec. 2004, p. 1379)
Information: http://www.ams.org/amsmtgs/sectional.html.

15–17 **The 26th Midwest-Pacific Differential Equations Conference**, University of Alberta, Edmonton, Alberta, Canada. (Aug. 2005, p. 786)
Description: This conference is the continuation of the Midwest Differential Equations Conference series, and it strives to represent a broader participation from across and beyond Midwest and Pacific regions. The conference is dedicated to Professors Jack W. Macki and James S. Muldowney for the occasion of their retirement from the University of Alberta. It celebrates their distinguished academic careers and their contributions to research and education in the area of differential equations.
Plenary Lectures: One hour plenary lectures will be given by: Lynn Erbe (University of Nebraska-Lincoln), John Mallet-Paret (Brown University), Michael Y. Li (University of Alberta), Robert O'Malley, Jr. (University of Washington), George R. Sell (University of Minnesota), Pauline van den Driessche (University of Victoria), James Wong (Hongkong City University), Jianhong Wu (York University), Pietro Zecca (University of Florence).
Contributed Talks: There will also be sessions of contributed talks. A refereed Conference Proceedings will be published by the Canadian Applied Mathematics Quarterly (CAMQ). Depending on funding, partial support may be provided for students and postdocs.
Information: To register online and for further information, please visit the conference website at http://www.math.ualberta.ca/ami/mwpde.html.

17–21 **IMA Workshop: Imaging from Wave Propagation**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: Margaret Cheney (Rensselaer Polytechnic Institute), Frank Natterer (Universitaet Muenster), William W. Symes (Rice University).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/imaging/fall/W10.17-21.05.html.

17–21 **Nonlinear Parabolic Problems**, Helsinki, Finland. (Jan. 2005, p. 82)
Description: The program will run at the University of Helsinki and at the Helsinki University of Technology (HUT) and is sponsored by the governmental agency The Academy of Finland.
Topics: Qualitative theory of parabolic equations, reaction-diffusion systems, fully nonlinear problems, free boundary problems, Navier-Stokes equations, maximal regularity, degenerate parabolic problems.
Main speakers (tentative list): M. Chipot (Zurich), Ph. Clement (Delft), J. Escher (Hannover), M. Fila (Bratislava), M. Hieber (Darmstadt), G. Karch (Wroclaw), H. Kozono (Sendai), Ph. Laurencot (Toulouse), J. Lopez-Gomez (Madrid), S. Nazarov (St. Petersburg), W.-M. Ni (Minnesota), M. Pierre (Rennes), J. Pruess (Halle), P. Quittner (Bratislava), J. Rehberg (Berlin), G. Simonett (Nashville), H. Sohr (Paderborn), V. Solonnikov (St. Petersburg), Ph. Souplet (Versailles), J. L. Vazquez (Madrid), D. Wrzosek (Warszawa), L. Weis (Karlsruhe), E.Yanagida (Sendai).
Information: http://www.math.helsinki.fi/research/FMSvisitor0506; or contact Herbert Amann, email: amann@math.unizh.ch; Jari Taskinen, email: jari.taskinen@helsinki.fi; Stig-Olof Londen, email: stig-olof.londen@hut.fi.

18–20 **DIMACS Short Course: Statistical De-identification of Confidential Health Data with Application to the HIPAA Privacy Regulations**, DIMACS Center, CoRE Bldg, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2005, p. 672)
Short Description: This two-and-a-half day short course will provide participants with a detailed overview of the HIPAA privacy regulations, theory and methods for statistical disclosure limitation, and applied experience with disclosure limitation methods. Participants completing the course should be able to: 1) understand the permissible uses of healthcare data for various purposes under the HIPAA regulations; 2) conceptualize and document data intrusion scenarios; 3) conduct and document statistical disclosure analyses measuring disclosure risks; 4) select and use appropriate disclosure limitation methods; 5) evaluate the associated trade-offs between disclosure risks and statistical information quality. Development of these skills should enable participants to supervise and work successfully with an expert certifying statistician.
Organizer: Larry Cox, CDC, email: lcox@cdc.gov; Daniel Barth-Jones, Wayne State University, email: dbjones@med.wayne.edu.
Local Arrangements: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
Information: http://dimacs.rutgers.edu/Workshops/Hipaa/;

*19–21 **Österreichische Statistische Tage**, Universität Klagenfurt, Klagenfurt, Austria.
Information: http://www.math.uni-klu.ac.at/stat/Tagungen/OST/.

20–22 **3rd Symposium on Stochastic Algorithms: Foundations and Applications (SAGA'05)**, Moscow State University, Moscow, Russia. (May 2005, p. 570)
Scope: The 3rd Symposium on Stochastic Algorithms, Foundations and Applications (SAGA'05) will be held in Moscow (Russia) from 20th to 22nd October 2005. The symposium offers the opportunity to present original research on the analysis, implementation, experimental evaluation and real-world application of stochastic algorithms. In particular, the focus of SAGA'05 is on new algorithmic ideas involving stochastic decisions and the design and evaluation of stochastic algorithms within realistic scenarios. Thus, the symposium wants to foster the co-operation between practitioners and theoreticians from this research area.

Information: Further information can be found at http://mech.math.msu.su/department/dm/SAGA2005 or http://www.dcs.kcl.ac.uk/events/saga05/.

21-22 **AMS Central Section Meeting**, University of Nebraska, Lincoln, Nebraska. (Dec. 2004, p. 1379)
Information: http://www.ams.org/amsmtgs/sectional.html.

21-26 **International Conference of Computational Methods in Sciences and Engineering 2005 (ICCMSE 2005)**, Hotel Poseidon, Loutraki, Korinthos, Greece. (Apr. 2005, p. 477)
Description: In the past decades many significant insights have been made in several areas of Computational Methods in Sciences and Engineering. New problems and methologies have appeared. There is permanently a need in these fields for the advancement of information exchange.
Topics: Computational Mathematics, Theoretical and Computational Physics and Theoretical and Computational Chemistry, Computational Engineering and Mechanics, Computational Biology and Medicine, Computational Geosciences and Meteorology, Computational Economics and Finance, Financial Forecasting, Scientific Computation, High Performance Computing, Parallel and Distributed Computing, Visualization, Problem Solving Environments, Software Tools, Advanced Numerical Algorithms, Modelling and Simulation of Complex System, Web-based Simulation and Computing, Grid-based Simulation and Computing, Computational Grids, Fuzzy Logic, Hybrid Computational Methods, Data Mining and Information Retrieval, Virtual Reality, Reliable Computing, Image Processing, Computational Science and Education etc.
Information: Secretary ICCMSE 2005 (Mrs Eleni Ralli-Simou), email: iccmse@uop.gr, 26 Menelaou Street, Amfithea Paleon Faliron, GR-175 64, Athens, Greece, fax: +30210 94 20 091 or + 30 2710 237397.

24-26 **SIAM Conference on Mathematics for Industry: Challenges and Frontiers**, Detroit Marriott Renaissance Center, Detroit, Michigan. (Apr. 2005, p. 477)
Information: SIAM's conference on Mathematics for Industry focuses attention on the many and varied opportunities to promote applications of mathematics to industrial problems. Since the SIAM community encompasses enormous talent for integrating and enriching both industrial work and academic research, this conference will stress interactions within the context of mathematical models and complex systems, and will encourage other mathematical themes of interest to industry, government, business and finance.
Information: http://widen@siam.org.

24-28 **International Conference on Computing and Mathematical Modeling for Environmental, Social-Economical, and Technical Systems-2005**, East China Normal University, Shanghai, China. (Apr. 2005, p. 477)
Topics: Include, but not limited to: Computing and Modeling of Earth Systems, Coastal and Marine Systems, GIS and Spatial Models, Neural Networks, Statistics and Statistical Modeling, Fuzzy Sets and Systems, Numerical Methods and Applications, Optimization and Decision Making, Environmental Modeling, Allocation of Resources, Mathematics and Computing of Robotics, Sensors and Measurement, Distance Learning and Educational technologies, Mathematics and Science Education.
Information: http://sci.tamucc.edu/~iccmm/index.html.

27-28 **DIMACS Workshop on Disease Clusters**, DIMACS Center, CoRE Bldg, Rutgers University, Piscataway, New Jersey. (Aug. 2005, p. 786)
Description: Disease clusters, defined as local excesses of disease in space, time or space and time, represent an important but vexing problem in public health. The workshop will bring together mathematicians, biostatisticians, epidemiologists and public health officials to develop an approach that, while statistically rigorous, is able to address the concerns of the public.
Organizers: Andrew Lawson, University of South Carolina, email: alawson@gwm.sc.edu; Daniel Wartenberg, Robert Wood Johnson Medical School, email: dew@eohsi.rutgers.edu.
Local Arrangements: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
Information: See http://dimacs.rutgers.edu/Workshops/Clusters/.

28-30 **Applications of Methods of Stochastic Systems and Statistical Physics in Biology**, University of Notre Dame, Notre Dame, Indiana. (Aug. 2005, p. 786)
Goals of the Workshop: Discussion of different applications of methods of stochastic analysis and statistical physics for studying biological systems and stimulation of new interdisciplinary collaborations. Some of the specific topics to be covered include pattern formation in development, aggregation in bacteria colonies, protein folding, regulation of gene expression, immunology, cytoskeleton, biological networks, and genetic drift. This workshop is organized in cooperation with SIAM (Society for Industrial and Applied Mathematics).
Organizers: Mark Alber (Notre Dame), email: alber.1@nd.edu; Albert-Laszlo Barabasi (Notre Dame), email: alb@nd.edu; Yi Jiang (Los Alamos), email: jiang@lanl.gov; James Glazier (IU Bloomington), email: glazier@indiana.edu.
Information: Limited funding may be available to support attendance by graduate students, postdocs and junior faculty. Poster presentations are encouraged and a limited number of contributed talks will also be accepted. For more information visit our website: http://www.nd.edu/~icsb/wrkshp2005.html; or contact Betsy Karnes, email: ekarnes@nd.edu; Dr. Mark Alber, email: malber@nd.edu.

30-November 3 **SIAM**, Hilton Phoenix East, Phoenix, Arizona. (May 2005, p. 570)
Information: The Call for Presentations deadlines for GD05 are fast approaching.
Deadline Dates: Minisymposium proposals: April 1, 2005; Abstracts for all contributed and minisymposium presentations: May 2, 2005.
Conference Webpage: http://www.siam.org/meetings/gd05/. For additional information, contact SIAM Conference Department at meetings@siam.org.

November 2005

4-6 **Geometric and Probabilistic Methods in Group Theory and Dynamical Systems**, Texas A&M University, College Station, Texas. (Apr. 2005, p. 477)
Organizers: Rostislav Grigorchuk, Gilles Pisier, Zoran Sunik.
Participants: M. Bestvina, M. Bridson, P. Diaconis, A. Eskin, B. Farb, E. Ghys, C. Gordon, E. Guentner, I. Kapovich, A. Katok, S. Katok, A. Lubotzky, S. Mozes, A. Olshanskii, S. Popa, A. Reid, L. Saloff-Coste, M. Sapir, K. Vogtmann, E. Zelmanov
Deadlines: Abstracts and Registration August 31, 2005, Financial Support July 31, 2005.
Information: http://www.math.tamu.edu/~sunik/05tamu.

7-11 **IMA Workshop: Frontiers in Imaging**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: Alberto Grunbaum (University of California, Berkeley), Dennis Healy (University of Maryland).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu or; http://www.ima.umn.edu/imaging/fall/W11.7-11.05.html.

*10-13 **Quantum Transport and Excitations from Macro to Nanoscale: Theory and Applications**, Aalborg University, Aalborg,

Denmark.
Description: The workshop is intended to boost the collaboration between physicists and mathematicians working on different aspects of quantum transport in quantum mechanics. We plan to blend talks given by mathematicians, theoretical and experimental physicists.
Topics: Will range among nonequilibrium statistical mechanics, spectral theory of interacting fermionic systems, density functional theory, singular perturbation theory, and enhanced excitonic effects in nanoscopic systems. The ultimate goal is a better theoretical understanding of various transport coefficients which can be measured in experiments.
Information: http://www.math.aau.dk/~cornean/workshop/.

12-13 **AMS Western Section Meeting**, University of Nebraska, University of Oregon, Eugene, Oregon. (Dec. 2004, p. 1379)
Information: http://www.ams.org/amsmtgs/sectional.html.

13-16 **INFORMS Annual 2005 Meeting**, New Orleans Marriott & Sheraton New Orleans, New Orleans, Louisiana. (Aug. 2005, p. 786)
Description: The theme of the 2005 Annual Meeting comprises a broad area of application in which our discipline's strengths in modeling, analysis and algorithm design can be utilized to make vital contributions. We focus on the role operations research can play in the interaction between ecological concerns and economic growth. As a natural outgrowth of this theme, the conference program will also emphasize the importance of the relationship between basic research and the practice of operations research.
Information: S. Owens; email: meetings@in forms.org.

17-20 **Analysis and related topics**, Lviv Ivan Franko National University, Lviv, Ukraine. (Aug. 2005, p. 786)
Description: The conference is devoted to the S. Mazur centennial, W. Lyantse's 85th anniversary and A. Gol'dberg's 75th anniversary.
Topics: The following topics will be presented at the conference: complex analysis; functional analysis; topological algebra; history of Lviv mathematics.
Organizers: The Lviv Mathematical Society and Lviv Ivan Franko National University.
Organizing and Program Committee: T. O. Banakh, Eu. V. Cheremnyh, I. E. Chyzhykov (secretary), S. Yu. Favorov, S. Yu. Grishyn, I. Yo. Guran, M. L. Gorbachuk, R. O. Hryniv, B. N. Khabibullin, A. A. Kondratyuk, V. M. Kyrylych, O. V. Lopushansky, I. I. Marchenko, V. K. Maslyuchenko, A. Z. Mokhon'ko, Ya. V. Mykytyuk, A. M. Plichko, I. V. Protasov, Ya. G. Prytula, F. S. Rofe-Beketov, M. M. Sheremeta, I. O. Shevchuk, O. B. Skaskiv, O. G. Storozh, M. V. Zabolotskyi, M. M. Zarichnyi, Yu. B. Zelins'kyi.
Deadline: October 15, 2005.
Information: http://www.franko.lviv.ua/faculty/mechmat/Conference/conf2005.htm;email: analysis05@franko.lviv.ua.

25-December 1 **Reform, Revolution and Paradigm Shifts in Mathematics Education**, Johor Bharu, Southern Malaysia (very close to Singapore). (Feb. 2005, p. 291)
Organizer: Mathematics Education into the 21st Century Project.
Program: November 25th: Arrivals & Welcome Reception (7.00 on). Includes food and drink. November 26th: First Working Day. Includes Official Opening Ceremony, Open Forum of Ideas. November 27 or 28: All-day Conference Excursion to Malacca. November 30th: Gala Dinner. December 1st: Last working day, morning only, lunch and farewells.
Working Sessions: Plenary Speechs, Paper Presentations, Working Group Meetings.
Workshops: Open Forum of Ideas, SuperCourse Meetings for General Information and for Writers.
Information: Alan Rogerson; email: arogerson@inetia.pl.

27-30 **ICDM '05: The 5th IEEE International Conference on Data Mining**, New Orleans, Louisiana. (Jun/Jul. 2005, p. 672)
Description: The conference draws researchers and application developers from a wide range of data mining related areas such as statistics, machine learning, pattern recognition, databases and data warehousing, data visualization, knowledge-based systems and high performance computing. As an important part of the conference, the workshops program will focus on new research challenges and initiatives, and the tutorials program will cover emerging data mining technologies and the latest developments in data mining.
Sponsor: IEEE Computer Society.
Deadline: June 15, 2005.
Important Dates: June 15, 2005: Paper submissions, Tutorial proposals, Workshop proposals, Panel proposals. August 20, 2005: Paper acceptance notices. September 7, 2005: Final camera-readies. November 27, 2005: Tutorials and Workshops. November 28-30, 2005: Conference.
All paper submissions will be handled electronically. Detailed instructions are provided on the conference home page at http://www.cacs.louisiana.edu/~icdm05/.
Information: Vijay Raghavan, University of Louisiana, Lafayette, Louisiana; phone: 337-482-6603; fax: 337-482-5791; email: raghavan@cacs.louisiana.edu.

27-30 **Understanding and Creating Music: UCM 2005**, Caserta, Italy. (Jun/Jul. 2005, p. 672)
Topics: The subject of the UCM 2005 is Music, investigated by different approaches, namely: Mathematics, Physics; Artificial Intelligence; Cognitive Psychology of Music; Linguistics and Logic models; Algorithmic methods, sound granular synthesis etc.; Music performance via real-time devices and algorithmic procedures; Music and Fine Arts via computer graphics.
Program: The scientific programme will consist of 5 thematic sessions with plenary lectures (invited speakers) and contributed talks. On November 26, 2005, there will be a concert of electronic and computer music.
Information: More information (aims, committees, contributing institutions, submissions, deadlines, etc.) is available at the UCM 2005 Conference website: http://www.unina2.it/capirelamusica.sun/.

28-December 3 **International Conference on Operator Algebras and their Connection to Mathematical Physics**, University Hassan I, Settat, Morocco. (Jun/Jul. 2005, p. 672)
Information: http://www.math.uni-muenster.de/math/inst/reine/inst/cuntz/icoamp/index.htm.

December 2005

5-9 **IMA Workshop: Integration of Sensing and Processing**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: David Brady (Duke University), Dennis Healy (University of Maryland).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/imaging/fall/W12.5-9.05.html.

5-9 **30th Australasian Conference in Combinatorial Mathematics and Combinatorial Computing (30ACCMCC)**, The University of Queensland, Brisbane, Australia. (May 2005, p. 570)
Invited Speakers: Simon Blackburn, Royal Holloway, University of London, U.K.; Matthew Brown, The University of Adelaide, Australia; Mike Grannell, The Open University, U.K.; Lily Khadjavi, Loyola Marymount University, U.S.A.; Curt Lindner, Auburn University, U.S.A.; Brendan McKay, The Australian National University, Canberra; Wal Wallis, Southern Illinois University, Carbondale, U.S.A.
Contributed talks are welcome in all areas of combinatorics, graph theory, combinatorial computing and applications.

Deadline: A closing date for abstracts and registration will be announced later; this will be around late October 2005.
Information: http://www.maths.uq.edu.au/cdmc/30accmcc.html. Email the Director at ejb@maths.uq.edu.au for further information, or check the conference web page.

12-15 **The Second International Conference on Technology, Knowledge and Society**, Hyderabad, India. (Jun/Jul. 2005, p. 672)
Description: The conference will take a broad and cross-disciplinary approach to technology in society. With a particular focus on digital information and communications technologies, the interests addressed by the conference include: human usability, technologies for citizenship and community participation, and learning technologies. Participants will include researchers, teachers and practitioners whose interests are either technical or humanistic, or whose work crosses over between the applied technological and social sciences.
As well as an impressive line up of international main speakers, the conference will also include numerous paper, workshop and colloquium presentations. We would particularly like to invite you to respond to the conference call for papers. If you are unable to attend the conference in person, virtual registrations are also available which allow you to submit a paper for refereeing and possible publication in this fully refereed academic journal, as well as access to the electronic version of the conference proceedings.
Information: Full details of the conference, including an online call for papers form, are to be found at the conference website: http://www.Technology-Conference.com.

12-16 **Intersection of Arithmetic Cycles and Automorphic Forms**, Centre de recherche mathématiques, Université de Montréal, Montréal, Québec, Canada. (Apr. 2005, p. 477)
Purpose: To explore the relationship between intersection numbers for arithmetic cycles on Shimura varieties, Fourier coefficients of automorphic forms, and special values of L-functions.
Organizers: Eyal Goren (McGill) and Henri Darmon (McGill).
Information: http://www.crm.umontreal.ca/Number2005/.

*12-16 **The Modeling of Cancer Progression and Immunotherapy**, AIM Research Conference Center, Palo Alto, California.
Workshop topics: This workshop, sponsored by AIM and the NSF, will bring together a multidisciplinary collection of experts to work on refining mathematical models of cancer growth, therapy delivery, and cancer interaction with the immune system. A central goal of the workshop will be to combine state of the art knowledge of immune-related treatment strategies with mathematical models that can reflect realistic qualitative and quantitative behavior of cancer growth and response to treatment.
Organizers: Lisette de Pillis, Ami Radunskaya, and Charles Wiseman.
Application deadline: September 12, 2005.
Information: http://aimath.org/ARCC/workshops/tumorimmune.html.

14-16 **CRAMS-05 International Conference on Applied Nonharmonic Fourier Analysis, Business & Computer**, University College (BCU), Beirut, Lebanon. (Apr. 2005, p. 477)
Topics: The conference commemorates the Riemann-Lebesgue Lemma Centennial. Its major themes include, but not limited to: multidimensional localization principle, generalized Tauberian theory, time-frequency-scale multiresolution analysis, the Segal-Bargmann transform, Gabor wavelets and frames, invertibility of Gabor transforms, functional analysis of Gabor frames, almost periodic and recurrent functional analysis, reversed filtration and regularization, connections with functional equations and tiling theory, nonlinear filter theory, analysis with fractal measures, signal reconstruction in communication theory, and fast numerical algorithms.
Program Committee: A. Aldroubi, S. Cheng, S. Drahomir, H. Feichtinger, N. Haidar, P. Jorgensen, G. Ladas and C. Pearce.
Deadlines: The deadline for submitting Abstracts is June 15, 2005, for notification of acceptance is August 15, 2005, and for full-length paper submission is Sept. 15, 2005. The welcoming reception is at 7:00 p.m., Dec. 14, 2005.
Programme Committee: Akram Aldroubi, Sui Cheng, Sever Dragomir, Hans Feichtinger, Nassar Haidar, Pale Jorgensen, Gerasimos Ladas and Charles Pearce.
Information: N. H. S. Haidar, Chairman of the Organizing Committee for CRAMS-05, Business & Computer University College (BCU), Commodore Str, Hamra, Beirut, Lebanon; tel: 961 1 752 370-4, ext. 131, 961 1 736 511, fax: 961 1 340 219, email: nhaidar@suffolk.edu, crams@bcucrams.org, basicsciences@hu.edu.lb; and website: http://www.bcucrams.org/ conference.html.

27-30 **ASL Winter Meeting (with APA)**, New York, New York. (Jun/Jul. 2005, p. 673)
Abstracts: Must be received by September 9, 2005 at the ASL Business Office: ASL, Box 742, Vassar College, 124 Raymond Ave., Poughkeepsie, New York 12604; fax: 1-845-437-7830; email: asl@vassar.edu.

15-January 31, 2006 **Semidefinite Programming and its Applications**, Institute for Mathematical Sciences, National University of Singapore, Singapore. (Apr. 2005, p. 477)
Program: Will provide a forum for the exchange of ideas among researchers working in theory, applications, algorithms, and software development of SDP.
The program will consist of tutorials and workshops with ample opportunities for collaborative research among local and international participants.
Organizing Committee: Chair: Michael Todd (Cornell University). Co-chairs: Jie Sun (National University of Singapore) and Kim-Chuan Toh (National University of Singapore).
Information: For general enquiries, please email ims@nus.edu.sg. For enquiries on scientific aspects of the program, please email Kim-Chuan Toh, mattohkc@nus.edu.sg. Completed forms should be received by the Institute at least one month before commencement of each activity. Registration is free of charge. Institute membership is not required for participation. Information about the program and registration forms are available at the website http://www.ims.nus.edu.sg/Programs/semidefinite/index.htm.

January 2006

*2-5 **International Conference on Geometric Function Theory, Special Functions and Applications**, Conference Hall, Hotel Surguru, 104, SAardar Vallabai Patel Road, Pondicherry-605 001, India.
Information: Convener, Bharathidasan Govt. College for Women, Pondicherry-605 003, India; email: narachandra@yahoo.com; Phone: (off) (0413) 2338504 (Res) (0413) 2339204.

2-5 **Mathematics in the Twentieth Century: In Commemoration of the Birth Centenary of André Weil**, Delhi, India. (Aug. 2005, p. 786)
Organizer: Mathematical Sciences Foundation, St. Stephen's College, Delhi.
Featured Speakers/Scientific Organizing Committee: Henry Helson, J. P. Kahane, J. P. Pier, Kenneth Ross, Norbert Schloumiuk, Ram Murty, B. S. Yadav, Dinesh Singh.
Information: email: conference.msf@gmail.com, indusahu612@gmail.com; http://www.mathscifound.org; Mathematical Sciences Foundation, St. Stephen's College, University of Delhi, Delhi-110007, India; Telephone/Fax: +91- 011-27666300.

3-7 **Moduli spaces of knots**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2005, p. 673)
Topics: This workshop, sponsored by AIM and the NSF, will be devoted to the study of the global topology of spaces of embedded curves in Euclidean spaces and other manifolds.

Organizers: Fred Cohen, Allen Hatcher, and Dev Sinha.
Deadline: October 3, 2005.
Information:http://aimath.org/ARCC/workshops/spaceofknots.html.

6–11 **Enumerative invariants in algebraic geometry and string theory**, Cetraro, Italy. (Jun/Jul. 2005, p. 673)
Lecture series: Dan Abramovich (Brown): Gromov-Witten invariants for orbifolds; Marcos Mariño (CERN): Open strings; Michael Thaddeus (Columbia): Moduli of sheaves; Ravi Vakil (Stanford): Gromov-Witten theory and the moduli space of curves.
Information: http://www.math.unifi.it/~cime/Courses/2005/01.html.

9–12 **IMA Workshop: New Mathematics and Algorithms for 3-D Image Analysis**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: Les Butler (Louisiana State University), Gestur Olafsson (Louisiana State University), Todd Quinto (Tufts University).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu; http://ima.umn.edu/imaging/spring/W1.9-12.06.html.

9-June 30 **Principles of the Dynamics of Non-Equilibrium Systems**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)
Description: The collective behaviour of nonequilibrium systems is poorly understood compared to systems in thermal equilibrium, for which statistical mechanics provides a well-established theory. By nonequilibrium systems we refer both to systems held far from thermal equilibrium by an external driving force and the complimentary situation of systems relaxing towards thermal equilibrium. Such systems display a broad range of phenomena, such as phase transitions and slow collective dynamics, which one would like to understand at a deeper level. The study of nonequilibrium systems has arisen in many different contexts, such as reaction-diffusion processes, interacting particle systems, driven diffusive systems, and the slow dynamics of glassy systems. In recent years progress has been made towards better understanding these systems. Mathematical tools have been developed, and some exact results pertaining to specific systems have been derived. These developments bring us closer to the point where one can address fundamental questions of generality, both of techniques and results. It is anticipated that bringing together the different communities of physicists and mathematicians working in this diverse field will foster the emergence of new directions and outlooks.
Focus: Driven diffusive systems of interacting particles; coarsening and persistence; glassy, constrained dynamics and ageing. Although all three of these areas will be explored throughout the programme, it is intended that there will be periods of focus on each, centered around topical workshops.
Organizers: M.R. Evans (Edinburgh), S. Franz (ICTP, Trieste), C. Godreche (SPEC, Saclay), D. Mukamel (Weizmann Inst.).
Information: http://www.newton.cam.ac.uk/programmes/PDS/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

12–15 **Joint Mathematics Meetings**, San Antonio, Texas. (May 2005, p. 570)
Information: http://www.ams.org/amsmtgs/national.html.

14–15 **ASL Winter Meeting (with Joint Mathematics Meetings)**, San Antonio, Texas. (Jun/Jul. 2005, p. 673)
Abstracts: Must be received by September 9, 2005 at the ASL Business Office: ASL, Box 742, Vassar College, 124 Raymond Ave., Poughkeepsie, New York 12604; fax: 1-845-437-7830; email: asl@vassar.edu.

16–18 **5th Annual Hawaii International Conference on Statistics, Mathematics, and Related Fields**, Waikiki, Honolulu, Hawaii. (Jun/Jul. 2005, p. 673)
Goal: Of the 2006 Hawaii International Conference on Statistics, Mathematics and Related Fields is to provide an opportunity for academicians and professionals from various statistics and/or mathematics related fields from all over the world to come together and learn from each other. An additional goal of the conference is to provide a place for academicians and professionals with cross-disciplinary interests related to statistics and mathematics to meet and interact with members inside and outside their own particular disciplines.
Deadline: August 29, 2005.
Information: On on web: click on Call for Papers for information on submitting a paper; email: statistics@hicstatistics.org.

16–20 **Random analytic functions**, AIM Research Conference Center, Palo Alto, California. (Aug. 2005, p. 787)
Workshop topics: This workshop, sponsored by AIM and the NSF, will be devoted to advancing the theory of random functions and surfaces. The main topics for the workshop are the distribution of zeroes of random analytic functions, discrete random analytic functions, the topology of random real zero sets.
Organizers: Amir Dembo, J. Maurice Rojas, Bernard Shiffman, and Steve Zelditch.
Application deadline: October 15, 2005.
Information:http://aimath.org/ARCC/workshops/randomzeros.html.

16–27 **"Propagation of Waves" CIMPA school and workshop**, Instituto de Matemáticas, UNAM, Cuernavaca, Mexico. (Apr. 2005, p. 478)
Description: 6 minicourses, 10 invited lectures, contributed talks.
Organizers: Luz de Teresa, Salvador Pérez Esteva, Carlos Villegas, Arturo Portnoy.
Deadline: October 30, 2005.
Information: http://wwww.matem.unam.mx/escuelaCIMPA; http://www.cimpa-icpam.org//index.html.

16-July 7 **Logic and Algorithms**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)
Description: Theoretical computer science is broadly divided into disciplines dealing with logic, semantics and formal methods on the one hand, and algorithmics and computational complexity on the other. The programme will focus on active areas of research that cut across this divide, dealing with algorithmic and complexity aspects of logic as well as logical methods in complexity. Among the areas of focus are computer-aided verification, specifically dealing with algorithms and structures for verifying properties of computing system and the logical, combinatorial, and algebraic methods deployed in their study.
Organizers: A. Dawar (Cambridge), M.Y. Vardi (Rice).
Information: http://www.newton.cam.ac.uk/programmes/LAA/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

22–24 **ACM-SIAM Symposium on Discrete Algorithms (SODA)**, Radisson Hotel Miami, Miami, Florida. (Aug. 2005, p. 787)
Description: This symposium focuses on research topics related to efficient algorithms and data structures for discrete problems. In addition to the design of such methods and structures, the scope also includes their use, performance analysis, and the mathematical problems related to their development or limitations. Performance analyses may be analytical or experimental and may address worst-case or expected-case performance. Studies can be theoretical or based on data sets that have arisen in practice and may address methodological issues involved in performance analysis.
Information: http://www.siam.org/meetings/DA06/index.htm.

23-27 **The property of rapid decay**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2005, p. 673)
Organizers: Indira Chatterji and Laurent Saloff-Coste.
Topics: This workshop, sponsored by AIM and the NSF, will be devoted to the property of Rapid Decay.
The property of Rapid Decay (abbreviated by property RD) is a property of convolution operators that captures certain aspects of the asymptotic geometry of a finitely generated group. Property RD is a very focused area of research in harmonic analysis and operator algebra. However, it has ramifications in geometry, topology and algebra
Deadline: October 20, 2005.
Information: http://aimath.org/ARCC/workshops/rapiddecay.html.

*23-28 **C*-algebras and elliptic theory. II**, Banach Center, Bedlewo, Poland.
Main topics: K-theory of C*-algebras, index theory, noncommutative geometry, algebras of pseudodifferential operators on singular manifolds, infinite Grassmannians and Fredholm pairs, deformation quantization.
Information: http://higeom.math.msu.su/bedlewo2006/.
Organizing Committee: Bogdan Bojarski, Grzegorz Lysik, Alexander Mishchenko (chairman) and Evgenij Troitsky.
Scientific Committee: P. Baum, D. Burghelea, P. Hajac, R. Melrose, A. Mishchenko, V. Nistor, B.-W. Schulze, N. Teleman, E. Troitsky, S. Woronowicz.

30-February 3 **Mathematics-in-Industry Study Group 2005**, Massey University, Auckland, New Zealand. (Jun/Jul. 2005, p. 673)
Program: Australian and New Zealand Industrial Organisations will present problems for formulation, possible solution, and interpretation.
Director: Professor Graeme Wake, Centre for Mathematics in Industry, Massey university, Auckland, New Zealand.
Deadlines: Problems will be listed on the website by November 2005. Registration is free to problem investigators, with costs covered by problem presenters. Student grants available to bona fide research students, supported by their supervisors. Applications received up to November 2005.
Information: http://misg2006.massey.ac.nz.

30-February 3 **The Caccetta-Haggkvist conjecture**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2005, p. 673)
Organizers: Maria Chudnovsky, Matt Devos, Paul Seymour, and Robin Thomas.
Topics: This workshop, sponsored by AIM and the NSF, will focus on the Caccetta-Haggkvist conjecture, which in its simplest form asserts the following: If G is an n-vertex directed graph with minimum outdegree at least n/k, then G has a directed cycle of length at most k. This has a number of variants and strengthenings, and in particular it has numerous connections with additive number theory. The workshop aims to clarify and develop these variants, and to bring together people working on different aspects of the conjecture in the hope of finding a solution.
Deadline: October 30, 2005.
Information: http://aimath.org/ARCC/workshops/caccetta.html.

February 2006

6-10 **IMA Workshop: The Mathematics and Art of Film Editing and Restoration**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: Guillermo P. Sapiro (University of Minnesota), Lance J. Williams (Applied Minds, Inc.), Andrew Zisserman (University of Oxford).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/imaging/spring/W2.6-10.06.html.

13-17 **Barcelona Conference in Planar Vector Fields**, Centre de Recerca Matemàtica, Bellaterra, Spain. (Jun/Jul. 2005, p. 673)
Speakers: Freddy Dumortier, Lubomir Gavrilov, Yu Ilyashenko, Chengzhi Li, Francesc Mañosas, James S. Muldowney, Robert Roussarie, Marco Sabatini, Jorge Sotomayor, Marco Antonio Teixeira, Jiazhong Yang, Michal Zhitomirskii.
Information: http://www.crm.es/ or email: PlanarVectorFields@crm.es.

*13-17 **Mathematical and Geophysical Fluid Dynamics**, AIM Research Conference Center, Palo Alto, California.
Organizers: Boris Rozovskii, Roger Temam, and Joseph Tribbia.
Workshop topics: This workshop, sponsored by AIM and the NSF, will bring together experts in the deterministic and stochastic dynamics of fluids and gases with experts in geosciences who work on numerical simulations of large scale models of climate and related subsystems. The main goal of the workshop is to facilitate transfer of recent advances in mathematical and computational Fluid Dynamics to the geophysical community involved in the modeling of the ocean and atmosphere, and to stimulate new developments in both areas.
Deadline: November 1, 2005.
Information: http://aimath.org/ARCC/workshops/geophysical.html.

13-18 **L-functions and Related Themes**, Centre de recherche mathématiques, Univ. de Montréal, Montréal, Québec, Canada. (Apr. 2005, p. 478)
Focus: The workshop will focus on the analytic theory of L-functions and how they are used in a variety of questions ranging from arithmetic geometry to classical analytic number theory.
Lecturers: Philippe Michel (Montpellier II); Kumar Murty (Toronto); K. Soundararajan (Michigan).
Organizers: Chantal David (Concordia) and Ram Murty (Queen's).
Information: http://www.crm.umontreal.ca/Number2005/.

20-24 **p-adic representations, modularity, and beyond**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2005, p. 673)
Organizers: Kiran Kedlaya and David Savitt.
Topics: This workshop, sponsored by AIM and the NSF, will be devoted to interactions between p-adic Hodge theory, p-adic Langlands correspondences, and the modularity of Galois representations. The main goals of the workshop are to clarify the connections between the aforementioned fields, and to identify some target results for both the short and long term.
Deadline: For application: November 20, 2005.
Information: http://aimath.org/ARCC/workshops/padicmodularity.html.

20-25 **Advanced Course on Arakelov Geometry and Shimura Varieties**, Centre de Recerca Matemàtica, Bellaterra, Spain. (Jun/Jul. 2005, p. 674)
Speakers: Ching-Li Chai (University of Pennsylvania), Henri Darmon (Mc Gill University), Damian Roessler (Université Paris 7).
Information: http://www.crm.es/ or email: ShimuraVarieties@crm.es.

*21-24 **XV International Symposium on Mathematical Methods applied to the Sciences**, San José, Costa Rica.
Topics: Data Analysis, Multivariate Statistics, Clustering and Classification Probability, Stochastic Processes, Financial Mathematics Optimization, Operations Research, Approximation, Numerical Analysis Modeling, Biomathematics Applications of the above topics.
Participation: Short courses (3 hours), Long (40 min) and short (20 min) communications; Participation only.

Registration: Please visit our website for prices and deadlines. We have special rates for Central Americans and students.
Information: http://www.emate.ucr.ac.cr/simmac/. At the website you may find the composition of the Scientific Committee and Organizing Committee, directions to the site of the Symposium as well as hotel, tourist and other useful information. The preliminary program will be available by the end of January, 2006. Javier Trejos (Chairman), jtrejos@cariari.ucr.ac.cr; Ivan Ruiz (Webmaster), irvieto@emate.ucr.ac.cr.

*24-27 **Lie groups: Dynamics, Rigidity, Arithmetic, in honor of Gregory Margulis' 60th birthday**, Yale University, New Haven, Connecticut.
Organizers: Andrew Casson, Dmitry Kleinbock, Alex Lubotzky, Hee Oh.
Main confirmed speakers: H. Abels, N. Alon, M. Burger, S.G.Dani, A. Eskin, H. Furstenberg, F. Grunewald, A. Katok, D. Kazhdan, E. Lindenstrauss, S. Mozes, M. S. Raghunathan, P. Sarnak, Y. Shalom, Y. T. Siu, R. Zimmer.
Information: Further details will become available on the conference website: http://www.math.yale.edu/Margulisconf.html.

March 2006

6-10 **IMA Workshop: Natural Images**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: Organizer: Olivier Faugeras (INRIA), Jan J. Koenderink (Utrecht University), Jitendra Malik (University of California at Berkeley).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/imaging/spring/W3.6-10.06.html.

13-17 **Anatomy of Integers**, Centre de recherche mathématiques Université de Montréal, Montréal, Québec, Canada. (Apr. 2005, p. 478)
Organizers: Jean-Marie de Koninck (Laval) and Andrew Granville (Montréal).
Workshop Focus: On multiplicative number theory, divisors, prime factors, distribution of prime divisors, multiplicative functions, smooth/friable numbers etc.
Lecturers: Kevin Ford (Urbana-Champaign); K. Soundararajan (Michigan); Gerald Tenenbaum (Institut Élie Cartan Nancy).
Information: http://www.crm.umontreal.ca/Number2005/.

20-30 **Functional Analysis**, Shiraz University, Shiraz, Iran. (Jun/Jul. 2005, p. 674)
Information: email: r_laghaei_84@yahoo.com.

April 2006

1-2 **AMS Southeastern Section Meeting**, Florida International University, Miami, Florida. (May 2005, p. 570)
Information: http://www.ams.org/amsmtgs/sectional.html.

3-7 **IMA Workshop: Shape Spaces**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: David Mumford (Brown University), Laurent Younes (The Johns Hopkins University).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/imaging/spring/W4.3-7.06.html.

3-8 **International Workshop on Multi-Rate Processes & Hysteresis**, University College Cork, Cork, Ireland. (Jun/Jul. 2005, p. 674)
Organizers: J. Gleeson (Cork, Ireland), M. Mortell (Cork, Ireland) (Co-Chairman), A. Pokrovskii (Cork, Ireland) (Co-Chairman); email: a.pokrovskii@ucc.ie.
Scientific Commitee: R. O'Malley (Seattle, USA) (Co-Chairman), V. Sobolev (Samara, Russia), (Co-Chairman).
Description: The aim of this conference is to bring together leading researchers willing to learn and share problems and techniques related to the singular perturbations and hysteresis in applied problems.
Topics: singular perturbations; hysteresis; random effects and noise; economic dynamics; laser dynamics; chemical kinetics; optoelectronics; control.
Information: Further details will become available on the conference website http://euclid.ucc.ie/murphys2006.htm.

6-12 **Additive Combinatorics**, Centre de recherche mathématiques, Université de Montréal, Montréal, Québec. (Apr. 2005, p. 478)
Topics: The topics covered will include: the Freiman-Ruzsa theorem, the structure of set theory addition, Gowers' approach to Szemeredi's theorem and Green and Tao's approach to combinatorial sets with structure. A mini-school will be organized before this workshop to introduce more people to this vibrant subject. More information will be made available on this site.
Lecturers: Tim Gowers (Cambridge), Ben Green (Cambridge), Imre Ruzsa (Alfréd Rényi Institute) and Terence Tao (UCLA).
Organizers: Jozsef Solymosi (UBC) and Andrew Granville (Montréal).
Information: http://www.crm.umontreal.ca/Number2005/.

8-9 **AMS Central Section Meeting**, University of Notre Dame, Notre Dame, Indiana. (May 2005, p. 570)
Information: http://www.ams.org/amsmtgs/sectional.html.

22-23 **AMS Eastern Section Meeting**, University of New Hampshire, Durham, New Hampshire. (May 2005, p. 570)
Information: http://www.ams.org/amsmtgs/sectional.html.

29-30 **AMS Western Section Meeting**, San Francisco State University, San Francisco, California. (May 2005, p. 570)
Information: http://www.ams.org/amsmtgs/sectional.html.

20-May 2 **INFORMS Practice Conference: Applying Science to the Art of Business**, Hotel Intercontinental Miami, Florida. (Aug. 2005, p. 787)
Description: Real-world applications, professional development, best practices and case studies, great networking- all in one in-depth conference.

*29-May 1 **2006 Barrett Lectures in Topology**, University of Tennessee, Knoxville, Tennessee.
Principal speakers (confirmed): John Baez (UC Riverside), Stephen Bigelow (UC Santa Barbara) and Bill Goldman (University of Maryland).
Information: email: dydak@math.utk.edu.

May 2006

5-10 **Combinatorial and Geometric Group Theory**, Vanderbilt University, Nashville, Tennessee. (Jun/Jul. 2005, p. 674)
Organizers: Goulnara Arzhantseva, Mike Mihalik, Denis Osin, Mark Sapir, Efim Zelmanov.
Speakers: M. Bestvina (University of Utah), M. Bridson (Imperial College), R. Grigorchuk (Texas A & M), V. Guba (Vologda State University), S. Ivanov (University of Illinois), I. Mineyev (University of Illinois), A. Myasnikov (McGill University), V. Nekrashevich (Bremen), A. Olshanskii (Vanderbilt),D. Osin (Vanderbilt), E. Rips (Hebrew University of Jerusalem),D. Wise (McGill University), E. Zelmanov (UC San Diego)
Information: http://www.math.vanderbilt.edu/~msapir/cggt/cggt.html;email: m.sapir@vanderbilt.edu.

8-19 **CANT 2006: Combinatorics, Automata and Number Theory**, University of Liege, Belgium. (Jun/Jul. 2005, p. 674)
Aim: The proposed international school is aimed at presenting and developing recent trends in Combinatorics (with emphasis on Combinatorics on Words), Automata Theory and Number Theory. On the one hand, the newest results in these areas shall benefit from a synthetic exposition, and on the other hand, emphasis on the connections existing between the main topics of the school will be sought. Concurrently to the school, there will be an international conference focusing on the same topics. Courses and lectures will be organized in the morning, while the afternoon sessions will be devoted to the conference.
Main Invited Speakers: J.-P. Allouche (CNRS, Univ. Paris-Sud), Y. Bugeaud (Univ. of Strasbourg), F. Durand (Univ. of Picardie, Amiens), P. Grabner (Techn. Univ. of Graz), J. Karhumaki (Turku Univ.), H. Prodinger (Univ. of Stellenbosch), J. Sakarovitch (CNRS, ENS Télécom.), J. Shallit (Univ. of Waterloo), B. Solomyak (Univ. of Washington), W. Thomas (RWTH Aachen).
Format: Five invited lecturers per week. Participants can decide to attend to one of the two weeks of this event. Talks will be selected on the basis of an extended abstract (max. 6 pages).
Deadline: For the submission of abstracts: April 1, 2006.
Information: http://http://www.cant2006.ulg.ac.be; email: M.Rigo@ulg.ac.be.

13-18 **Analytic methods for Diophantine equations**, Banff International Research Station, Banff, Alberta, Canada. (Apr. 2005, p. 478)
Description: This meeting brings together the participants of the MSRI and CRM workshops The meeting will be held at the Banff International Research Station.
Organizers: Andrew Granville (Montréal), Yuri Tschinkel (Göttingen), Michael Bennett (UBC), Chantal David (Concordia) and Bill Duke (UCLA).
Information: email: paradis@crm.umontreal.ca.

*17-19 **Conference of Applied Statistics in Ireland**, University College Cork, Cork, Ireland.
Information: Details to follow; email: kingshuk@stat.ucc.ie.

17-21 **ASL Annual Meeting**, Montreal, Canada. (Jun/Jul. 2005, p. 674)
Abstracts: Must be received by February 10, 2006 at the ASL Business Office: ASL, Box 742, Vassar College, 124 Raymond Ave., Poughkeepsie, New York 12604; fax: 1-845-437-7830; email: asl@vassar.edu.

22-26 **IMA Workshop: Visual Learning and Recognition**, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, Minnesota. (Jan. 2005, p. 82)
Organizers: Donald Geman (Johns Hopkins University), Jitendra Malik (University of California at Berkeley), Shimon Ullman (Weizmann Institute of Science).
Information: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St. SE, 400 Lind Hall, Minneapolis, MN 55455; phone: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/imaging/spring/W5.22-26.06.html.

*24-26 **International Workshop on Post-Quantum Cryptography**, Katholieke Universiteit Leuven, Belgium.
Deadline: Submission of extended abstracts: April 3, 2006.
Information: http://postquantum.cr.yp.to/.

June 2006

12-15 **2006 International Conference on Applied Mathematics and Interdisciplinary Research-Nankai**, Nankai University, Tianjin, P. R. China. (May 2005, p. 570)
Information: The website of the meeting is at http://www.isam.nankai.edu.cn. Please check out the website for further information.

12-16 **Function Theories in Higher Dimensions**, Tampere University of Technology, Tampere, Finland. (Jun/Jul. 2005, p. 674)
Topics: Clifford analysis and applications, Several complex variables, Harmonic analysis.
Organizing committee: Professor Sirkka-Liisa Eriksson, Tampere University of Technology, Finland; Heinz Leutwiler, Universität Erlangen-Nuernberg, Germany; Helmuth Malonek, University of Aveiro, Portugal; Mika Koskenoja, University of Helsinki, Finland; Soeren Krausshar, University of Ghent, Belgium; Katja Kaunismaa (Secretary), Tampere University of Technology, Finland.
Information: The home pages of the conference will be updated at the following address: http://www.tut.fi/fthd.

19-23 **Free Analysis**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2005, p. 674)
Organizers: Dimitri Shlyakhtenko and Dan Voiculescu.
Topics: This workshop, sponsored by AIM and the NSF, will be devoted to the non-commutative analysis underlying problems in areas related to free probability theory. Typical examples of these are L2 questions for free difference quotient derivations. The topics of the workshop are: Free entropy (the analog of entropy in free probability theory), L2 Betti numbers for von Neumann algebras, Large deviations for random multi-matrix systems.
Deadline: March 19, 2006.
Information: http://aimath.org/ARCC/workshops/freeanalysis.html.

*19-23 **Modern stochastics: theory and applications**, Kyiv National Taras Shevchenko University, Kyiv, Ukraine.
Description: Conference is dedicated to the 60th anniversary of Department of Probability Theory and Mathematical Statistics of Kyiv University and to the memory of Professor M. I. Yadrenko (16.04.1932-28.09.2004)
Topics: Theory of random processes and fields, stochastic analysis, stochastic differential equations, infinite-dimensional analysis, Markov and semi-Markov processes, Gaussian and related processes, fractal analysis, statistics of stochastic processes, limit theorems, methods of financial mathematics and risk theory.
Speakers: E. Ahmed (Canada), C. Bender (Germany), A. Gushchin (Russia), J. Hunter (New Zealand), N. Leonenko (UK), I. Norros (Finland), D. Silvestrov (Sweden), C. Tudor (France), A. Veretennikov (UK), S. Zwanzig (Sweden).
Information: Department of Probability Theory and Mathematical Statistics, Faculty of Mechanics and Mathematics, Kyiv National Taras Shevchenko University, Volodymyrska 64, 01033, Kyiv, Ukraine. Contact: Prof. Yuliya Mishura; email: prob.conf.2006@univ.kiev.ua; Phone/Fax: (+38)(044)2590392; http://www.mechmat.univ.kiev.ua/probability/Events/2006/informletterengl.html.

21-23 **ICNPAA-2006: Mathematical Problems in Engineering and Aerospace Sciences**, Budapest, Hungary. (May 2005, p. 570)
Contact and Information: ICNPAA-2006, S. Sivasundaram, 104 Snow Goose Ct., Daytona Beach, FL 32119; email: info@icnpaa.com, seenithi@aol.com; http://www.icnpaa.com.

25-28 **INFORMS International Hong Kong 2006**, Sheraton Hotel & Towers Hong Kong, Hong Kong, China. (Jun/Jul. 2005, p. 674)
Description: Join your colleagues for this international event, bringing O.R. professionals together to present the latest research, introduce methodologies, and share new developments in the field. We are proud to partner with the Hong Kong Operational Research Society and the Operations Research Society of China in organizing this important conference.
Information: http://www.informs.org/Conf/Hongkong06.

25-28 **The Sixth AIMS Conference on Dynamical Systems, Differential Equations and Applications**, University of Poitiers, Poitiers, France. (Jun/Jul. 2005, p. 674)
Description: The conference will provide a unique international forum for the international community of mathematicians and scientists working in analysis, differential equations, dynamical systems, and their applications to real world problems in the forms of modeling and computation. The aim of this conference is to bring together the worldwide senior experts and young researchers as well to this beautiful city, Poitiers, to report recent achievements, exchange ideas, and address future trends of research, in a relaxing and stimulating environment. This is the first time ever for an AIMS conference to be held in the European continent. Sponsors: American Institute of Mathematical Sciences (AIMS) and University of Poitiers.
Topics: The conference covers all the major research areas in analysis, dynamics and applications including modeling and computations.
Format: There will be one-hour plenary talks, 30-minute special session talks, and 20-minutes contributed talks.
Conference Coordinator: Xin Lu; email: lux@uncw.edu.
Plenary speakers: A. Bressan (USA), O. Diekmann (Netherlands), P.-L. Lions (France), A. Mielke (Germany), M. Mimura (Japan), P. Polacik (USA), P. Pucci (Italy), B. Sandstede (UK), L. Wen (China).
Funding: Some limited funding from NSF is expected to support graduate students and young researchers.
Information: http://www.aimSciences.org for updates.

*26-30 **Calibrations**, AIM Research Conference Center, Palo Alto, California.
Workshop topics: This workshop, sponsored by AIM and the NSF, will be devoted to problems in calibrated geometry related to mirror symmetry and gauge theory. Some specific topics to be discussed include: Calibrated cycles and mirror symmetry; Calibrated geometry and gauge Theory; Moduli spaces of calibrated cycles.
Organizers: Robert Bryant, Xiaobo Liu, and Pit-Mann Wong.
Application deadline: March 26, 2006.
Information:http://aimath.org/ARCC/workshops/calibrations.html.

27-July 3 **International Commission on Mathematical Instruction: Challenging Mathematics In and Beyond the Classroom**, Trondheim, Norway. (Apr. 2005, p. 478)
Scope: The scope of this study will be wide. It will look at, for instance, the impact of mathematical challenges both inside and outside of the classroom, the role of mathematical challenges in supporting the curriculum for students of all levels of ability, vehicles for propagating mathematical challenges and assessment of their effectiveness. We would like to emphasize that we are interested in students and activities of all type, and want to go far beyond contests for talented students.
Discussion document: Has been prepared by an international committee chaired by Ed Barbeau of the University of Toronto (barbeau@math.utoronto.ca) and Peter Taylor of the University of Canberra in Australia who is the executive-director of the Australian Mathematical Trust (pjt@olympiad.org). This document defines terms, describes issues, provides sample situations, and poses questions for discussion. Finally, it indicates how to become involved in the Study Conference. Would-be participants will be asked to submit a brief curriculum vita and a 6-10 page document addressing matters relevant to the study no later than August 31, 2005. The committee plans to send out invitations by January 31, 2006. The Conference will be followed by a publication.
A copy of the discussion document can be obtained by going to the website http://www.amt.canberra.edu, clicking on "LINKS" and then on "ICMI Study 16".
Deadline: August 31, 2005.
Information: http://www.amt.canberra.edu/icmis16.html/.

July 2006

2-7 **ICOTS 7, Working Cooperatively in Statistics Education**, Salvador (Bahia), Brazil. (Mar. 2004, p. 361)
Topics: (1) Working cooperatively in statistics education: L. Cordani (Brazil), lisbethk@terra.com.br; M. Shaughnessy (USA), mike@mth.pdx.edu; (2) Statistics Education at the School Level: D. Ben-Zvi (Israel), dbenzvi@univ.haifa.ac.il; L. Pereira (Singapore), lpereira@nie.edu.sg; (3) Statistics Education at the Post Secondary Level: M. Aliaga (USA), aliaga@umich.edu; E. Svensson (Sweden), elisabeth.svensson@esi.oru.se; (4) Statistics Education/Training and the Workplace: P. Silva (Brazil), pedrosilva@ibge.gov.br; P. Martín (Spain), pilar.guzman@uam.es; (5) Statistics Education and the Wider Society: B. Phillips (Australia), bphillips@groupwise.swin.edu.au; P. Boland (Ireland), Philip.J.Boland@ucd.ie; (6) Research in Statistics Education: C. Reading (Australia), creading@metz.une.edu.au; M. Pfannkuch (New Zealand), pfannkuc@scitec.auckland.ac.nz; (7) Technology in Statistics Education: A. Blejec (Slovenia), andrej.blejec@uni-lj.si; C. Konold (USA), konold@srri.umass.edu; (8) Other Determinants and Developments in Statistics Education: T. Chadjipadelis (Greece), chadji@polsci.auth.gr; B. Carlson (USA), bcarlson@eclac.cl; (9) An International Perspective on Statistics Education: D. North (South Africa), delian@icon.co.za; A. S. Haedo (Argentina), haedo@qb.fcen.uba.ar; (10) Contributed Papers: J. Engel (Germany), Engel_Joachim@ph-ludwigsburg.de; A. Mc Lean (Australia), alan.mclean@buseco.monash.edu.au; (11) Posters: C. E. Lopez (Brazil), celilopes@directnet.com.br.
Information: C. Batanero, batanero@ugr.es; http://www.maths.otago.ac.nz/icots7.

7-8 **Second International Conference on Nonsmooth/Nonconvex Mechanics with Applications in Engineering**, Faculty of Engineering, Aristotle University, Thessaloniki, Greece. (Apr. 2005, p. 478)
Conference Topics: Contact Mechanics-Friction & stick-slip effects, Elastoplasticity-Shakedown-Limit Analysis, Convex Analysis and Mechanics, Nonsmooth Analysis and Optimization, Nonconvex Mechanics and Duality, Variational, quasivariational and hemivariational inequalities, Energy methods in Mechanics and Structural Analysis, Nonsmooth Dynamics, Structural Optimization, Structural Control and Identification, Computational Mechanics, Applications, Mathematical Analysis and Approximation resultsm, Innovative topics (like Chaotic behaviour, Fractal approximation, Neural Networks etc.)
Deadlines: Submission of Abstract by May 1, 2005. Preliminary acceptance by July 30, 2005. Submission of full paper by February 28, 2006.
Conference Organizer: c/o Professor C. C. Baniotopoulos, Institute of Steel Structures, Department of Civil Engineering, Aristotle University, GR-54124 Thessaloniki, Greece, tel.: +30 2310 99 5753 Fax: +30 2310 99 5642, email: nnmae2006@civil.auth.gr.
Information: http://www.civil.auth.gr/nnmae2006/.

10-14 **International Conference on Analytic Topology**, Lake Plaza Hotel, Rotorua, New Zealand. (Apr. 2005, p. 478)
Description: The main goal of this conference is to bring together a group of researchers from around the world, who are working at the interface between Topology and Analysis, to discuss recent developments and future directions of Analytic Topology.
Organizers: Warren B. Moors (Auckland University, email: moors@math.auckland.ac.nz); and Jiling Cao (Auckland University, email: cao@math.auckland.ac.nz).
Information: http://www.math.auckland.ac.nz/~cao/conference06.html.

10-14 **Ninth International Conference on p-adic functional analysis**, University of Concepcion, Concepcion, Chile. (Aug. 2005, p. 787)
Scientific Committee: A. Escassut, H. Ochsenius, J. Araujo, J. Rivera-Lerelier, J. Aguayo.

Organizing Committee: J. Aguayo (jaguayo@udec.cl); H. Ochsenius (hochsen@mat.puc.cl); X. Vidaux (xvidaux@udec.cl; M. Saavedra (mariansa@udec.cl).

17-August 11 **Spectral Theory and Partial Differential Equations**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)
Organizers: M. van den Berg (Bristol), B. Helffer (Orsay), A. Laptev (Stockholm), A.V. Sobolev (Sussex).
Information: http://www.newton.cam.ac.uk/programmes/STP/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

23-27 **The Ninth International Conference on Integral Methods in Science and Engineering (IMSE-2006)**, Sheraton Fallsview Hotel and Conference Centre, Niagara Falls, Ontario, Canada. (Aug. 2005, p. 787)
Information: email: spotapenko@uwaterloo.ca.

24-December 22 **Noncommutative Geometry**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)
Organizers: A. Connes (IHES), S. Majid (Queen Mary), A. Schwarz (UC Davis).
Information: http://www.newton.cam.ac.uk/programmes/NCG/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

27-August 2 **ASL European Summer Meeting (Logic Colloquium '06)**, Nijmegen, Netherlands. (Jun/Jul. 2005, p. 675)
Abstracts: Rules for Abstracts (including those submitted by title) may be found at http://www.aslonline.org/rules_abstracts.html.

30-August 24 **Bayesian Nonparametric Regression: Theory, Methods and Applications**, Isaac Newton Institute for Mathematical Sciences, Cambridge, United Kingdom. (Oct. 2004, p. 1097)
Organizers: Professor N. Hjort (Oslo), Dr C. Holmes (Oxford), Professor P. Mueller (Texas), Professor S. Walker (Bath).
Information: Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K., Tel.: +44 1223 335999, Fax.: +44 1223 330508; email: info@newton.cam.ac.uk ; http://www.newton.cam.ac.uk/programmes/BNR/index.html.

September 2006

4-8 **Satellite Conference on Differential Equations and Singularities, in honor of J. M. Aroca's 60th birthday**, Tordesillas(Valladolid, Spain). (Jun/Jul. 2005, p. 675)
Topics: Resolution of singularities, local study of singularities, singular foliations, differential algebra, asymptotic analysis, and differential and geometrical study of dynamical systems.
Scientific Committee: Felipe Cano (Univ. Valladolid), Frank Loray (Univ. Rennes I), Juan Jose Morales (U. Politecnica Catalunya), Paulo Sad (IMPA), Mark Spivakovsky (Univ. Paul Sabatier).
Organizers: Jorge Mozo Fernández, José Cano and Fernando Sanz (Univ. Valladolid).
Confirmed speakers: H. Hironaka, Lê-Dung-Tràng, J. M. Lion, I. Luengo, J. F. Mattei, R. Moussu, J. V. Pereira, J. P. Ramis, J. P. Rolin, J. Seade, M. Singer, B. Teissier, H. Umemura, H. Yoshida.
Information: http://www.uva.es/tordesillas2006; email: sedf2006@ieip.uva.es.

December 2006

14-18 **First Joint International Meeting with the Taiwanese Mathematial Society**, Taiwan, Taiwan. (Dec. 2004, p. 1379)
Information: http://www.ams.org/amsmtgs/internmtgs.html.

15-17 **International Conference on Computer & Information Science (ICCIS'2005)**, Fort Panhala, Kolhapur, India. (Dec. 2004, p. 1379)
Aim: To provide a platform for academics and professionals in computer science and information technology to meet, communicate, exchange ideas, and establish professional networks.
Sponsors: Technomathematics Research Foundation, India.
Important Dates: Full paper due: April 20, 2005. Proposals for tutorials and sessions due: February 20, 2005. Notification of acceptance: June 15th, 2005. Camera-ready paper with registration fee due: July 20, 2005.
Information: http://pune.sancharnet.in/kpr_tmrf/iccis05.html.

16-20 **DION 2005: An International Conference on Diophantine Equations: in honour of Professor T. N. Shorey on his 60th Birthday**, Tata Institute of Fundmental Research, Mumbai, India. (Jun/Jul. 2005, p. 675)
Information: Conference is open to mathematicians working in Number Theory and allied areas. Interested persons may find information at: email: math.tifr.res.in; http://www.math.tifr.res.in/~dion2005.

26-January 6, 2006 **CIMPA School on Commutative Algebra**, Institute of Mathematics, Hanoi, Vietnam. (Jun/Jul. 2005, p. 675)
Objective: The aim of the School is to introduce mathematicians from developing countries to some fundamental techniques and recent developments in Commutative Algebra and to promote the collaboration between mathematicians of different developing and developed countries.
Scientific program: The school will be divided into two parts. The first week (26 - 30.12.05) is a school with 4 instructional courses on the following topics: Local cohomology (M. Brodmann), Toric rings and varieties (D. Cox), Finite free resolutions (J. Herzog), Blow-up algebras (B. Ulrich). The second week (January 3-6, 2006) is devoted to an international conference. Besides invited lectures on recent development in Commutative Algebra, there will be opportunities for mathematicians from developing countries to present their research works.
Participation: The school and the conference are open to all mathematicians. The local organizers will arrange for visa and accommodation. Conference fees: 100 USD.
Support: There are a limited number of grants which cover travel and living expenses for mathematicians from developing countries.
Deadlines: Requests for participation and applications for support should be sent to the local coordinator before July 31, 2005.
Address for correspondences: L. T. Hoa, Institute of Mathematics, 18 Hoang Quoc Viet, 10307 Hanoi, Vietnam; Tel.: 0084-4-8361317 (Ext. 202); fax: 0084-4-7564303; email: cimpa@math.ac.vn.

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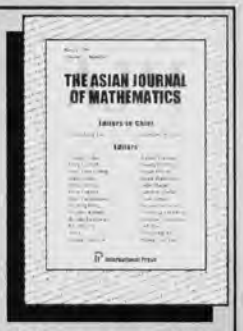

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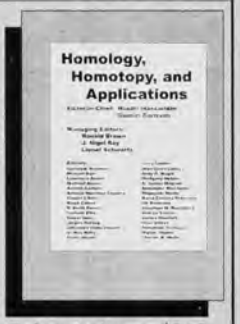

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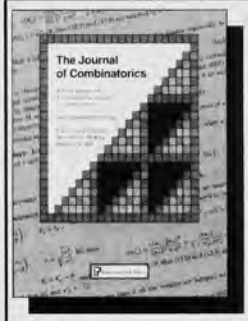

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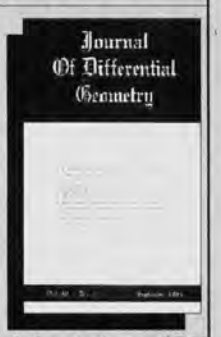

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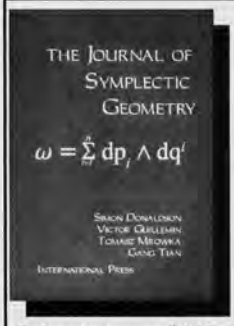

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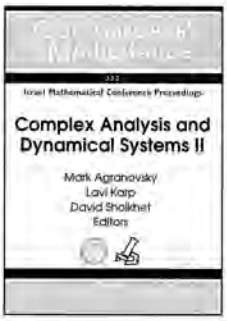


Complex Analysis and Dynamical Systems II

A Conference in Honor of Professor Lawrence Zalcman's Sixtieth Birthday, June 9–12, 2003, Nahariya, Israel

Mark Agranovsky, *Bar-Ilan University, Ramat-Gan, Israel*, and **Lavi Karp** and **David Shoikhet**, *ORT Braude College, Karmiel, Israel*, Editors

This volume is a collection of papers reflecting the conference held in Nahariya, Israel in honor of Professor Lawrence Zalcman's sixtieth birthday. The papers, many written by leading authorities, range widely over classical complex analysis of one and several variables, differential equations, and integral geometry.

Topics covered include, but are not limited to, these areas within the theory of functions of one complex variable: complex dynamics, elliptic functions, Kleinian groups, quasiconformal mappings, Tauberian theorems, univalent functions, and value distribution theory. Altogether, the papers in this volume provide a comprehensive overview of activity in complex analysis at the beginning of the twenty-first century and testify to the continuing vitality of the interplay between classical and modern analysis. It is suitable for graduate students and researchers interested in computer analysis and differential geometry.

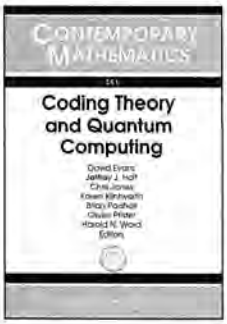
This book is copublished with Bar-Ilan University.

Contents: **M. Agranovsky** and **D. Shoikhet**, Lawrence Zalcman at sixty; **M. Agranovsky** and **D. Shoikhet**, Bibliography of Lawrence Zalcman; **M. L. Agranovsky** and **E. K. Narayanan**, A local two radii theorem for the twisted spherical means on $\mathbb{C}^n$; **V. Azarin**, A multiplicator problem and characteristics of growth of entire functions; **J. Bellissard**, **J. Geronimo**, **A. Volberg**, and **P. Yuditskii**, Are they limit periodic?; **W. Bergweiler**, Quasinormal families and periodic points; **M. Blinov**, **M. Briskin**, and **Y. Yomdin**, Local center conditions for the Abel equation and cyclicity of its zero solution; **D. Bshouty** and **A. Lyzzaik**, Univalent functions starlike with respect to a boundary point; **O. Calin**, **D.-C. Chang**, **P. Greiner**, and **Y. Kannai**, On the geometry induced by a Grusin operator; **M. Elin** and **V. Khatskevich**, The Kœnigs embedding problem for operator affine mappings; **H. M. Farkas**, On an arithmetical function II; **P. C. Fenton**, A glance at Wiman-Valiron theory; **L. Flatto**, Billiards in an ellipse; **F. W. Gehring** and **G. J. Martin**, (p,q,r)-Kleinian groups and the Margulis constant; **J. Globevnik**, Holomorphic extendibility and the argument principle; **A. Golberg**, Homeomorphisms with finite mean dilations; **A. Gol'dberg**, On a connection between the number of poles of a meromorphic function and the number of zeros of its derivatives; **I. Graham**, **G. Kohr**, and **J. A. Pfaltzgraff**, The general solution of the Loewner differential equation on the unit ball in $\mathbb{C}^n$; **W. K. Hayman**, On the zeros of a q-Bessel function; **A. Hinkkanen**, Entire functions with no unbounded Fatou components; **D. Khavinson**, A note on a theorem of J. Globevnik; **F. C. Klebaner**, Behaviour of a dynamical system far from its equilibrium; **J. Korevaar**, A Tauberian theorem for Laplace transforms with pseudofunction boundary behavior; **S. L. Krushkal**, The Schwarzian derivative and complex Finsler metrics; **A. M. Kytmanov** and **S. G. Myslivets**, On evaluation of the Cauchy principal value of the singular Cauchy-Szegö integral in a ball of $\mathbb{C}^n$; **A. Lecko**, Boundary properties of convex functions; **O. Makhmudov** and **I. E. Niyozov**, Regularization of a solution to the Cauchy problem for the system of thermoelasticity; **I. Markina**, Modules of vector measures on the Heisenberg group; **E. Ournycheva** and **B. Rubin**, An analogue of the Fuglede formula in integral geometry on matrix spaces; **V. P. Palamodov**, Characteristic problems for the spherical mean transform; **V. S. Rabinovich**, On the essential spectrum of electromagnetic Schrödinger operators; **E. Reich**, A critical example for the necessary and sufficient condition for unique quasiconformal extremality; **S. Reich** and **A. J. Zaslavski**, Generic convergence of iterates for a class of nonlinear mappings in hyperbolic spaces; **V. Ryazanov**, **U. Srebro**, and **E. Yakubov**, The Beltrami equation and FMO functions; **B.-W. Schulze** and **N. Tarkhanov**, Pseudodifferential operators with operator-valued symbols; **J. Siciak**, Pluripolar sets and pseudocontinuation; **H. Silverman** and **E. M. Silvia**, Convolution inverses; **S. K. Vodopyanov**, Composition operators on Sobolev spaces; **V. V. Volchkov** and **Vit. V. Volchkov**, New results in integral geometry.

Contemporary Mathematics, Volume 382

October 2005, 432 pages, Softcover, ISBN 0-8218-3709-5, LC 2005041245, 2000 *Mathematics Subject Classification*: 30-XX, 32-XX, 37-XX, 34-XX, 35-XX, 46-XX, 47-XX, **All AMS members US$79**, List US$99, Order code CONM/382

Applications



Coding Theory and Quantum Computing

David Evans and **Jeffrey J. Holt**, *University of Virginia, Charlottesville, VA*, **Chris Jones**, *St. Mary's College of California, Moraga, CA*, and **Karen Klintworth, Brian Parshall, Olivier Pfister**, and **Harold N. Ward**, *University of Virginia, Charlottesville, VA*, Editors

A conference, Coding Theory and Quantum Computing, was held in Charlottesville, VA, to provide an opportunity for computer scientists, mathematicians, and physicists to interact about subjects of common interest. This proceedings volume grew out of that meeting.

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The material presented is suitable for graduate students and researchers interested in coding theory and in quantum computing.

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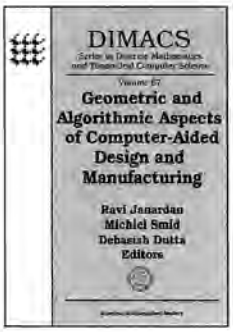
Contemporary Mathematics, Volume 381

August 2005, 147 pages, Softcover, ISBN 0-8218-3600-5, LC 2005041088, 2000 *Mathematics Subject Classification*: 81P68, 68Q05, 94B05, 05E20, **All AMS members US$39**, List US$49, Order code CONM/381



Geometric and Algorithmic Aspects of Computer-Aided Design and Manufacturing

Ravi Janardan, *University of Minnesota, Minneapolis, MN*, **Michiel Smid**, *Carleton University, Ottawa, ON, Canada*, and **Debasish Dutta**, *University of Michigan, Ann Arbor, MI*, Editors

Computer-Aided Design and Manufacturing (CAD/CAM) is concerned with all aspects of the process of designing, prototyping, manufacturing, inspecting, and maintaining complex geometric objects under computer control. As such, there is a natural synergy between this field and Computational Geometry (CG), which involves the design, analysis, implementation, and testing of efficient algorithms and data representation techniques for geometric entities such as points, polygons, polyhedra, curves, and surfaces. The DIMACS Center (Piscataway, NJ) sponsored a workshop to further promote the interaction between these two fields. Attendees from academia, research laboratories, and industry took part in the invited talks, contributed presentations, and informal discussions. This volume is an outgrowth of that meeting.

Topics covered in this volume include geometric modeling, computational topology, computational metrology, geometric constraint solving, part immobilization, geometric aspects of machining, layered manufacturing, and algebraic methods.

The book is suitable for graduate students and researchers interested in geometric and algorithmic aspects of computer-aided design and manufacturing.

Contents: I. Boier-Martin, D. Zorin, and **F. Bernardini**, A survey of subdivision-based tools for surface modeling; **T. K. Dey**, Sample based geometric modeling; **D. Blackmore, Y. Mileyko, M. C. Leu, W. C. Regli**, and **W. Sun**, Computational topology and swept volumes; **V. Srinivasan**, Elements of computational metrology; **M. Sitharam**, Combinatorial approaches to geometric constraint solving: Problems, progress and directions; **A. F. van der Stappen**, Immobilization: Analysis, existence, and output-sensitive synthesis; **R. Janardan** and **M. Smid**, Geometric algorithms for layered manufacturing; **P. Singh** and **D. Dutta**, A process planning framework for multi-direction layered deposition; **T. Kim** and **S. E. Sarma**, Machinability: Geometric reasoning for cutting; **D. Misra, V. Sundararajan**, and **P. K. Wright**, Zig-zag tool path generation for sculptured surface finishing; **I. Z. Emiris** and **I. S. Kotsireas**, Implicitization exploiting sparseness; **J. Keyser, K. Ouchi**, and **J. M. Rojas**, The exact rational univariate representation for detecting degeneracies; **W. R. Franklin**, Mass properties of the union of millions of identical cubes.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 67

September 2005, approximately 360 pages, Hardcover, ISBN 0-8218-3628-5, LC 2004062274, 2000 *Mathematics Subject Classification*: 12Y05, 52C45, 65D17, 65D18, 68U05, 68U07, 68W30, 68W40, **All AMS members US$79**, List US$99, Order code DIMACS/67

Recent Advances in Adaptive Computation

Z.-C. Shi and **Z. Chen**, *Chinese Academy of Sciences, Beijing, China*, **T. Tang**, *Hong Kong Baptist University, China*, and **D. Yu**, *Chinese Academy of Sciences, Beijing, China*, Editors

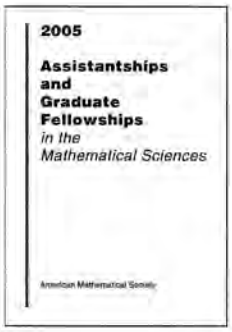
There has been rapid development in the area of adaptive computation over the past decade. The International Conference on Recent Advances in Adaptive Computation was held at Zhejiang University (Hangzhou, China) to explore these new directions. The conference brought together specialists to discuss modern theories and practical applications of adaptive methods. This volume contains articles reflecting the invited talks given by leading mathematicians at the conference. It is suitable for graduate students and researchers interested in methods of computation.

Contents: **M. Ainsworth**, A synthesis of a posteriori error estimation techniques for conforming, non-conforming and discontinuous Galerkin finite element methods; **C. Carstensen** and **M. Jensen**, Averaging techniques for reliable and efficient *a posteriori* finite element error control: Analysis and applications; **Z. Chen** and **X. Liu**, Adaptive computation with PML for time-harmonic scattering problems; **B. Guo**, Recent progress on a-posteriori error analysis for the p and h-p finite element methods; **R. H. W. Hoppe**, Adaptive mortar edge element methods in electromagnetic field computation; **W. B. Liu**, Adaptive multi-meshes in finite element approximation of optimal control; **R. Rannacher**, Adaptive finite element methods in flow computations; **A. H. Schatz**, Maximum norm error estimates for the finite element method allowing highly refined grids; **T. Tang**, Moving mesh methods for computational fluid dynamics; **J. Behrens** and **L. Mentrup**, A conservative scheme for 2D and 3D adaptive semi-Lagrangian advection; **L. Chen** and **J. Xu**, An optimal streamline diffusion finite element method for a singularly perturbed problem; **Y. Chen**, A posteriori error estimates of mixed methods for two phase flow problems; **M. Gunzburger** and **H.-C. Lee**, Reduced-order modeling of Navier-Stokes equations via centroidal Voronoi tessellation; **B.-O. Heimsund** and **X.-C. Tai**, A two-mesh superconvergence method for mesh adaptivity; **W. Huang** and **X. Zhan**, Adaptive moving mesh modeling for two dimensional groundwater flow and transport; **Y.-L. Huang** and **W.-C. Wang**, Adaptive computation of the corner singularity with the monotone jump condition capturing scheme; **S. Li**, Adaptive mesh refinement and its application to magneto-hydrodynamics; **Z. Li** and **X. Yang**, An immersed finite element method for elasticity equations with interfaces; **R. Lin** and **Z. Zhang**, Derivative superconvergence of equilateral triangular finite elements; **K. Liang** and **P. Lin**, A splitting moving mesh method for 3-D quenching and blow-up problems; **K.-S. Moon**, **E. von Schwerin**, **A. Szepessy**, and **R. Tempone**, An adaptive algorithm for ordinary, stochastic and partial differential equations; **N. Yan**, Recovery type a posteriori error estimate for distributed convex optimal control problems governed by integral-differential equations; **S. Zhang** and **D. Yu**, A mortar element method for coupling natural boundary element method and finite element method for unbounded domain problem; **P. A. Zegeling**, **W. D. de Boer**, and **H. Z. Tang**, Robust and efficient adaptive moving mesh solution of the 2-D Euler equations.

Contemporary Mathematics, Volume 383

October 2005, approximately 440 pages, Softcover, ISBN 0-8218-3662-5, LC 2005045327, 2000 *Mathematics Subject Classification*: 65M12, 65M50, 65M60, 65N12, 65N15, 65N30, 65N50, 65N55, 76-02, 76D05, **All AMS members US$87**, List US$109, Order code CONM/383

General and Interdisciplinary



Assistantships and Graduate Fellowships 2005

From a review of a previous edition:

This directory is a tool for undergraduate mathematics majors seeking information about graduate programs in mathematics. Although most of the information can be gleaned from the Internet, the usefulness of this directory for the prospective graduate student is the consistent format for comparing different mathematics graduate programs without the hype. Published annually, the information is up-to-date, which is more than can be said of some Websites. Support for graduate students in mathematics is a high priority of the American Mathematical Society, which also provides information for fellowships and grants they offer as well as support from other societies and foundations. The book is highly recommended for academic and public libraries.

—American Reference Books Annual

This valuable reference source brings together a wealth of information about resources available for graduate study in mathematical sciences departments in the U.S. and Canada.

November 2005, approximately 128 pages, Softcover, ISBN 0-8218-3866-0, **Individual member US$18**, List US$23, Order code ASST/2005

Change is Possible

Stories of Women and Minorities in Mathematics

Patricia Clark Kenschaft, *Montclair State University, Upper Montclair, NJ*

The role of minority and women mathematicians in developing our American mathematical community is an important but previously under-told story. Pat Kenschaft, in her highly readable and entertaining style, fills this knowledge gap. This valuable book should be in your personal library!

—Donald G. Saari, University of California, Irvine

Kenschaft reveals the passions that motivated past and present mathematicians and the obstacles they overcame to achieve their dreams. Through research and in-depth personal interviews, she has explored the sensitive issues of racism and sexism, rejoicing in positive changes and alerting us to issues that still need our attention.

—Claudia Zaslavsky, the author of "Africa Counts" and other books on equality issues in mathematics education

Based on dozens of interviews and extensive historical research, and spiced with interesting photographs, this entertaining book relates stories about mathematicians who have defied stereotypes.

There are five chapters about women that provide insight into the nineteenth and the mid-twentieth century, the early 1970s, the early 1990s, and 2004. Activists in many fields will take heart at the progress made during that time. The author documents the rudimentary struggles to become professionals, being married without entirely giving up a career, organizing to eliminate flagrant discrimination, improving the daily treatment of women in the professional community, and the widespread efforts toward true equality.

The stories of African Americans in mathematics include the efforts of Benjamin Banneker, an eighteenth century American who had three grandparents born in Africa. He helped design Washington, DC, and made the computations for almanacs that succeeded Benjamin Franklin's. There are stories about African American mathematicians who were students and faculty in late nineteenth century colleges and accounts of several efforts to integrate the mathematical community in the mid-twentieth century. These stories indicate that though some efforts were more successful than others, all of them were difficult.

The book concludes with a happier chapter about five black mathematicians in the early twenty-first century. The book also includes five interviews with leading Latin American mathematicians, along with the results of a survey of Latino research mathematicians in the Southwest.

The author is a skilled story-teller with good stories to tell. This book is a page-turner that all mathematicians—as well as others concerned with equality—should read. It is a work of great interest and an enjoyable read.

Contents: Introduction; With the help of good white men; Women and mathematics in the nineteenth century; The Twentieth century: Mathematics and marriage; African American mathematicians from the eighteenth through the twentieth century; Latino mathematicians; Reawakening: The Association for Women in Mathematics; Skits tell what's happening around 1990; Women in mathematics now (2004); Minorities in mathematics now (2004); Conclusions; Appendix (to Chapter 5): What were the careers of 75 African American mathematicians of New Jersey in mid-1985?.August 2005, approximately 212 pages, Softcover, ISBN 0-8218-3748-6, LC 2005048105, 2000 *Mathematics Subject Classification*: 01A80, 01A70, 01A99, **All AMS members US$23**, List US$29, Order code CHANGE

John von Neumann: Selected Letters

Miklós Rédei, *Eotvos Lorand University, Budapest, Hungary,* Editor

John von Neumann was perhaps the most influential mathematician of the twentieth century. Not only did he contribute to almost all branches of mathematics, he created new fields and was a pioneering influence in the development of computer science.

During and after World War II, he was a much sought-after technical advisor. He served as a member of the Scientific Advisory Committee at the Ballistic Research Laboratories, the Navy Bureau of Ordinance, and the Armed Forces Special Weapons Project. He was a consultant to the Los Alamos Scientific Laboratory and was appointed by U.S. President Dwight D. Eisenhower to the Atomic Energy Commission. He received the Albert Einstein Commemorative Award, the Enrico Fermi Award, and the Medal of Freedom.

This collection of about 150 of von Neumann's letters to colleagues, friends, government officials, and others illustrates both his brilliance and his strong sense of responsibility. It is the first substantial collection of his letters, giving a rare inside glimpse of his thinking on mathematics, physics, computer science, science management, education, consulting, politics, and war. With an introductory chapter describing the many aspects of von Neumann's scientific, political, and social activities, this book makes great reading. Readers of quite diverse backgrounds will be fascinated by this first-hand look at one of the towering figures of twentieth century science.

Also of interest and available from the AMS is *John von Neumann: The Scientific Genius Who Pioneered the Modern Computer, Game Theory, Nuclear Deterrence, and Much More.*

Copublished with the London Mathematical Society beginning with volume 4. Members of the LMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners.

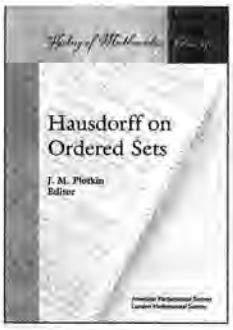
Contents: Introductory comments; Letter to N. Aronszajn; Letters to F. Aydelotte; Letter to E.F. Beckenbach; Letter to

H. Bethe; Letters to G. Birkhoff; Letter to W.J.E. Blaschke; Letter to R.S. Burington; Letters to V. Bush; Letter to R. Carnap; Letter to W. Cattell; Letter to T.M. Cherry; Letter to H. Cirker; Letter to H. Crocker; Letter to M.R. Davie; Letter to W.E. Deming; Letter to J.L. Destouches; Letter to P.A.M. Dirac; Letters to J. Dixmier; Letter to P.A. Dodd; Letter to W.M. DuMond; Letter to R.E. Duncan; Letter to editor of Evening Star; Letter to R. Farquharson; Letter to A. Flexner; Letter to R.A. Fornaguerra; Letter to N.H. Goldsmith; Letter to W.H. Gottsschalk (and Hans Rademacher); Letters to K. Gödel; Letter to G. Haberler; Letters to I. Halperin; Letter to G.B. Harrison; Letter to M. Horvath; Letter to A.S. Householder; Letters to C.C. Hurd; Letter to K. Husimi; Letters to P. Jordan; Letters to I. Kaplansky; Letter to C.E. Kemble; Letter to J.R. Killian; Letters to H.D. Kloosterman; Letter to H. Kuhn; Letter to J. Lederberg; Letter to W.E. Lingelbach; Letter to S. MacLane; Letter to J.C.C. McKinsey; Letter to M.M. Mitchell; Letter to T.V. Moore; Letter to O. Morgenstern; Letters to M. Morse; Letter to E. Nagel; Letter to J.R. Oppenheimer; Letters to R. Ortvay; Letter to W. Overbeck; Letter to H.H. Rankin; Letter to H.P. Robertson; Letter to E. Schrödinger; Letter to E. Segre; Letters to F.B. Silsbee; Letter to L. Spitzer; Letters to M. Stone; Letters to L.L. Strauss; Letter to J. Stroux; Letter to T. Tannaka; Letter to E. Teller; Letters to L.B. Tuckerman; Letters to S. Ulam; Letter to E.R. van Kampen; Letters to O. Veblen; Letters to N. Wiener; Letter to H. Wold; Notes on addresses of von Neumann's letters; Bibliography.

History of Mathematics, Volume 27

November 2005, approximately 328 pages, Hardcover, ISBN 0-8218-3776-1, LC 2005048258, 2000 *Mathematics Subject Classification*: 00A99, 01A70, **All AMS members US$47**, List US$59, Order code HMATH/27

Logic and Foundations



Hausdorff on Ordered Sets

J. M. Plotkin, *Michigan State University, East Lansing, MI*, Editor

Georg Cantor, the founder of set theory, published his last paper on sets in 1897. In 1900, David Hilbert made Cantor's Continuum Problem and the challenge of well-ordering the real numbers the first problem of his famous lecture at the International Congress in Paris. Thus, as the nineteenth century came to a close and the twentieth century began, Cantor's work was finally receiving its due and Hilbert had made one of Cantor's most important conjectures his number one problem. It was time for the second generation of Cantorians to emerge.

Foremost among this group were Ernst Zermelo and Felix Hausdorff. Zermelo isolated the Choice Principle, proved that every set could be well-ordered, and axiomatized the concept of set. He became the father of abstract set theory. Hausdorff eschewed foundations and developed set theory as a branch of mathematics worthy of study in its own right, capable of supporting both general topology and measure theory. He is recognized as the era's leading Cantorian.

Hausdorff published seven articles in set theory during the period 1901-1909, mostly about ordered sets. This volume contains translations of these papers with accompanying introductory essays. They are highly accessible, historically significant works, important not only for set theory, but also for model theory, analysis and algebra.

This book is suitable for graduate students and researchers interested in set theory and the history of mathematics.

Also available from the AMS by Felix Hausdorff are the classic works, *Grundzüge der Mengenlehre* (Volume 61) and *Set Theory* (Volume 119), in the AMS Chelsea Publishing series.

This item will also be of interest to those working in general and interdisciplinary areas.

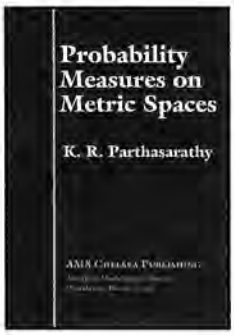
Copublished with the London Mathematical Society beginning with volume 4. Members of the LMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners.

Contents: J. M. Plotkin, Selected Hausdorff bibliography; **J. M. Plotkin**, Introduction to "About a certain kind of ordered sets"; **F. Hausdorff**, About a certain kind of ordered sets [H 1901b]; **J. M. Plotkin**, Introduction to "The concept of power in set theory"; **F. Hausdorff**, The concept of power in set theory [H 1904a]; **J. M. Plotkin**, Introduction to "Investigations into order types, I, II, III"; **F. Hausdorff**, Investigations into order types [H 1906b]; **J. M. Plotkin**, Introduction to "Investigations into order types IV, V"; **F. Hausdorff**, Investigations into order types [H 1907a]; **J. M. Plotkin**, Introduction to "About dense order types"; **F. Hausdorff**, About dense order types [H 1907b]; **J. M. Plotkin**, Introduction to "The fundamentals of a theory of ordered sets"; **F. Hausdorff**, The fundamentals of a theory of ordered sets [H 1908]; **J. M. Plotkin**, Introduction to "Graduation by final behavior"; **F. Hausdorff**, Graduation by final behavior [H 1909a]; **F. Hausdorff**, Appendix. Sums of $\aleph_1$ sets [H 1936b]; Bibliography.

History of Mathematics, Volume 25

July 2005, 322 pages, Softcover, ISBN 0-8218-3788-5, LC 2005045328, 2000 *Mathematics Subject Classification*: 01A75, 01A60, 03-03, 06-03, 26-03, **All AMS members US$55**, List US$69, Order code HMATH/25

Probability



Probability Measures on Metric Spaces

K. R. Parthasarathy

From a review of the original edition:

A very readable book which should serve as an excellent source from which a student could learn the subject ... a convenient reference for the specialist for theorems which must by now be regarded as basic to the subject.

—Mathematical Reviews

Having been out of print for over 10 years, the AMS is delighted to bring this classic volume back to the mathematical community.

With this fine exposition, the author gives a cohesive account of the theory of probability measures on complete metric spaces (which he views as an alternative approach to the general theory of stochastic processes). After a general description of the basics of topology on the set of measures, he discusses regularity, tightness, and perfectness of measures, properties of sampling distributions, and metrizability and compactness theorems. Next, he describes arithmetic properties of probability measures on metric groups and locally compact abelian groups. Covered in detail are notions such as decomposability, infinite divisibility, idempotence, and their relevance to limit theorems for "sums" of infinitesimal random variables. The book concludes with numerous results related to limit theorems for probability measures on Hilbert spaces and on the spaces $C[0,1]$.

The *Mathematical Reviews* comments about the original edition of this book are as true today as they were in 1967. It remains a compelling work and a priceless resource for learning about the theory of probability measures.

The volume is suitable for graduate students and researchers interested in probability and stochastic processes and would make an ideal supplementary reading or independent study text.

This item will also be of interest to those working in analysis.

Contents: The Borel subsets of a metric space; Probability measures in a metric space; Probability measures in a metric group; Probability measures in locally compact abelian groups; The Kolmogorov consistency theorem and conditional probability; Probability measures in a Hilbert space; Probability measures on $C[0,1]$ and $D[0,1]$; Bibliographical notes; Bibliography; List of symbols; Author index; Subject index.

AMS Chelsea Publishing

September 2005, 276 pages, Hardcover, ISBN 0-8218-3889-X, 2000 *Mathematics Subject Classification*: 60Bxx, **All AMS members US$35**, List US$39, Order code CHEL/352.H

New AMS-Distributed Publications

Algebra and Algebraic Geometry

Transformation Groups

Symplectic Torus Actions and Toric Manifolds

Goutam Mukherjee, *Indian Statistical Institute, Calcutta, India*, Editor

The importance of cohomology theory in the study of symplectic and Hamiltonian torus actions has been recognized for a long time. Its usefulness in the field continues today, specifically in the theory of toric varieties. One of the major aims of this book is to illustrate the cohomological methods used in the study of symplectic and Hamiltonian torus actions and to present some recent results.

The second purpose of this book is to present the theory of toric manifolds, which is a study of toric varieties from a topological viewpoint, and to illustrate some applications to combinatorics

Most of the techniques and proofs are either new and have not appeared elsewhere or are written in a style that is more accessible to readers. The volume is suitable for graduate students in mathematics having some basic knowledge in algebraic and differential topology.

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

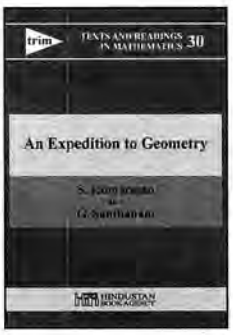
A publication of Hindustan Book Agency; distributed worldwide except in India by the AMS.

Contents: Localization theorem and symplectic torus actions; Toric varieties; Torus actions on manifolds; Bibliography; Index.

Hindustan Book Agency

April 2005, 140 pages, Hardcover, ISBN 81-85931-54-2, 2000 *Mathematics Subject Classification*: 14M25, 53D20, 55P60, 57R17, 57R91, 57S15, **All AMS members US$32**, List US$40, Order code HIN/22

Geometry and Topology



An Expedition to Geometry

S. Kumaresan, *University of Mumbai, India*, and **G. Santhanam**, *Indian Institute of Technology, Kanpur, India*

This book uses a holistic view of geometry to introduce axiomatic, algebraic, analytic, and differential geometry.

Starting with an informal introduction to non-Euclidean plane geometries, the book develops the theory of these geometries to put them on a rigorous footing. It can be considered an explanation of the Kleinian view *a la* Erlangen Programme. The treatment, however, goes beyond the Kleinian view of geometry.

Some noteworthy topics presented include ...

- various results about triangles (including results on areas of geodesic triangles) in Euclidean, hyperbolic, and spherical planes
- affine and projective classification of conics
- twopoint homogeneity of the three planes and
- the fact that the set of distance preserving maps (isometries) are essentially the same as the set of lengths preserving maps of these planes.

Geometric intuition is emphasized throughout the book. Figures are included wherever needed. The book has several exercises varying from computational problems to investigative or explorative open questions.

A publication of Hindustan Book Agency; distributed worldwide except in India by the AMS.

Contents: Introduction; Affine geometry; Projective geometry; Classification of conics; Euclidean geometry; Hyperbolic plane geometry; Spherical plane geometry; Theory of surfaces; A group action.

Hindustan Book Agency

April 2005, 242 pages, Hardcover, ISBN 81-85931-50-X, 2000 *Mathematics Subject Classification*: 51-01, 53-01, **All AMS members US$30**, List US$38, Order code HIN/21

Classified Advertisements

Positions available, items for sale, services available, and more

CALIFORNIA

MILLS COLLEGE
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Mills College invites applications for a full-time, tenure-track position as an Assistant, Associate, or Full Professor of Mathematics starting Fall 2006. Required: Ph.D. in mathematics and a broad background in mathematics. Applicants must submit evidence of superior teaching and research abilities. Teaching load: equivalent of five courses per year. Applicants at the Associate and Full Professor level must have extensive teaching experience and demonstrate truly exceptional teaching ability. Duties: teach a variety of courses in mathematics; contribute to an environment that excites women about mathematics and prepares them for careers that use mathematics; help build a strong program in mathematics that is attractive to students with diverse backgrounds and interests.

Located in the San Francisco Bay Area, Mills College is a selective liberal arts college for women with co-educational graduate programs (see `http://www.mills.edu`). Mills offers 39 undergraduate majors and 23 graduate degree and certificate programs, including a master's program in interdisciplinary computer science, and a B.A./M.A. program in mathematics. The faculty/student ratio is 1:10.

Please send a vita, at least three letters of recommendation, and statements of teaching philosophy and research agenda to: Chair of the Mathematics Search Committee, Mills College, 5000 MacArthur Blvd., Oakland, CA 94613 (e-mail address: `mathsearch@mills.edu`). The deadline for receiving this material is December 1, 2005. Persons of color and those committed to working in a multicultural environment are encouraged to apply. AA/EOE.

000063

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
Department of Mathematics

The Mathematics Department at University of California, Santa Cruz, is recruiting for: One tenure-track position for Assistant Professor in the area of number theory, subject to availability of funding, available July 1, 2006. The teaching load is four one-quarter courses per year. Appointees will be expected to teach, pursue their research and perform department and university service. Minimum qualifications: Ph.D. or equivalent by 6/30/06 in mathematics; demonstrated achievements or potential for excellence in research, teaching, and professional service. The campus is especially interested in candidates who can contribute to the diversity and excellence of the academic community through their research, teaching and/or service. Salary: $46,300–$51,700 (step and salary commensurate with experience). Deadline: Application materials and reference letters must be postmarked by November 4, 2005. Applicants must submit a Curriculum Vitae, a research statement, a teaching statement, and four letters of recommendation (at least one letter must address teaching experience and ability). Letters of recommendation will be treated as confidential documents (Please direct your letter writers to the UCSC Confidentiality Statement at `http://www2.ucsc.edu/ahr/policies/confstm.htm`).

All applications should be sent to: Faculty Recruitment Committee, Mathematics Department, University of California, 1156 High Street, Santa Cruz, CA 95064. Please refer to position #A100-06 in your reply. Inquiries (not applications) can be sent to `mathrcr@ucsc.edu`. UCSC is an EEO/AA employer. See `http://www.math.ucsc.edu/Jobs/Current.html` for complete job description.

000053

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 2005 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 ads.

Upcoming deadlines for classified advertising are as follows: October 2005 issue–July 25, 2005; November 2005 issue–August 26, 2005; December 2005 issue–September 28, 2005; January 2006 issue–October 28, 2005; February 2006 issue–November 29, 2005; March 2006 issue–December 30, 2005.

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 email to `classads@ams.org`. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 20904. Advertisers will be billed upon publication.

UNIVERSITY OF CALIFORNIA, SANTA CRUZ
Mathematics Department

The Mathematics Department at UCSC expects to have one or more Youngs Visiting Assistant Professorships, subject to availability of funding, available Fall 2006. We invite applications from qualified mathematicians in all fields. Appointees are expected to teach and pursue their research. Available for periods of two years, with a possible extension to a third year depending on teaching performance. Minimum qualifications: Ph.D. (or equivalent expected by 6/30/06) in Mathematics or a closely related field. Demonstrated excellence in teaching and research. Salary Range: $48,900–51,700. Deadline: Application materials and reference letters must be postmarked by November 28, 2005. Applicants must submit a Curriculum Vitae, a research statement, a teaching statement, and three letters of recommendation (at least one letter must address teaching experience and ability). All letters will be treated as confidential documents (Please direct your letter writers to the UCSC Confidentiality Statement at http://www2.ucsc.edu/ahr/policies/confstm.htm).

All application materials should be sent to: VAP Recruitment Committee, Mathematics Department, University of California, 1156 High Street, Santa Cruz, CA 95064. Please refer to provision #T05-39 in your reply. Inquiries (not applications) can be sent to mathrcr@ucsc.edu. UCSC is an EEO/AA Employer. See http://www.math.ucsc.edu/Jobs/Current.html for complete job description.

000056

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IN MATHEMATICS
2006-07

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The teaching load for Gibbs Assistant Professors will be kept light, so as to allow ample time for research. This will consist of three one-semester courses per year. Part of the duties may consist of a one-semester course at the graduate level in the general area of the instructor's research. Inquiries and applications should be addressed to gibbs.committee@math.yale.edu or to:

The Gibbs Committee
Department of Mathematics
Yale University
P.O. Box 208283
New Haven, Connecticut 06520-8283

Applications and supporting material must be received by January 1, 2006. Offers expected to be made in early February.

000059

ILLINOIS

THE UNIVERSITY OF CHICAGO
Department of Mathematics

The University of Chicago Department of Mathematics invites applications for the following positions:

1. L.E. Dickson Instructor: This is open to mathematicians who have recently completed or will soon complete a doctorate in mathematics or a closely related field, and whose work shows remarkable promise in mathematical research and teaching. The appointment typically is for two years, with the possibility of renewal for a third year. The teaching obligation is up to four one-quarter courses per year. For applicants who are U.S. citizens or permanent residents, there is the possibility of reduced teaching and resources for summer support and travel from the department's VIGRE grant.

2. Assistant Professor: This is open to mathematicians who are further along in their careers, typically two or three years past the doctorate. These positions are intended for mathematicians whose work has been of outstandingly high caliber. Appointees are expected to have the potential to become leading figures in their fields. The appointment is generally for three years, with a teaching obligation of three one-quarter courses per year.

Applicants will be considered for any of the positions above which seem appropriate. Complete applications consist of (a) a cover letter, (b) a curriculum vitae, (c) three or more letters of reference, at least one of which addresses teaching ability, and (d) a description of previous research and plans for future mathematical research. Applicants are strongly encouraged to include information related to their teaching experience, such as a teaching statement or evaluations from courses previously taught, as well as an AMS cover sheet. If you have applied for an NSF Mathematical Sciences Postdoctoral Fellowship, please include that information in your application, and let us know how you plan to use it if awarded. Applications should be sent to:

Appointments Secretary
Department of Mathematics
University of Chicago
5734 S. University Avenue
Chicago, IL 60637

Applications may also be submitted online through http://www.mathjobs.org. We will begin screening applications on December 2, 2005. Screening will continue until all available positions are filled. The University of Chicago is an Equal Opportunity/Affirmative Action Employer.

000060

KANSAS

KANSAS STATE UNIVERSITY
Department of Mathematics

Subject to budgetary approval, applications are invited for tenure-track and visiting positions commencing August 13, 2006; rank and salary commensurate with qualifications. The department seeks candidates whose research interests mesh well with current faculty. The department has research groups in the areas of analysis, algebra, geometry/topology, and differential equations. Applicants must have strong research credentials as well as strong accomplishment or promise in teaching. Letter of application, current vita, description of research, and at least three letters of reference evaluating research should be sent to:

Louis Pigno
Department of Mathematics
Cardwell Hall 138
Kansas State University
Manhattan, KS 66506

The department also requires that the candidate arrange for letters to be submitted evaluating teaching accomplishments and potential. Offers may begin by December 1, 2005, but applications for positions will be reviewed until February 1, 2006, or until positions are closed. AA/EOE

000055

MICHIGAN

MICHIGAN STATE UNIVERSITY
East Lansing, MI 48824
proMSc Program in
Industrial Mathematics

Direct your students toward one of the professional M.Sc. programs. Industry needs business-savvy mathematicians. See http://www.sciencemasters.com/.

000019

RHODE ISLAND

Brown University
Mathematics Department

The Mathematics Department, pending budgetary approval, invites applications for an opening at the level of Associate Professor with tenure to begin July 1, 2006.

(Exceptionally qualified senior candidates may be considered for appointment as Full Professor.) Candidates should have a distinguished research record and a strong commitment to excellence in undergraduate and graduate teaching. Preference will be given to applicants with research interests consonant with those of the present members of the Department (for more information see http://www.math.brown.edu/faculty/faculty.html). Qualified individuals are invited to send a letter of application, a curriculum vitae, and three letters of recommendation, one of which should address teaching, to be forwarded to: Senior Search Committee, Department of Mathematics, Box 1917, Brown University, Providence, Rhode Island 02912. Applications received by October 15, 2005, will receive full consideration, but the search will remain open until the position is closed or filled. For further information or inquiries, write to srsearch@math.brown.edu. Brown University is an Equal Opportunity/Affirmative Action employer and encourages applications from women and minorities.

000058

TEXAS

TEXAS A&M UNIVERSITY
The Department of Mathematics

The Department of Mathematics is in the third year of an aggressive four-year hiring plan to increase its tenured and tenure-track faculty by 25%. As part of this effort, we anticipate several openings for tenured, tenure-eligible, and visiting faculty positions beginning fall 2006. The field is open, but we particularly seek applications from individuals whose mathematical interests would augment and build upon existing strengths both within the Mathematics Department as well as other departments in the University. Salary, teaching loads and start-up funds are competitive. For a Tenured Position the applicant should have an outstanding research reputation and would be expected to fill a leadership role in the department. An established research program, including success in attracting external funding and supervision of graduate students, and a demonstrated ability and interest in teaching are required. Informal inquiries are welcome. For an Assistant Professorship, we seek strong research potential and evidence of excellence in teaching. Research productivity beyond the doctoral dissertation will normally be expected. We also have several visiting positions available. Our Visiting Assistant Professor positions are for a three year period and carry a three course per year teaching load. They are intended for those who have recently received their Ph.D. and preference will be given to mathematicians whose research interests are close to those of our regular faculty members. Senior Visiting Positions may be for a semester or one year period. The complete dossier should be received by December 15, 2005. Early applications are encouraged since the department will start the review process in October. Applicants should send the completed "AMS Application Cover Sheet", a vita, and arrange to have letters of recommendation sent to: Faculty Hiring, Department of Mathematics, Texas A&M University, College Station, Texas 77843-3368. Further information can be obtained from: http://www.math.tamu.edu/hiring.

Texas A&M University is an Equal Opportunity Employer. The University is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff committed to teaching and working in a multicultural environment and strongly encourages applications from women, minorities, individuals with disabilities, veterans. The University is responsive to the needs of dual career couples.

000062

Southern Methodist University
Dedman College
Department of Mathematics

Applications are invited for two tenure-track assistant professor positions, to begin in the fall semester of 2006. Applicants must have a Ph.D., provide evidence of outstanding research, and have a strong commitment to teaching at all levels. Applications in all areas of computational and applied mathematics are encouraged. The Department of Mathematics offers an active doctoral program in computational and applied mathematics. Current research includes numerical analysis of ordinary and partial differential equations, mathematical software, dynamical systems and bifurcations, fluid dynamics, nonlinear optics, perturbation methods, and mathematical biology. Visit http://www.smu.edu/math for more information about the department.

To apply, send a letter of application with a curriculum vitae, a list of publications, and research and teaching statements to: The Faculty Search Committee, Department of Mathematics, Southern Methodist University, P.O. Box 750156, Dallas, Texas 75275-0156. Applicants must also arrange for three letters of recommendation to be forwarded to the Faculty Search Committee. The Search Committee can be contacted by sending e-mail to mathsearch@mail.smu.edu. (Tel: (214) 768-2452; Fax: (214) 768-2355).

To ensure full consideration for the position, the application must be received by December 9, 2005, but the committee will continue to accept applications until the position is filled. The committee will notify applicants of its employment decision after the position is filled.

SMU, a private university with an engineering school, is situated in a quiet residential section of Dallas. SMU will not discriminate on the basis of race, color, religion, national origin, sex, age, disability or veteran status. SMU is also committed to nondiscrimination on the basis of sexual orientation.

000061

BRAZIL

INSTITUTE FOR PURE AND APPLIED MATHEMATICS

The Institute for Pure and Applied Mathematics (IMPA) invites applications for two tenure-track positions with an initial appointment of four years. Further information, such as salaries, application procedure and areas of interest will be announced after August 31st, 2005, at the site http://www.impa.br/Concursos/positions.html.

000064

NORTHWESTERN
UNIVERSITY

CALL FOR NOMINATIONS

NEMMERS PRIZE IN MATHEMATICS

$150,000

Northwestern University invites nominations for the Frederic Esser Nemmers Prize in Mathematics to be awarded during the 2005-06 academic year. The award includes payment to the recipient of $150,000. Made possible by a generous gift to Northwestern by the late Erwin Esser Nemmers and the late Frederic Esser Nemmers, the award is given every other year.

Candidacy for the Nemmers Prize in Mathematics is open to those with careers of outstanding achievement in mathematics as demonstrated by major contributions to new knowledge or the development of significant new modes of analysis. Individuals of all nationalities and institutional affiliations are eligible except current or recent members of the Northwestern University faculty and recipients of the Nobel Prize.

The recipient of the 2006 Nemmers Prize in Mathematics will deliver a public lecture and participate in other scholarly activities at Northwestern University for 10 weeks during the 2006-07 academic year.

Nominations for the Frederic Esser Nemmers Prize in Mathematics will be accepted until December 1, 2005. Nominating letters of no more than three pages should describe the nominee's professional experience, accomplishments, and qualifications for the award. A brief *curriculum vitae* of the nominee is helpful but not required. Nominations from experts in the field are preferred to institutional nominations; direct applications will not be accepted.

Nominations may be sent to:

nemmers@northwestern.edu

or

Secretary
Selection Committee for the Nemmers Prizes
Office of the Provost
Northwestern University
633 Clark Street
Evanston, Illinois 60208-1119
U.S.A.

www.northwestern.edu/provost/awards/nemmers

RECIPIENTS OF THE FREDERIC ESSER NEMMERS PRIZE IN MATHEMATICS

JOHN H. CONWAY
MIKHAEL GROMOV
JOSEPH B. KELLER
YURI I. MANIN
YAKOV G. SINAI
EDWARD WITTEN

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, 2005** to:
Membership and Programs Department
American Mathematical Society
201 Charles Street, Providence, RI 02904-2294
e-mail (for inquiries only): icm06@ams.org

You may type in the answers for printing and mailing at www.ams.org/employment/icmapp.html

ICM2006 TRAVEL GRANT APPLICATION

for U.S. mathematicians attending the
International Congress of Mathematicians, Madrid, Spain, 2006

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 Madrid 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, 2006)*:
line one: _____
line two: _____
city _____ state _____ zip _____
telephone _____ e-mail _____

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 (ICM2006 sections):

☐ 1. Logic and Foundations
☐ 2. Algebra
☐ 3. Number Theory
☐ 4. Algebraic and Complex Geometry
☐ 5.Geometry
☐ 6. Topology
☐ 7. Lie Groups and Lie Algebras
☐ 8. Analysis
☐ 9. Operator Algebras and Functional Analysis
☐ 10. Ordinary Differential Equations and Dynamical Systems
☐ 11. Partial Differential Equations
☐ 12. Mathematical Physics
☐ 13. Probability and Statistics
☐ 14. Combinatorics
☐ 15. Mathematical Aspects of Computer Science
☐ 16. Numerical Analysis and Scientific Computing
☐ 17. Control Theory and Optimization
☐ 18. Applications of Mathematics in the Sciences
☐ 19. Mathematical Education and Popularization of Mathematics
☐ 20. 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 Membership and Programs, AMS, 201 Charles Street, Providence, RI 02904-2294. LETTERS ONLY (not applications) may be sent via e-mail to icm06@ams.org. Name of applicant and "ICM06" should appear on the first line of the message. Deadline for receipt of letters is October 31, 2005.

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:

☐ U.S. citizen or permanent resident
☐ 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.

Mathematical Sciences Employment Center

Henry B. Gonzalez Convention Center, San Antonio, Texas
January 12, 13, 14, and 15, 2006

2006 Employment Center Schedule

October 26, 2005 Registration deadline for inclusion in Winter List books.

December 16, 2005 Advance registration deadline. After this date, all registration activities will happen on site in San Antonio.

Thursday, January 12

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 a.m.–4:00 p.m. Submission of Scheduled Employment Register interview request forms for both Friday and Saturday interviews. No request forms can be accepted after 4:00 p.m. Thursday.

9:30 a.m.–6:00 p.m. Interview Center open.

No Scheduled Employment Register interviews are held on Thursday.

Friday, January 13

7:00 a.m.–8:15 a.m. Distribution of interview schedules for both Friday and Saturday 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.).

Saturday, January 14

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 (doors open at 7:30 a.m.; do not schedule before 8:00 a.m.).

Sunday, January 15

9:00 a.m.–12 noon Interview Center open.

Note: Any participant who plans to use the Scheduled Employment Register must appear at the Employment Center on Thursday by 4:00 p.m. to turn in the Interview Request/Availability Form. If unexpected delays occur while travelling, contact the AMS at 800-321-4267, ext. 4107.

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 job seekers 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 four-day program which takes place on the Thursday, Friday, Saturday, and Sunday (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 that 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). Following three or four years of a job market favorable to candidates, the Employment Center applicant/employer ratio has worsened over the last few years. At the 2005 Employment Center, 549 candidates and 121 employers participated, giving an overall applicant-to-employer ratio of 4.5:1 (compared with 424 applicants and 129 employers in 2003, a ratio of 3.2:1). 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. The total number of interviews arranged is dependent on the number of participating employers. Fewer employers will mean fewer interviews overall.

At the January 2006 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, 2005) can be printed in the *Winter List* distributed to employers.

Employer forms submitted by registered employers have no connection with the AMS online 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 Thursday, January 12, which of the eight sessions (of five interviews each) they will participate in and submit their Availability/Interview Request Forms between 9:30 a.m. and 4:00 p.m. Thursday. 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 Friday and Saturday interviews on Friday 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 (however, **no more than two** may sit at the table at one time). For follow-up interviews, the scheduled tables will also be available for use until 7:30 p.m. on Friday and Saturday, and on Sunday morning from 9:00 a.m. to noon.

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. Friday or Saturday, or on Sunday 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 Thursday 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:

Thursday, January 12, 2006, 9:30 a.m.–6:00 p.m.
Friday, January 13, 2006, 8:00 a.m.–7:30 p.m.
Saturday, January 14, 2006, 8:00 a.m.–7:30 p.m.
Sunday, January 15, 2006, 9:00 a.m.–noon

The fee for use of this area is the same as the normal employer fee, $230. 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 Antonio, 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. Only banners that can be draped over the four-foot table can be accommodated.

About the *Winter List of Applicants*

This booklet contains hundreds of résumés of applicants who registered by October 26 for the Employment Center. It will be mailed in December to all employers who register by October 26 and 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 place a job description in the book of employers. This description must be submitted on the Employer Form, which is located on the Web at `www.ams.org/emp-reg`, 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 sent separately) 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. They should register for the Employment Center by completing the following steps:

> Indicate on the Joint Meetings registration form (available either electronically in early September 2005 at `www.ams.org/amsmtgs/2095_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.
>
> Submit an Employer (job listing) Form electronically at www.ams.org/emp-reg, or use 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 is 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 16 for the normal fees or on site in San Antonio at the on-site rates. Call 800-321-4267, ext. 4113, with any questions or deadline problems.

Any representatives of the institution can sit at the table together or working in shifts (however, the limit is two at one time). If possible, their names should be listed on the Employer Form as a reference point for the applicants. Employment Center fees should be paid only for each table required, not for each person.

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 $230 for the first table and $80 for each additional table. On-site registration fees (any registrations after 12/16/05) are $310 for the first table and $110 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 16 may register on site in San Antonio 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 Thursday, January 12, 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 may be handwritten on site). If registering for the employer-scheduled Interview Center only, registration on Friday is possible.

Applicants: Use of the computer-scheduled program is now optional

In 2006 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 2006 Employment Center will find themselves talking with employers in two different settings:

1. A computer-scheduling program sets 15-minute interviews at 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. Many applicants prefer the interviews they are invited for in this setting, since it is more relaxed and interviews tend to last longer.

Overall, many applicants report being disappointed that there are not more research-oriented jobs being interviewed for at the Employment Center. The best way to predict what type of employers will interview at the Employment Center is to peruse a list of institutions from the previous year, available at `www.ams.org/emp-reg`. Applicants should expect that many of the jobs are best suited to enthusiastic and well-qualified candidates who can contribute on many levels in an academic setting.

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 (Friday and Saturday). 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 Thursday, 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 Friday morning.

Applicants are advised to place as many selections as possible on their scannable request sheets; however, be advised that this may result in interviews with less-preferred employers. Applicants should be aware that each year approximately 10 percent of applicants signing up for all services fail to submit a schedule request sheet. This is often due to having too many schedule conflicts.

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 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 bachelor's-granting 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. Approximately 40 percent of applicants responding to a recent survey report having between zero and two interviews in the Interview Center. The rest reported higher numbers. Most of the applicants reported that at least some of the Interview Center appointments had been arranged in advance of the meetings.

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 brief 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 for public perusal some information about their availability during the meetings.

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.

Results

In a recent survey, 55 percent of applicants responding reported being invited for at least one on-campus visit to an employer they had interviewed with during the Employment Center; 42 percent reported receiving at least one job offer in the months following the interview. Overall, 23 percent reported accepting a position with an employer they spoke with during the Employment Center. Another 23 percent reported (in June) having no new job offers. The rest accepted positions with employers they met through other means.

Applicants: Register Early

Applicants need to complete the following steps by the advance deadline of October 26, 2005.

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 available in early September 2005 at www.ams.org/amsmtgs/2095_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 $42; "Message Center and *Winter List* ONLY" registration is $21.

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 email acknowledgement almost immediately. For registration and payments, the Meetings Service Bureau acknowledges all payments. When payments AND the Applicant Form have been received, another acknowledgement will go out by email, if possible, or by mail. Please allow a week or so for processing, but after that contact staff (AMS 800-321-4267, ext. 4113) if you do not receive acknowledgement from the Employment Center.

Around December 15 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 16. 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 16 must register on site at the Joint Meetings registration desk and pay higher fees ($80 Employment Center fee; however, the "Message Center and *Winter List* ONLY" fee is always just $21).

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 meetings 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 Thursday, January 12, 2006, or they will not be included when the interview-scheduling program runs Thursday night. Should unexpected delays occur while travelling, contact the AMS at 800-321-4267, ext. 4107. 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 Thursday is allowed for a higher fee but is severely discouraged. Most employers will not notice an Applicant Form that arrives on Thursday. 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. Registering on site for a mailbox only is possible, at the $21 rate, on Thursday and Friday. Pay the fees at the Joint Meetings registration area and then bring your receipt to the Employment Center desk to register yourself.

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.

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, 2005,** in order to appear in the *Winter List*. However, meeting registration (and payment of fees) is required before the forms can be processed.

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

EMPLOYER FORM

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 12–15, 2006
SAN ANTONIO, TEXAS

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Register 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 Employers*.
3. Please list all potential interviewers, for reference by applicants, but pay fees only for each separate table.
4. Forms will not be processed until registration and payment of fees have been received.

EMPLOYER CODE:

Institution _____

Department _____

Mailing address _____

_____

E-mail address (one only) _____

URL (or other contact info) _____

Name(s) of Interviewer(s) 1. _____

2. _____

3. _____

4. _____

Specialties sought _____

_____

Title(s) of position(s) _____

Number of positions _____

Starting date _____ / _____ (Month / Year)

Term of appointment _____ (Years)

Renewal ☐ Possible ☐ Impossible

Tenure-track position ☐ Yes ☐ No

Teaching hours per week _____

Degree preferred _____

Degree accepted _____

Duties _____

_____

_____

Experience preferred _____

_____

_____

Significant other requirements, needs, or restrictions which will influence hiring decisions _____

_____

_____

This position will be subject to a security clearance which will require U.S. citizenship: ☐ Yes ☐ No

THE EMPLOYER PLANS TO USE THE FOLLOWING SERVICES (check all that apply):

☐ One or more computer-scheduled Interview Tables

☐ One or more self-scheduled Interview Tables

☐ Placing this form for information only (not using a table)

APPLICANT RÉSUMÉ FORM

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 12–15, 2006
SAN ANTONIO, TEXAS

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Register 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 CODE:

Last name _____ First name _____

Mailing address (include zip code) _____

_____

E-mail address (one only) _____

URL (or other contact info) _____

Specialties _____

_____

(use MR classification codes plus text if possible; applicants will be indexed by first number only)

DESIRED POSITION:

Academic: ☐ Research ☐ University Teaching College Teaching: ☐ 4-year ☐ 2-year

Would you be interested in nonacademic employment? ☐ Yes ☐ 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) ☐ U.S. Citizen ☐ Non-U.S. Citizen, authorized to work permanently in U.S. ☐ Other

This applicant will be using: ☐ ALL Employment Center services ☐ Message Center and Winter List ONLY

Resources on the AMS Website

MATH in the MEDIA www.ams.org/mathmedia

A Monthly Magazine from the American Mathematical Society

FEATURE COLUMN www.ams.org/featurecolumn

Monthly Essays on Mathematical Topics

Math in the Media is a new centralized tracker of articles about mathematics that appear in the media. The collection—*Tony Phillips' Take on Math in the Media*; *Math Digest* (summaries of mathematics in the news); and *Reviews* of books, plays, and films with mathematical themes—is a great way to keep abreast of math news as reported in newspapers and general science magazines. The **Feature Column** is a series of essays on various mathematical themes, such as voting, bin-packing, and networks.

Math in the Media and the **Feature Column** offer a wealth of information about current mathematics and its applications, and can serve as a starting point for math club or classroom discussions.

Conferences

Call for Proposals for the 2007 von Neumann Symposium

Through a bequest from Carroll V. Newson to memorialize the late John von Neumann and his accomplishments, the Society established a quadrennial symposium called the von Neumann Symposium. Subjects of these one-week symposia are to be topics of emerging significance that are expected to underlie future mathematical development. Ideas expressed and shared at these Symposia, and the new understandings embodied in the von Neumann proceedings, will reflect exceptional mathematical leadership.

Conference topics in this series have included Quantization and Nonlinear Wave Equations (1994); Arithmetic Fundamental Groups and Noncommutative Algebra (1999); and Symposium on Complex Geometry, Calibrations and Special Holonomy (2003).

Proposals for topics for the 2007 symposium are invited from mathematicians, either singly or in groups. Proposals must include (1) the names and affiliations of proposed members and the chair of the Organizing Committee; (2) a two-to-four page narrative addressing the focus of the topic, including its importance and timeliness; (3) estimated attendance; (4) a list of recent conferences in the same or closely related areas; (5) a tentative list of names and affiliations of the proposed principal speakers; and (6) a list of likely candidates who would be invited to participate and their current affiliations.

Individuals willing to serve as organizers should be aware that the professional meetings staff in the Society's Providence office will provide full support and assistance before, during, and after the conference, thus relieving the organizers of most of the administrative detail. There is some flexibility on the dates for when the symposium can be held in 2007.

Organizers should also note that it is required that the proceedings be published by the AMS and a member of the Organizing Committee must be willing to serve as editor of the proceedings which will be published by the AMS.

An application form to be used when submitting suggested proposal(s) may be obtained by writing to the director of Meetings and Conferences, American Mathematical Society, 201 Charles St., Providence, RI 02904; or by telephone: 401-455-4146; fax: 401-455-4004; email: meet@ams.org.

Deadline for proposals is **January 16, 2006**. Proposals will be considered by the Von Neumann Symposium Selection Committee.

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/`. Final programs for Sectional Meetings will be archived on the AMS website accessible from the stated URL and in an electronic issue of the *Notices* as noted below for each meeting.

Annandale-on-Hudson, New York

Bard College

October 8–9, 2005
Saturday - Sunday

Meeting #1009
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: August 2005
Program first available on AMS website: August 25, 2005
Program issue of electronic *Notices*: October 2005
Issue of *Abstracts*: Volume 26, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 16, 2005

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Persi Diaconis, Stanford University, *Erdős picture of "most things"* (Erdős Memorial Lecture).

Harold Rosenberg, University of Paris VII, *Minimal and constant mean curvature surfaces in homogeneous 3-manifolds.*

Alice Silverberg, University of California Irvine, *Applying number theory and algebraic geometry to cryptography.*

Christopher Sogge, Johns Hopkins University, *Estimates for eigenfunctions of the Laplacian.*

Benjamin Sudakov, Princeton University, *Probabilistic reasoning and Ramsey theory.*

Special Sessions

Algebraic and Geometric Combinatorics (Code: SS 12A), **Cristian P. Lenart**, State University of New York at Albany, and **Lauren L. Rose** and **Sheila Sundaram**, Bard College.

Extremal and Probablistic Combinatorics (Code: SS 11A), **Benjamin Sudakov**, Princeton University.

Geometric Group Theory (Code: SS 1A), **Sean Cleary**, The City College of New York, and **Melanie I. Stein**, Trinity College.

Geometric Transversal Theory (Code: SS 3A), **Richard Pollack**, Courant Institute, New York University, and **Jacob Eli Goodman**, The City College of New York.

Global Theory of Minimal Surfaces (Code: SS 6A), **David A. Hoffman**, Mathematical Sciences Research Institute, and **Harold Rosenberg**, University of Paris VII.

History of Mathematics (Code: SS 2A), **Patricia R. Allaire**, Queensborough Community College, CUNY, **Robert E. Bradley**, Adelphi University, and **Jeff Suzuki**, Bard College.

Homological Aspects of Commutative Algebra (Code: SS 4A), **Alexandre Tchernev**, University of Albany, SUNY, and **Janet Vassilev**, University of Arkansas.

Infinite Groups (Code: SS 10A), **Anthony M. Gaglione**, United States Naval Academy, **Benjamin Fine**, Fairfield University, and **Dennis Spellman**, Philadelphia University.

Invariants of Graphs and Matroids (Code: SS 8A), **Gary Gordon** and **Lorenzo Traldi**, Lafayette College.

Mathematical Methods for the Analysis of Images and High-Dimensional Data (Code: SS 13A), **Erik M. Bollt**, Clarkson University, and **Rick Chartrand**, Los Alamos National Laboratory.

Measurable, Symbolic, and Tiling Dynamical Systems (Code: SS 9A), **Natalie Priebe Frank**, Vassar College, and **Samuel J. Lightwood**, Western Connecticut State University.

Special Functions and Orthogonal Polynomials: Theory and Applications (Code: SS 7A), **Diego Dominici**, State University of New York at New Paltz.

Theory of Infinite-Dimensional Lie Algebras, Vertex Operator Algebras, and Related Topics (Code: SS 5A), **Antun Milas**, SUNY at Albany, **Alex J. Feingold**, Binghamton University, and **Yi-Zhi Huang**, Rutgers University.

Johnson City, Tennessee

East Tennessee State University

October 15–16, 2005

Saturday - Sunday

Meeting #1010

Southeastern Section
Associate secretary: Matthew Miller
Announcement issue of *Notices*: August 2005
Program first available on AMS website: September 1, 2005
Program issue of electronic *Notices*: October 2005
Issue of *Abstracts*: Volume 26, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 23, 2005

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Alberto Bressan, Pennsylvania State University, *Optimal transportation metrics and nonlinear wave equations.*

Assaf Naor, Microsoft Research, *The b-Lipschitz theory of metric spaces: A survey of recent progress and algorithmic applications.*

Prasad V. Tetali, Georgia Institute of Technology, *Markov chain mixing: An update.*

Rekha R. Thomas, University of Washington, *Gröbner bases: From theory to applications and back.*

Special Sessions

Approximation Theory (Code: SS 5A), **Robert Gardner**, East Tennessee State University, and **Narendra Kumar Govil**, Auburn University.

Commutative Ring Theory (Code: SS 1A), **David F. Anderson** and **David E. Dobbs**, University of Tennessee at Knoxville.

Discrete Models in Biology (Code: SS 7A), **Debra Knisley**, East Tennessee State University, and **Michael A. Langston**, Department of Computer Science, University of Tennessee, Knoxville.

Geometry and Algorithms in Metric Spaces (Code: SS 8A), **W. J. Bo Brinkman**, Computer Science & Systems Analysis Department, Miami University, and **Beata Randrianantoanina**, Miami University.

Mathematical Applications in Survival Analysis and Biostatistics (Code: SS 6A), **Don Hong**, East Tennessee State University, and **Tiejian Wu**, Department of Public Health, East Tennessee State University.

Mathematical Aspects of Wave Propagation Phenomena (Code: SS 2A), **Boris P. Belinskiy**, University of Tennessee at Chattanooga, and **Anjan Biswas**, Tennessee State University.

Mathematical Education of Teachers (Code: SS 3A), **Frederick Norwood** and **Michel Helfgott**, East Tennessee State University.

Nonlinear PDE Evolutionary Systems and Their Control (Code: SS 9A), **George Avalos**, University of Nebraska-Lincoln, and **Irena M. Lasiecka**, University of Virginia.

Nonlinear Wave Equations and Applications (Code: SS 4A), **Alberto Bressan** and **Yuxi Zheng**, Pennsylvania State University.

Lincoln, Nebraska

University of Nebraska in Lincoln

October 21–23, 2005

Friday - Sunday

Meeting #1011

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: August 2005
Program first available on AMS website: September 8, 2005
Program issue of electronic *Notices*: October 2005
Issue of *Abstracts*: Volume 26, Issue 4

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 30, 2005

The scientific information listed below may be dated. For the latest information, see www.ams.org/amsmtgs/sectional.html.

Invited Addresses

Sir Michael Atiyah, University of Edinburgh, *The nature of space.* (Einstein Public Lecture in Mathematics "In celebration of the 100th anniversary of Albert Einstein's *annus mirabilis*").

Howard A. Masur, University of Illinois at Chicago, *Billiards in polygons: Connections of geometry and complex analysis to dynamical systems.*

Alejandro Uribe, University of Michigan, *Title to be announced.*

Judy Walker, University of Nebraska, *Title to be announced.*

Jack Xin, University of Texas, *Title to be announced.*

Special Sessions

Algebraic Geometry (Code: SS 1A), **Brian Harbourne**, University of Nebraska-Lincoln, and **Bangere P. Purnaprajna**, University of Kansas.

Analysis of Partial Differential and Integral Equations (Code: SS 18A), **Congming Li**, University of Colorado.

Association Schemes and Related Topics (Code: SS 22A), **Sung Yell Song**, Iowa State university, and **Paul M. Terwilliger**, University of Wisconsin.

Calculus of Variations (Code: SS 17A), **Mikil Foss**, University of Nebraska-Lincoln, and **Giovanni Leoni**, Carnegie Mellon University.

Combinatorial Matrix Theory (Code: SS 10A), **Leslie Hogben**, Iowa State University, and **Bryan L. Shader**, University of Wyoming.

Commutative Algebra (Code: SS 14A), **Lars Winther Christensen, Srikanth B. Iyengar**, and **Sean M. Sather-Wagstaff**, University of Nebraska-Lincoln.

Dynamic Equations on Time Scales (Code: SS 5A), **Lynn H. Erbe** and **Allan C. Peterson**, University of Nebraska-Lincoln.

Geometric Methods in Group Theory and Semigroup Theory (Code: SS 6A), **Susan M. Hermiller** and **John C. Meakin**, University of Nebraska-Lincoln, and **Zoran Sunik**, Texas A&M University.

Geometry of Differential Equations (Code: SS 11A), **Jeanne Nielsen Clelland**, University of Colorado, **Irina A. Kogan**, North Carolina State University, and **Zhijun Qiao**, University of Texas-Pan American.

Graph Theory (Code: SS 8A), **Andrew J. Radcliffe**, University of Nebraska-Lincoln, **Zsuzsanna Szaniszlo**, Valparaiso University, and **Jonathan Cutler**, University of Nebraska-Lincoln.

K-Theory and Algebraic Cycles (Code: SS 16A), **Christian Haesemeyer**, University of Illinois at Urbana-Champaign, and **Gregory Grant Piepmeyer** and **Mark Edward Walker**, University of Nebraska-Lincoln.

Large Cardinals in Set Theory (Code: SS 4A), **Paul B. Larson**, Miami University, **Justin Tatch Moore**, Boise State University, and **Ernest Schimmerling**, Carnegie Mellon University.

Mathematical and Engineering Aspects of Coding Theory (Code: SS 3A), **Lance Perez** and **Judy Walker**, University of Nebraska-Lincoln.

Mathematical Ecology (Code: SS 9A), **David Logan**, University of Nebraska-Lincoln, and **William Robert Wolesensky**, College of St. Mary.

Mathematical Education of Teachers (Code: SS 15A), **W. James Lewis**, University of Nebraska-Lincoln, **Cheryl Lynn Olsen**, Shippensburg University of Pennsylvania, and **Ira J. Papick**, University of Missouri-Columbia.

Nonlinear Analysis and Control of Partial Differential Equations (Code: SS 13A), **George Avalos, Petronela Radu, Mohammad A. Rammaha**, and **Richard L. Rebarber**, University of Nebraska-Lincoln.

Randomness in Computation (Code: SS 7A), **John M. Hitchcock**, University of Wyoming, **Aduri Pavan**, Iowa State University, and **Vinodchandran Variyam**, University of Nebraska-Lincoln.

Recent Progress in Operator Algebras (Code: SS 2A), **Allan P. Donsig** and **David R. Pitts**, University of Nebraska-Lincoln.

Representation Theory of Noetherian Rings (Code: SS 12A), **Roger A. Wiegand** and **Sylvia Margaret Wiegand**, University of Nebraska-Lincoln.

Scattering and Spectral Problems in Geometry (Code: SS 21A), **Peter A. Perry**, University of Kentucky, and **Alejandro Uribe**, University of Michigan.

Undergraduate Research (Code: SS 19A), **Richard L. Rebarber** and **Gordon S. Woodward**, University of Nebraska-Lincoln.

Universal Algebra and Order (Code: SS 20A), **John William Snow**, Sam Houston State University, and **Japheth L. M. Wood**, Chatham College.

Eugene, Oregon

University of Oregon

November 12–13, 2005

Saturday - Sunday

Meeting #1012

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: September 2005
Program first available on AMS website: September 29, 2005
Program issue of electronic *Notices*: November 2005
Issue of *Abstracts*: Volume 26, Issue 4

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 20, 2005

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Matthew Foreman, University of California Irvine, *Classification and anti-classification theorems for measure preserving transformations.*

Mark Haiman, University of California Berkeley, *Title to be announced.*

Wilhelm Schlag, California Institute of Technology, *Title to be announced.*

Hart F. Smith, University of Washington, *Title to be announced.*

Special Sessions

Algebraic Combinatorics and Geometry (Code: SS 7A), **Sara C. Billey**, University of Washington, and **Mark Haiman**, University of California Berkeley.

Algebraic Geometry Motivated by Physics (Code: SS 9A), **Alexander Polishchuk** and **Arkady Vaintrob**, University of Oregon.

Algebraic Topology of Moduli Spaces (Code: SS 8A), **Boris I. Botvinnik**, University of Oregon, **Uwe Kaiser**, Boise State University, and **Dev Sinha**, University of Oregon.

Applications of Algebraic Topology (Code: SS 12A), **Daniel Dugger** and **Hal Sadofsky**, University of Oregon.

Harmonic Analysis and PDEs (Code: SS 13A), **Wilhelm Schlag**, California Institute of Technology, and **Hart F. Smith**, University of Washington.

K-Theory in M-Theory (Code: SS 6A), **Gregory D. Landweber**, University of Oregon, and **Charles F. Doran**, University of Washington.

New Directions in Spectral Theory and Geometric Analysis (Code: SS 11A), **Leon Friedlander**, University of Arizona, and **Patrick McDonald**, New College of Florida.

Noncommutative Algebra and Noncommutative Birational Geometry (Code: SS 3A), **Arkady Dmitrievich Berenstein**, University of Oregon, and **Vladimir Retakh**, Rutgers University.

Partial Differential Equations with Applications (Code: SS 4A), **Alexander Panchenko**, Washington State University, **R. E. Showalter**, Oregon State University, and **Hong-Ming Yin**, Washington State University.

Regular Algebras and Noncommutative Projective Geometry (Code: SS 2A), **Brad Shelton**, University of Oregon, **Michaela Vancliff**, University of Texas at Arlington, and **James J. Zhang**, University of Washington.

Representations of Groups and Algebras (Code: SS 5A), **Jonathan W. Brundan**, **Alexander S. Kleshchev**, and **Viktor Ostrik**, University of Oregon.

Resolutions (Code: SS 1A), **Christopher Alan Francisco**, University of Missouri, and **Irena Peeva**, Cornell University.

Wavelets, Frames, and Related Expansions (Code: SS 10A), **Marcin Bownik**, University of Oregon, and **Darrin M. Speegle**, St. Louis University.

Accommodations

Participants should make their own arrangements directly with the hotel of their choice and request the University of Oregon discount. The AMS is not responsible for rate changes or for the quality of the accommodations. Rates quoted do not include taxes. **Hotels have varying cancellation or early checkout penalties; be sure to ask for details when making your reservation.**

Best Western Greentree Inn, 1759 Franklin Blvd., Eugene, OR 97403; 541-485-2727. Located across the street from the campus. For further information visit `http://www.bestwestern.com/greentreeinneugene` or contact `greentreeinn@aol.com`.

Best Western New Oregon Motel, 1655 Franklin Blvd., Eugene, OR 97403; 541-683-3669. Located across the street from the campus. For further information visit `http://www.bestwestern.com/neworegon` or contact `neworegon@aol.com`.

Rooms for both hotels are $60.50/single and $66.50/double plus a current 10.5% tax.

Food Service

There are a number of restaurants adjacent to the campus. A list of restaurants will be available at the registration desk.

Local Information

Please visit the website maintained by the Department of Mathematics at `http://darkwing.uoregon.edu/~math/`; for a campus map visit `http://geography.uoregon.edu/infographics/uowebmap.html`.

Other Activities

AMS Book Sale: Examine the newest titles from the AMS! Complimentary coffee will be served, courtesy of AMS Membership Services. The AMS Book Sale will operate during the same hours as registration. The location of the Book Sale will be announced at a later date.

AMS Editorial Activity: An acquisitions editor from the AMS book program will be present to speak with prospective authors. If you have a book project that you would like to discuss with the AMS, please stop by the book exhibit.

Parking

Parking lots 6A and 6B will be the closest to McKenzie Hall and Deady Hall and require no parking pass on Saturday and Sunday. If parking on campus on Friday, there will be visitor-parking passes available at the kiosk on 13th Ave. off Agate Street. On the map it shows as a small dot on

13th Ave. between Oregon Hall and University Health and Counseling Bldg. Note: Do not park in a reserved spot that says it is "reserved at all times" or you will be ticketed and fined. Campus parking: http://uoadmit.uoregon.edu/visit/maps/index.htm.

Registration and Meeting Information

The registration desk will be located in the hall area in front of 240 B McKenzie Hall and will be open 7:30 a.m. to 4:00 p.m. on Saturday and 8:00 a.m. to noon on Sunday.

Registration fees (payable on site only) are $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 Eugene Airport, conveniently located approximately ten miles from downtown and the campus, is serviced by United Airlines, Horizon Air, America West, Delta, and flights connecting from any number of major airlines. Some visitors choose to fly into Portland and drive two hours south to Eugene. For Eugene Airport information, call 541-682-5544.

The official airline for the meetings is Delta Airlines. Take advantage of Delta's new SimpliFares and enjoy the following benefits:

- No Saturday-night stay required—more flexibility
- Always affordable—Realize up to 50% savings on every day fares in the contiguous 48 states
- Lower change fees—reduced from $100 to $50 to change travel plans
- Just eight fares—less guessing and easier planning

To make immediate reservations, call Delta Airlines at 1-800-221-1212; be sure to reference **US738367060.** Or visit http://www.delta.com and enter SkyBonus account number **US738367060** in your passenger information screen to be recognized as a participant in the Joint Mathematics Meetings. Your benefits include:

- No service fees
- 1,000 SkyMile bonus points
- No airport lines; check in online

By Car: From the Eugene Airport: Follow Highway 99 until it becomes Seventh Avenue. Get in the right lane and follow Seventh Avenue until it becomes Franklin Boulevard. Get in the right lane and follow Franklin Boulevard to Agate Street. Turn right onto Agate and right again onto Thirteenth Avenue. Proceed to the Information Kiosk.

From Portland and the North: From I-5 South, take Exit 194B. Take Exit 2, keep left and follow the signs to the University. Proceed in the left lane over the Ferry Street Bridge, exiting onto Broadway, which becomes Franklin Boulevard. Follow Franklin Boulevard to Agate Street. Turn right onto Agate and right again onto Thirteenth Avenue. Proceed to the Information Kiosk.

From Ashland and the South: From I-5 Northbound, take Exit 192. Merge onto Franklin Boulevard. After merging, get in the left lane and follow Franklin Boulevard through two lights. At the third light, turn left onto Agate Street (Agate Street is unmarked from this direction, but has a sign for Riverfront Drive, which goes to the right). At the first stop sign, turn right onto Thirteenth Avenue. Proceed to the Information Kiosk.

From the Oregon Coast: Take 126 East until it becomes West Eleventh Avenue. Follow West Eleventh Avenue to Garfield Street and turn left. Take Garfield to Seventh Avenue and turn right. Get in the right lane and follow Seventh Avenue until it becomes Franklin Boulevard. Get in the right lane and follow Franklin Boulevard to Agate Street. Turn right onto Agate and right again onto Thirteenth Avenue. Proceed to the Information Kiosk.

From Bend and the East: Take 126 West through Springfield and into Eugene. Take Exit 2, the Coburg Road exit ramp; keep left at the fork in the ramp. Go straight onto Southbound Coburg Road, which becomes the Ferry Street Bridge. Stay in the left lane on the bridge, exiting onto Broadway, which becomes Franklin Boulevard. Follow Franklin Boulevard to Agate Street. Turn right onto Agate and right again onto Thirteenth Avenue. Proceed to the Information Kiosk.

Cabs or shuttle services from airport:

Approximate fees run $20–$25 from airport to university area (please ask when calling).

Omni Shuttle, 541-461-7959, 1-800-741-5097; 24-hour service.

V.I.P. Taxi, 541-484-0920, 1-800-484-2189, code 2432. For airport service, a 20% discount is available for at least 4-hour advance reservation.

By train (or bus): Amtrak, Eugene, 1-800-872-7245; Greyhound-Trailways, Eugene, 541-344-6265; Lane Transit District (Eugene's bus system), 541-687-5555.

Car Rental. Avis is the official car rental company for the sectional meeting in Eugene, Oregon. All rates include unlimited free mileage. Special rates for this meeting are effective November 5, 2005–November 20, 2005, and begin at $26/day for a subcompact car at the weekend rate (available from noon Thursday through Monday at 11:59 p.m.). Should a lower qualifying rate become available at the time of booking, Avis is pleased to offer a 5% discount off the lower qualifying rate or the meeting rate, whichever is lower. Rates do not include any state or local surcharges, tax, optional coverages, or gas refueling charges. Renters must meet Avis's age, driver, and credit requirements. Reservations may be made by calling 1-800-331-1600 or online at http://www.avis.com. Avis Meeting Discount Number is **B159266.**

Special Travel Information for International Participants. Visa regulations are continually changing for travel to the United States. Visa applications may take from three to four months to process and require a personal interview as well as specific personal information. International participants should view the important information about traveling to the U.S. found at http://www7.nationalacademies.org/visas/Traveling_to_US.html and http://travel.state.gov/visa/index.html. If you need a preliminary conference invitation in order to secure a visa, please send your request to wsd@ams.org.

If you discover you do need a visa, the National Academies website (see above) provides these tips for successful visa applications:

• Visa applicants are expected to provide evidence that they intend to return to their country of residence. Therefore, applicants should provide proof of "binding" or sufficient ties to their home country or permanent residence abroad. This may include documentation of the following:

– family ties in home country or country of legal permanent residence

– property ownership

– bank accounts

– employment contract or statement from employer stating that the position will continue when the employee returns

• Visa applications are more likely to be successful if done in a visitor's home country than in a third country.

• Applicants should present their entire trip itinerary, including travel to any countries other than the United States, at the time of their visa application.

• Include a letter of invitation from the meeting organizer or the U.S. host specifying the subject, location and dates of the activity, and how travel and local expenses will be covered.

• If travel plans will depend on early approval of the visa application, specify this at the time of the application.

• Provide proof of professional scientific and/or educational status (students should provide a university transcript).

This list is not to be considered complete. Please visit the websites above for the most up-to-date information.

Reminder: Machine-readable passports required by June 26, 2005.

The Department of Homeland Security reminds travelers from the twenty-seven Visa Waiver Program (VWP) countries that as of June 26, 2005, they must have a machine-readable passport to enter the United States without a visa. Beginning June 26, 2005, transportation carriers will be fined $3,300 per violation for transporting any VWP traveler to the United States without a machine-readable passport. Similarly, VWP travelers arriving in the United States on that date without a machine-readable passport should not anticipate being granted one-time entry into the country. As an alternative for persons with immediate travel plans who are unable to obtain a machine-readable passport in time, the individual may apply for a U.S. visa at a U.S. consulate or embassy abroad.

Weather

Typical weather conditions and temperatures in November: average temperatures: low 36°F, high 48°F. Good chance of rain!

Taichung, Taiwan

Tung-Hai University

December 14–18, 2005

Wednesday - Sunday

Meeting #1013

First Joint International Meeting between the AMS and the Taiwanese Mathematical Society.
Associate secretary: John L. Bryant
Announcement issue of *Notices*: June 2005
Program first available on AMS website: Not applicable
Program issue of electronic *Notices*: Not applicable
Issue of *Abstracts*: Not applicable

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: September 30, 2005
For abstracts: September 30, 2005

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/internmtgs.html`. See also the official webpage for the meeting maintained by the local hosts at `http://www.math.thu.edu.tw/2005ims/en/index.htm`.

Invited Addresses

Ching-Shui Cheng, Institute of Statistical Science, Academia Sinica, *Title to be announced.*

Lawrence Ein, University of Illinois at Chicago, *Title to be announced.*

Chang-Shou Lin, National Chung Cheng University, *Title to be announced.*

Richard M. Schoen, Stanford University, *Title to be announced.*

Jing Yu, National Tsing Hua University, *Title to be announced.*

Jiu-Kang Yu, Purdue University, *Title to be announced.*

Special Sessions

Affine Algebraic Geometry, **Ming-Chang Kang**, National Taiwan University, and **Kwai-Man Fan**, National Chung Cheng University.

Algebraic Geometry, **Jung-Kai Chen**, National Taiwan University, **Chin-Lung Wang**, National Central University, and **Robert Lazarsfeld**, University of Michigan.

Differential Geometry, **Dong-Ho Tsai**, National Tsing Hua University, and **Bennett Chow**, University of California San Diego.

Discrete Mathematics (Graph Coloring), **Gerard J. Chang**, National Taiwan University, **Douglas B. West**, University of Illinois at Urbana-Champaign, and **Xuding Zhu**, National Sun Yat-sen University.

Dynamics and Differential Equations, **Song-Sun Lin**, National Chiao Tung University, and **Shui-Nee Chow**, Georgia Institute of Technology.

Lie Algebra and Representation Theory, **Shun-Jen Cheng**, National Taiwan University, and **Brian J. Parshall** and **Weiqiang Wang**, University of Virginia.

Number Theory (Arithmetic Geometry over Local and Global Fields), **Liang-Chung Hsia**, National Central University, and **William A. Cherry**, University of North Texas.

Operator Theory and Control, **Fang-Bo Yeh**, Tung-Hai University, and **Nicholas J. Young**, University of Newcastle.

Optimization and Applications, **Soon-Yi Wu**, National Cheng Kung University, and **Shu-Cherng Fang**, Industrial Engineering and Operations Research, North Carolina State University.

Partial Differential Equations and Geometric Analysis, **Chiun-Chuan Chen** and **Yng-Ing Lee**, National Taiwan University, **Sun-Yung Alice Chang**, Princeton University, and **Robert J. Sibner**, Graduate College, City University of New York.

Probability, **Tai-Ho Wang**, National Chung Cheng University, **Ching-Tang Wu**, National Kaohsiung University, and **George Yin**, Wayne State University.

Scientific Computing, **Wei-Cheng Wang**, National Tsing-Hua University, and **Thomas Y. Hou**, California Institute of Technology.

Statistical Modeling and Applications, **Ming-Yen Cheng**, National Taiwan University, and **Jianqing Fan**, Department of Operations Research and Financial Engineering, Princeton University.

San Antonio, Texas

Henry B. Gonzalez Convention Center

January 12–15, 2006

Thursday – Sunday

Meeting #1014

Joint Mathematics Meetings, including the 112th Annual Meeting of the AMS, 89th Annual Meeting of the Mathematical Association of America, annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), the winter meeting of the Association for Symbolic Logic (ASL), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).

Associate secretary: Matthew Miller
Announcement issue of *Notices*: October 2005
Program first available on AMS website: November 1, 2005
Program issue of electronic *Notices*: January 2006
Issue of *Abstracts*: Volume 27, Issue 1

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 28, 2005

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Joint Invited Addresses

Svetlana Y. Jitomirskaya, University of California Irvine, *Title to be announced* (AMS-MAA Invited Address).

AMS Invited Addresses

Herbert Edelsbrunner, Duke University, *Title to be announced.*

David Eisenbud, Mathematical Sciences Research Institute, *Title to be announced* (Retiring Presidential Address).

Charles L. Fefferman, Princeton University, *Whitney's extension problems.*

Mikhail Kapranov, Yale University, *Title to be announced.*

Hendrik W. Lenstra Jr., Universiteit Leiden, *Title to be announced* (Colloquium Lecture).

Dusa McDuff, SUNY at Stony Brook, *Recent developments in symplectic topology.*

Michael Savageau, University of California Davis, *Title to be announced* (Josiah Willard Gibbs Lecture).

AMS Special Sessions

Some sessions are cosponsored with other organizations. These are noted within the parenthesis at the end of each listing where applicable.

Algebraic and Enumerative Combinatorics (Code: SS 12A), **Catherine H. Yan** and **Marcelo Aguiar**, Texas A&M University, **Joseph P. Kung**, University of North Texas, and **Laura F. Matusevich**, University of Pennsylvania.

Algebraic Groups, Symmetric Spaces, and Invariant Theory (Code: SS 15A), **Aloysius G. Helminck**, North Carolina State University, and **Dan Gagliardi**, St. Lawrence University.

Algebraic Statistics: Theory and Practice (Code: SS 4A), **Seth M. Sullivant**, University of California Berkeley, and **Elizabeth S. Allman**, University of Southern Maine.

Analysis and Implementation of Finite Element Methods (Code: SS 19A), **Atife Caglar**, University of Wisconsin-Green Bay (AMS-SIAM).

Ancient and Nonwestern Mathematics (Code: SS 14A), **Duncan J. Melville**, St. Lawrence University (AMS-MAA).

Arithmetic Geometry and Modular Forms (Code: SS 16A), **Matthew A. Papanikolas** and **Ahmad M. El-Guindy**, Texas A&M University.

Boundary Value Problems for Ordinary Differential Equations (Code: SS 22A), **John R. Graef**, University of Tennessee at Chattanooga, and **Johnny L. Henderson**, Baylor University (AMS-SIAM).

Commutative Rings and Monoids (Code: SS 25A), **Scott T. Chapman**, Trinity University, and **James B. Coykendall**, North Dakota State University.

Contemporary Dynamical Systems (Code: SS 21A), **Dmitry Zenkov**, University of Michigan, **Youngna Choi**, Montclair State University, **Anthony M. Bloch**, University of Michigan, **Todd L. Fisher**, University of Maryland, **Melvin Leok**, University of Michigan, **David S. Richeson**, Dickenson College, and **James S. Wiseman**, Swarthmore College (AMS-SIAM).

Continued Fractions (Code: SS 6A), **Nancy Wyshinski** and **James G. McLaughlin**, Trinity College.

Current Events (Code: SS 10A), **David Eisenbud**, Mathematical Sciences Research Institute.

Division Algebras, Galois Theory, Cohomology and Geometry (Code: SS 1A), **Kelly L. McKinnie** and **David J. Saltman**, University of Texas at Austin.

Dynamic Equations with Applications (Code: SS 23A), **Allan C. Peterson**, University of Nebraska, and **Martin J. Bohner**, University of Missouri-Rolla.

Extension of Functions (Code: SS 5A), **Alvario Arias**, University of Denver, **Charles L. Fefferman**, Princeton University, **Edward W. Odell**, University of Texas Austin, and **Thomas Slumprecht**, Texas A&M University.

Field Extensions and Algorithms (Code: SS 33A), **Peter Stevenhagen** and **H. W. Lenstra Jr.**, Universiteit Leiden.

Frames and Operator Theory in Analysis and Signal Processing (Code: SS 20A), **Peter R. Massopust**, Tuboscope Vetco Pipeline Services, **David R. Larson**, Texas A&M University, **Manos I. Papadakis**, University of Houston, **Zuhair Nashed**, University of Central Florida, **Ahmed I. Zayed**, DePaul University, and **Minh Chuong Nguyen**, Institute of Mathematics, Hanoi, Vietnam (AMS-SIAM).

History of Mathematics (Code: SS 26A), **Joseph W. Dauben**, Herbert H. Lehman College (CUNY), **Patti Hunter**, Westmont College, and **Karen H. Parshall**, University of Virginia (AMS-MAA).

Interdisciplinary Research Involving Analysis and Logic (Code: SS 35A), **Su Gao**, University of North Texas, **Jose N. Iovino**, University of Texas at San Antonio, and **Itay Ben-Yacov**, University of Wisconsin-Madison (AMS-ASL).

Invariant Theory (Code: SS 31A), **Mara D. Neusel**, Texas Tech University, and **David L. Wehlau**, Royal Military College.

Mahler Measure and Heights (Code: SS 13A), **Michael J. Mossinghoff**, Davidson College, and **Jeffrey D. Vaaler**, University of Texas at Austin.

The Many Lives of Lattice Theory, the Theory of Ordered Sets, and Universal Algebra (Code: SS 9A), **Japheth L. M. Wood**, Chatham College, **John W. Snow**, Sam Houston State University, **Jonathon D. Farley**, Harvard University, **Stefan E. Schmidt**, Phoenix Math Systems Modeling, Inc., and **Anthony A. Harkin**, Harvard University.

Mathematics Education Reform (Code: SS 8A), **Bonnie S. Saunders**, University of Illinois at Chicago, **William H. Barker**, Bowdoin College, **Dale R. Oliver**, Humboldt State University, and **Kenneth Millet**, University of California Santa Barbara (AMS-MAA-MER).

New Developments in Symplectic Topology (Code: SS 34A), **Dusa McDuff**, SUNY at Stony Brook, **Aleksey Zinger**, SUNY at Stony Brook and Stanford University, **Ely Kerman**, University of Illinois at Urbana-Champaign, and **Margaret F. Symington**, Georgia Institute of Technology and Mercy College.

Nonautonomous Discrete Dynamics (Code: SS 36A), **Saber N. Elaydi**, Trinity University, and **Jim M. Cushing**, University of Arizona.

Nonlinear Dynamical Systems (Code: SS 11A), **Zhijun Qiao** and **Andras Balogh**, University of Texas Pan American, **Guihua Fei**, University of Minnesota-Duluth, and **Zhaosheng Feng**, University of Texas Pan American (AMS-SIAM).

Quantum Invariants of Knots and 3-Manifolds (Code: SS 18A), **Patrick M. Gilmer**, Louisiana State University, and **Charles D. Frohman**, University of Iowa.

Recent Advances in Mathematical Biology and Epidemiology (Code: SS 29A), **Sophia Jang**, University of Louisiana at Lafayette, and **Linda Allen** and **Lih-Ing Roeger**, Texas Tech University (AMS-MAA-SIAM).

Recent Trends in Convex and Discrete Geometry (Code: SS 17A), **Valeriu Soltan**, George Mason University, **Tibor Bisztriczky**, University of Calgary, and **Paul Goodey**, University of Oklahoma.

Research in Mathematics by Undergraduates (Code: SS 28A), **Darren Narayan** and **Carl V. Lutzer**, Rochester Institute of Technology, **Michael J. Fisher**, California State University, Fresno, and **Bernard Brooks** and **Tamas I. Wiandt**, Rochester Institute of Technology (AMS-MAA-SIAM).

Stochastic, Large Scale and Hybrid Systems with Applications (Code: SS 7A), **Aghalaya S. Vatsala**, University of Louisiana at Lafayette, and **Gangaram S. Ladde**, University of Texas at Arlington (AMS-SIAM).

Symbolic-Numeric Computation and Applications (Code: SS 30A), **Agnes Szanto**, North Carolina State University, **Jan Verschelde**, University of Illinois at Chicago, and **Zhonggang Zeng**, Northeastern Illinois University (AMS-SIAM).

Syzygies in Commutative Algebra and Geometry (Code: SS 32A), **Irena Peeva**, Cornell University, **Sorin E. Popescu**, SUNY at Stony Brook, and **Gregory G. Smith**, Queen's University.

Theory and Application of Stochastic Differential Equations (Code: SS 24A), **Armando Arciniega**, University of Texas at San Antonio, and **Edward J. Allen**, Texas Tech University (AMS-SIAM).

Time Reversal Methods: Analysis and Applications (Code: SS 3A), **Peter A. McCoy** and **Reza Malek-Madani**, U.S. Naval Academy (AMS-SIAM).

Topological Spaces Associated with C(X) (Code: SS 27A), **Chawne M. Kimber**, Lafayette College, and **Warren Wm. McGovern**, Bowling Green State University.

Value Distribution in Classical and p-adic Functions Theory (Code: SS 2A), **Alain Escassut**, University Blaise Pascal, **Chung-Chun Yang**, Hong Kong University of Science and Technology, and **Ilpo Laine**, University of Joensuu.

Miami, Florida

Florida International University

April 1–2, 2006
Saturday - Sunday

Meeting #1015
Southeastern Section
Associate secretary: Matthew Miller
Announcement issue of *Notices*: December 2005
Program first available on AMS website: February 16, 2006
Program issue of electronic *Notices*: April 2006
Issue of *Abstracts*: Volume 27, Issue 2

Deadlines
For organizers: September 1, 2005
For consideration of contributed papers in Special Sessions: December 13, 2005
For abstracts: February 7, 2006

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Edward Odell, University of Texas at Austin, *Title to be announced.*

Karen H. Parshall, University of Virginia, *Title to be announced.*

Michael S. Vogelius, Rutgers University, *Title to be announced.*

Special Sessions

Approximation Theory and Orthogonal Polynomials (Code: SS 5A), **Doron S. Lubinsky**, Georgia Institute of Technology, and **Edward B. Saff**, Vanderbilt University.

Commutative Algebra and Algebraic Geometry (Code: SS 1A), **Laura Ghezzi**, Florida International University, and **Huy Tài Hà**, Tulane University, and **Aron Simis**, University Federal de Pernambuco.

Geometry of Riemannian Manifolds with Additional Structures (Code: SS 2A), **Tedi C. Draghici**, **Gueo V. Grantcharov**, and **Philippe Rukimbira**, Florida International University.

Harmonic Analysis and Partial Differential Equations (Code: SS 10A), **Mario Milman**, Florida Atlantic University, and **Marius Mitrea**, University of Missouri.

Invariants of Low-Dimensional Manifolds (Code: SS 9A), **Thomas G. Lennes**, Florida International University, and **Nikolai N. Saveliev**, University of Miami, Coral Gables.

Monomials and Resolutions (Code: SS 3A), **Joseph P. Brennan**, North Dakota State University, and **Heath M. Martin**, University of Central Florida.

Partial Differential Equations and Several Complex Variables (Code: SS 6A), **Shiferaw Berhanu**, Temple University, and **Hamid Meziani**, Florida International University.

Qualitative Analysis of Partial Differential Equations (Code: SS 4A), **Congming Li**, University of Colorado.

Singular Integrals, Geometric Analysis, and Free Boundary Problems (Code: SS 8A), **Laura De Carli**, Florida International University, and **Marianne Korten** and **Charles N. Moore**, Kansas State University.

Structure of Function Spaces and Applications (Code: SS 7A), **Jan Lang**, The Ohio State University, and **Osvaldo Mendez**, University of Texas at El Paso.

Notre Dame, Indiana

University of Notre Dame

April 8–9, 2006
Saturday - Sunday

Meeting #1016
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: December 2005
Program first available on AMS website: February 23, 2006
Program issue of electronic *Notices*: April 2006
Issue of *Abstracts*: Volume 27, Issue 2

Deadlines
For organizers: September 9, 2005
For consideration of contributed papers in Special Sessions: December 20, 2005
For abstracts: February 14, 2006

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Douglas N. Arnold, Institute for Math and Applications, University of Minnesota, *Title to be announced.*

Béla Bollobás, University of Memphis and Cambridge University, *Inhomogeneous random graphs* (Erdős Memorial Lecture).

Steven C. Hofmann, University of Missouri, *Title to be announced.*

Michael Larsen, University of Indiana, *Title to be announced.*

Christopher M. Skinner, University of Michigan, *Title to be announced.*

Special Sessions

Combinatorial Algebraic Geometry (Code: SS 2A), **Juan C. Migliore**, University of Notre Dame, and **Uwe R. Nagel**, University of Kentucky.

Commutative Algebra (Code: SS 1A), **Alberto Corso**, University of Kentucky, **Claudia Polini**, University of Notre Dame, and **Bernd Ulrich**, Purdue University.

Developments and Applications in Differential Geometry (Code: SS 4A), **Jianguo Cao**, **Xiaobo Liu**, and **Brian Smyth**, University of Notre Dame.

Ergodic Theory (Code: SS 3A), **Nikos Frantzikinakis**, Pennsylvania State University, **Bryna R. Kra**, Northwestern University, and **Mate Wierdl**, University of Memphis.

Several Complex Variables (Code: SS 6A), **Nancy K. Stanton** and **Jeffrey A. Diller**, University of Notre Dame.

Special Functions and Orthogonal Polynomials (Code: SS 5A), **Diego Dominici**, State University of New York at New Paltz.

Durham, New Hampshire

University of New Hampshire

April 22–23, 2006

Saturday - Sunday

Meeting #1017

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: January 2006
Program first available on AMS website: March 9, 2006
Program issue of electronic *Notices*: April 2006
Issue of *Abstracts*: Volume 27, Issue 2

Deadlines

For organizers: September 22, 2005
For consideration of contributed papers in Special Sessions: January 3, 2006
For abstracts: February 28, 2006

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Ailana M. Fraser, University of British Columbia, *Title to be announced.*

Dmitri Nikshych, University of New Hampshire, *Title to be announced.*

Florian Pop, University of Pennsylvania, *Title to be announced.*

Konstantina Trivisa, University of Maryland, College Park, *Title to be announced.*

Special Sessions

Banach Lattices, Regular Operators, and Applications (Code: SS 3A), **A. K. Kitover**, Community College of Philadelphia, **M. Orhon**, University of New Hampshire, and **A. W. Wickstead**, Queen's University of Belfast.

Banach Spaces of Analytic Functions (Code: SS 2A), **Rita A. Hibschweiler**, University of New Hampshire, and **Thomas H. MacGregor**, SUNY Albany and Bowdoin College.

Discrete and Convex Geometry (Code: SS 1A), **Daniel A. Klain**, University of Massachusetts (Lowell), **Barry R. Monson**, University of New Brunswick, and **Egon Schulte**, Northeastern University.

San Francisco, California

San Francisco State University

April 29–30, 2006

Saturday - Sunday

Meeting #1018

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: January 2006
Program first available on AMS website: March 16, 2006
Program issue of electronic *Notices*: April 2006
Issue of *Abstracts*: Volume 27, Issue 2

Deadlines

For organizers: September 30, 2005
For consideration of contributed papers in Special Sessions: January 10, 2006
For abstracts: March 7, 2006

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Lincoln Chayes, University of California Los Angeles, *Title to be announced.*

C. Robin Graham, University of Washington, *Title to be announced.*

Vadim Kaloshin, California Institute of Technology, *Title to be announced.*

Benoit B. Mandelbrot, Yale University, *From pure mathematics to roughness in art.* (Einstein Public Lecture in Mathematics).

Yuval Peres, University of California Berkeley, *Title to be announced.*

Special Sessions

Elliptic Methods in Geometry (Code: SS 3A), **C. Robin Graham**, University of Washington, and **Rafe Mazzeo**, Stanford University.

Fractal Geometry: Connections to Dynamics, Geometric Measure Theory, Mathematical Physics and Number Theory (Code: SS 4A), **Michel L. Lapidus** and **Erin P. Pearse**, University of California Riverside, and **Machiel van Frankenhuysen**, Utah Valley State College.

Gröbner Bases (Code: SS 2A), **Bernd Sturmfels** and **Alexander Yong**, University of California Berkeley.

History and Philosophy of Mathematics (Code: SS 1A), **Shawnee L. McMurran**, California State University, San Bernardino, and **James J. Tattersall**, Providence College.

Salt Lake City, Utah

University of Utah

October 7–8, 2006

Saturday - Sunday

Meeting #1019

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: July 2006
Program first available on AMS website: August 24, 2006
Program issue of electronic *Notices*: October 2006
Issue of *Abstracts*: Volume 27, Issue 3

Deadlines

For organizers: March 7, 2006
For consideration of contributed papers in Special Sessions: June 20, 2006
For abstracts: August 15, 2006

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

William Arveson, University of California Berkeley, *Title to be announced.*

Alexei Borodin, California Institute of Technology, *Title to be announced.*

Izabella Joanna Laba, University of British Columbia, *Title to be announced.*

Darren Long, University of California Santa Barbara, *Title to be announced.*

Special Sessions

Harmonic Analysis: Trends and Perspectives (Code: SS 1A), **Alex Iosevich**, University of Missouri, and **Michael T. Lacey**, Georgia Institute of Technology.

Cincinnati, Ohio

University of Cincinnati

October 21–22, 2006

Saturday - Sunday

Meeting #1020

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: July 2006
Program first available on AMS website: September 7, 2006
Program issue of electronic *Notices*: October 2006
Issue of *Abstracts*: Volume 27, Issue 3

Deadlines

For organizers: March 21, 2006
For consideration of contributed papers in Special Sessions: July 5, 2006
For abstracts: August 29, 2006

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Suncica Canic, University of Houston, *Title to be announced.*

Bryna R. Kra, Northwestern University, *Title to be announced.*

Ezra N. Miller, University of Minnesota, *Title to be announced.*

Jon G. Wolfson, Michigan State University, *Title to be announced.*

Storrs, Connecticut

University of Connecticut

October 28–29, 2006

Saturday - Sunday

Meeting #1021

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: July 2006
Program first available on AMS website: September 14, 2006
Program issue of electronic *Notices*: October 2006
Issue of *Abstracts*: Volume 27, Issue 4

Deadlines

For organizers: March 28, 2006
For consideration of contributed papers in Special Sessions: July 11, 2006
For abstracts: September 6, 2006

Fayetteville, Arkansas

University of Arkansas

November 3–4, 2006
Friday – Saturday

Meeting #1022
Southeastern Section
Associate secretary: Matthew Miller
Announcement issue of *Notices*: September 2006
Program first available on AMS website: September 21, 2006
Program issue of electronic *Notices*: November 2006
Issue of *Abstracts*: Volume 27, Issue 4

Deadlines
For organizers: April 3, 2006
For consideration of contributed papers in Special Sessions: July 18, 2006
For abstracts: September 12, 2006

The scientific information listed below may be dated. For the latest information, see `www.ams.org/amsmtgs/sectional.html`.

Invited Addresses

Richard P. Anstee, University of British Columbia, *Title to be announced.*

Arun Ram, University of Wisconsin, *Title to be announced.*

Donald G. Saari, University of California Irvine, *Title to be announced.*

Andras Vasy, Massachusetts Institute of Technology, *Title to be announced.*

Special Sessions

Dirac Operators in Analysis and Geometry (Code: SS 1A), **John Ryan**, University of Arkansas, **Marius Mitrea**, University of Missouri, and **Mircea Martin**, Baker University.

New Orleans, Louisiana

New Orleans Marriott and Sheraton New Orleans Hotel

January 4–7, 2007
Thursday – Sunday

Meeting #1023
Joint Mathematics Meetings, including the 113th Annual Meeting of the AMS, 90th 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), with sessions contributed by the Society for Industrial and Applied Mathematics (SIAM).
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: October 2006
Program first available on AMS website: November 1, 2006
Program issue of electronic *Notices*: January 2007
Issue of *Abstracts*: Volume 28, Issue 1

Deadlines
For organizers: April 1, 2006
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Davidson, North Carolina

Davidson Colege

March 3–4, 2007
Saturday – Sunday
Southeastern Section
Associate secretary: Matthew Miller
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 3, 2006
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Oxford, Ohio

Miami University

March 16–17, 2007
Friday – Saturday
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

Tucson, Arizona

University of Arizona

April 21–22, 2007

Saturday – Sunday
Southwestern Section
Associate secretary: Michel L. Lapidus
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: September 21, 2006
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

San Diego, California

San Diego Convention Center

January 6–9, 2008

Sunday – Wednesday
Joint Mathematics Meetings, including the 114th Annual Meeting of the AMS, 91st 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: Michel L. Lapidus
Announcement issue of *Notices*: October 2007
Program first available on AMS website: November 1, 2007
Program issue of electronic *Notices*: January 2008
Issue of *Abstracts*: Volume 29, Issue 1

Deadlines

For organizers: April 1, 2007
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Bloomington, Indiana

Indiana University

April 4–6, 2008

Friday – Sunday
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: September 4, 2007
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Washington, District of Columbia

Marriott Wardman Park Hotel and Omni Shoreham Hotel

January 7–10, 2009

Wednesday – Saturday
Joint Mathematics Meetings, including the 115th Annual Meeting of the AMS, 92nd 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: Lesley M. Sibner
Announcement issue of *Notices*: October 2008
Program first available on AMS website: November 1, 2008
Program issue of electronic *Notices*: January 2009
Issue of *Abstracts*: Volume 30, Issue 1

Deadlines

For organizers: April 1, 2008
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

San Francisco, California

Moscone Center West and the San Francisco Marriott

January 6–9, 2010

Wednesday – Saturday
Joint Mathematics Meetings, including the 116th Annual Meeting of the AMS, 93rd 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: Matthew Miller
Announcement issue of *Notices*: October 2009
Program first available on AMS website: November 1, 2009
Program issue of electronic *Notices*: January 2010
Issue of *Abstracts*: Volume 31, Issue 1

Deadlines

For organizers: April 1, 2009

For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

New Orleans, Louisiana

New Orleans Marriott and Sheraton New Orleans Hotel

January 5–8, 2011

Wednesday - Saturday
Joint Mathematics Meetings, including the 117th Annual Meeting of the AMS, 94th Annual Meeting of the Mathematical Association of America, 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*: October 2010
Program first available on AMS website: November 1, 2010
Program issue of electronic *Notices*: January 2011
Issue of *Abstracts*: Volume 32, Issue 1

Deadlines

For organizers: April 2, 2011
For consideration of contributed papers in Special Sessions:
To be announced
For abstracts: To be announced

Meetings and Conferences of the AMS

Associate Secretaries of the AMS

Western Section: Michel L. Lapidus, Department of Mathematics, University of California, Sproul Hall, Riverside, CA 92521-0135; e-mail: lapidus@math.ucr.edu; telephone: 951-827-5910.

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: Matthew Miller, Department of Mathematics, University of South Carolina, Columbia, SC 29208-0001, e-mail: miller@math.sc.edu; telephone: 803-777-3690.

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 can be found at** www.ams.org/meetings/.

Meetings:

Important Information regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 100 in the January 2005 issue of the *Notices* for general information regarding participation in AMS meetings and conferences.

Abstracts

Speakers should submit abstracts on the easy-to-use interactive Web form. No knowledge of LaTeX is necessary to submit an electronic form, although those who use LaTeX may submit abstracts with such coding, and all math displays and similarily coded material (such as accent marks in text) must be typeset in LaTeX. Visit http://www.ams.org/cgi-bin/abstracts/abstract.pl.

Questions about abstracts and requests for paper forms may be sent to abs-info@ams.org.

Paper abstract forms must be sent to Meetings & Conferences Department, AMS, P.O. Box 6887, Providence, RI 02940. There is a $20 processing fee for each paper abstract. There is no charge for electronic abstracts. Note that all abstract deadlines are strictly enforced.

Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

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