Mathematics to the Rescue (Retiring Presidential Address)
page 9

The Mathematical Work of the 1998 Fields Medalists
page 17

AWM in the 1990s: A Recent History of the Association for Women in Mathematics
page 27

Gainesville Meeting
page 109

Urbana Meeting
page 111

Tucson Program
page 121

San Antonio Program
page 129
DERIVE is the trusted mathematical assistant relied upon by students, educators, engineers, and scientists around the world. It does for algebra, equations, trigonometry, vectors, matrices, and calculus what the scientific calculator does for numbers — it eliminates the drudgery of performing long and tedious mathematical calculations. You can easily solve both symbolic and numeric problems and see the results plotted as 2D or 3D graphs.

For everyday mathematical work DERIVE is a tireless, powerful, and knowledgeable assistant. For teaching or learning mathematics, DERIVE gives you the freedom to explore different mathematical approaches better and more quickly than by using traditional methods.

System Requirements:
Windows 95, 3.1x or NT running on a computer with 8 megabytes of memory.

Suggested Retail Price: $250.
Educational pricing available.

For product information and list of dealers, fax, email, write, or call Soft Warehouse, Inc. or visit our website at http://www.derive.com.

See us at Booth #401.
New Titles from the AMS

**Introduction to Approximation Theory**
*Second Edition*
E. W. Cheney

E. W. Cheney's highly respected and well-known book... covers an enormous amount of material... [It] is written with clarity and precision which those who are familiar with the author's many papers have come to expect... [T]he notes are invaluable; their effect is to make a small book almost encyclopedic in character... In the quality of its exposition and the skill and care manifest in its organization, the book is a classic with few competitors. Anyone involved with computer mathematics will want it nearby.

- *Computing Reviews*

AMS Chelsea Publishing; 1962; 259 pages; Hardcover; ISBN 0-8218-1374-9; List $26; All AMS members $22; Order code CHEL/517.HNT01

**Partial Differential Equations**
P. R. Garabedian

This book is primarily a text for a graduate course in partial differential equations, although the later chapters are devoted to special topics not ordinarily covered in books in this field... The author has made use of an interesting combination of classical and modern analysis in his proofs... Because of the author's emphasis on constructive methods for solving problems which are of physical interest, his book will likely be as useful to the engineer as to the mathematician... The author and publisher are to be commended on the general appearance of the book.

- *Mathematical Reviews*

This book is a gem. It fills the gap between the standard introductory material on PDEs that an undergraduate is likely to encounter after a good ODE course (separation of variables, the basics of the second-order equations from mathematical physics) and the advanced methods (such as Sobolev spaces and fixed point theorems) that one finds in modern books.

The text contains the standard topics that one expects in an intermediate PDE course: the Dirichlet and Neumann problems, Cauchy's problem, characteristics, the fundamental solution, PDEs in the complex domain, plus a chapter on finite differences, on nonlinear fluid mechanics, and another on integral equations.

AMS Chelsea Publishing; 1964; 672 pages; Hardcover; ISBN 0-8218-1377-3; List $45; All AMS members $41; Order code CHEL/518.HNT01

**Classical Galois Theory with Examples**
Lisl Gaal

This book is strongly recommended to beginning graduate students who already have some background in abstract algebra. The exposition and proofs are intended to present Galois theory in as simple a manner as possible... The large number of partially or fully solved examples is its special feature.

- *Mathematical Reviews*

AMS Chelsea Publishing; 1971; 248 pages; Hardcover; ISBN 0-8218-1375-7; List $29; All AMS members $26; Order code CHEL/269.HNT01

**Introduction to Hilbert Space and the Theory of Spectral Multiplicity**
*Second Edition*
Paul R. Halmos

The main purpose of this book is to present the so-called multiplicity theory and the theory of unitary equivalence, for arbitrary spectral measures, in separable or not separable Hilbert space... The approach to this theory, as presented by the author, has much claim to novelty. By a skilful permutation of the fundamental ideas of Wecken and Nakano and consistently referring to the simple situation in the finite-dimensional case, the author succeeds in presenting the theory in a clear and perspicuous form.

- *Mathematical Reviews*

AMS Chelsea Publishing; 1967; 114 pages; Hardcover; ISBN 0-8218-1379-1; List $19; All AMS members $17; Order code CHEL/282.HNT01

**Vertex Algebras for Beginners**
*Second Edition*
Victor Kac, Massachusetts Institute of Technology, Cambridge

Very good introductory book on vertex algebras.

- *Zentralblatt für Mathematik*

Essential reading for anyone trying to learn about vertex algebras... well worth buying for experts.

- *Bulletin of the London Mathematical Society*

This revised edition is based on courses given by the author at MIT and at Rome University in spring 1997. New material is added, including the foundations of a rapidly growing area of algebraic conformal theory. Also, in some places the exposition is significantly simplified.

University Lecture Series; Volume 10; 1998; 201 pages; Softcover; ISBN 0-8218-1396-X; List $29; All AMS members $23; Order code ULECT/10.HNT01

**How to Teach Mathematics**
*Second Edition*
Steven G. Krantz, Washington University, St. Louis, MO

Praise for the First Edition...

*An original contribution to the educational literature on teaching mathematics at the post-secondary level. The book itself is an explicit proof of the author's claim 'teaching can be rewarding, useful, and fun'.*

- *Zentralblatt für Mathematik*

This expanded edition of the original bestseller, How to Teach Mathematics, offers hands-on guidance for teaching mathematics in the modern classroom setting. Twelve appendices have been added that are written by experts who have a wide range of opinions and viewpoints on the major teaching issues.

The broad appeal of this text makes it accessible to areas other than mathematics. The principles presented can apply to a variety of disciplines—from music to English to business. Lively and humorous, yet serious and sensible, this volume offers readers incisive information and practical applications.

1999; 337 pages; Softcover; ISBN 0-8218-1398-6; List $34; All AMS members $28; Order code GTM/226.HNT01

All prices subject to change. Charges for delivery are $3.00 per order. For optional air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from American Mathematical Society, P.O. Box 6248, Boston, MA 02111-6248, USA. For credit card orders, fax 1-401-455-4046 or call toll free 1-800-321-4AMS (4267) in the U.S. and Canada, 1-401-455-4000 worldwide. Or place your order through the AMS bookstore at www.ams.org/bookstore/. Residents of Canada, please include 7% GST.
Feature Articles

Mathematics to the Rescue (Retiring Presidential Address) 9
Cathleen Synge Morawetz
This article, based on the 1997 AMS Retiring Presidential Address, describes some problems in partial differential equations that have interested the author for a long period of time and on which some progress has been made.

The Mathematical Work of the 1998 Fields Medalists 17
James Lepowsky, Joram Lindenstrauss, Yuri I. Manin, and John Milnor
Four experts give a sense of the scope and importance of the work of Fields Medalists Borcherds, Gowers, Kontsevich, and McMullen.

AWM in the 1990s: A Recent History of the Association for Women in Mathematics 27
Jean E. Taylor and Sylvia M. Wiegand
The authors describe how the activities of the AWM have evolved as the AWM strives for equal opportunity and equal treatment for women and other underrepresented groups in mathematics.

Communications

International Congress of Mathematicians
Allyn Jackson 39

Visual Explanations—A Book Review
Bill Casselman
Against the Gods: The Remarkable Story of Risk—A Book Review
S. L. Zabell 43

From the AMS

1999 AMS Election 58
AMS Standard Cover Sheet 60

Departments

Editorial ........................................ 4
Commentary ..................................... 5
Mathematics People .......................... 51
Mathematics Opportunities ............... 52
For Your Information ........................ 54
Reference and Book List ..................... 56
Mathematics Calendar ........................ 64
New Publications Offered by the AMS .... 73
Publications of Continuing Interest ...... 81
Classifieds ..................................... 83
Membership Forms ........................... 99
Meetings and Conferences Table of Contents 184
Copyright Policies

Copyright policies are back in the news. Some see copyright transfer as the villain in the publishing business; others see it as the savior. A group of twelve people, writing in the September 4 issue of Science, which is published by the American Association for the Advancement of Science, has floated a novel proposal: "Federal agencies that fund research should recommend (or even require) as a condition of funding that the copyrights of articles or other works describing research that has been supported by those agencies remain with the author." The author would license publication while retaining copyright.

Science responded immediately with an editorial in the same issue, saying, "Copyright transfer is critical to the process of communicating scientific information accurately." The editorial went on to cite the extensive editing process that articles undergo, as well as the benefit to the author of the wide distribution of an article, concluding, "This degree of investment in the scientific publication process requires the assignment of copyright. This allows the society publisher to provide stewardship over the paper, to protect it from misuse by those who would otherwise be free to plagiarize or alter it, and to expand the distribution of information products for the benefit of the society. ...Science holds the copyright of its authors because of our belief that we materially improve and protect the product we create together."

Caltech's provost weighed in with his own idea, printed in The Chronicle of Higher Education for September 22. The Chronicle summarizes the proposal this way: "Journal publishers would be informed that they could publish articles by Caltech researchers only if the authors and the university retained copyrights to the material." Having the university own all copyrights is indeed a bold new idea.

The importance of transfer of copyright varies with circumstances and with the views of the publisher. AMS policy allows authors the choice of retaining or transferring copyright of articles or books to be published by the AMS, and the AMS has developed a standard "Consent to Publish and Copyright Agreement" to implement this policy. Authors must sign a statement that permits the AMS to publish, and they are given the option of transferring the copyright to the AMS as well. For the AMS research journals, the AMS policy recognizes that the important thing is that articles be copyrighted, not necessarily that the AMS hold the copyright. In part, copyright protects an investment that is paid for by the subscribers of a journal, and there are relatively few subscribers to research journals.

Special circumstances apply to the Notices. For one thing, the subscription base for the Notices is the entire membership of the AMS. The Notices is already freely available on the Internet, where anyone with access to the Internet may see any back issue of the Notices from 1995 on for free, may download its articles, and may even make a printed copy of the exact Notices pages. We may safely assume that most people who would stop paying dues if only they could see the Notices articles for free have already done so. In other words, the subscription base to the Notices is not really affected by considerations of copyright.

In the case of the Notices, the decision whether to transfer copyright is primarily one of convenience, affecting things like who gets to write letters of permission for reprinting. Convenience can be a more complicated matter than it may sound, and the AMS encourages authors to transfer copyright to the AMS to avoid certain pitfalls, such as making it impractical to have one's collected works published posthumously.

The Notices is somewhat different from the research journals, because some of its articles are published jointly with journals in other countries, or are modified versions of longer articles published in less widely available sources, or are translated from journals from other countries. For this reason, the Notices has developed its own "Consent to Publish and Copyright Agreement" that takes these special circumstances into account.

The main thing for the Notices is to encourage wide circulation of its articles and, in so doing, to help advance mathematics as much as it can. Whether the AMS or authors hold copyrights does not seem to affect this activity.

—Anthony W. Knapp
Commentary

Another Opinion

A “Rotator Crisis” at NSF

The Division of Mathematical Sciences (DMS) at the National Science Foundation handles grant proposals and program leadership in mathematics by using a good many temporary program directors, or “rotators”, recruited for one- or two-year terms from the universities. According to Don Lewis, DMS director for the past three years, these rotators are critical to the health of the Division because they bring to Washington the perspective and fresh thinking of the active researcher. They are also in short supply, and with Lewis nearing the end of his term, the Division is experiencing something of a “rotator crisis”.

In recent years the presence of active researchers as DMS program directors has become more important. The NSF budgeting process now begins with a thought exercise of imagining cutbacks of 20 percent; directors are then asked how they would build that amount back. Naturally, they would like to do so by funding the most exciting new ideas. The involvement of rotators increases the chances that this will happen.

Typically, rotators manage research programs that include, but aren’t confined to, their specialty. Of current DMS program directors, thirteen are rotators and eight are permanent staff. Next year, with the routine ending of some two-year rotator terms and the departure of several long-time permanent staff, DMS will need at least one new director in every program and would like to increase the permanent staff (many of whom are former rotators). To fill each position, DMS finds that it has to contact about fifty people—a substantial effort.

Are the DMS rotators worth this effort? I would argue that the answer is yes. Permanent staffers are, of course, essential. These are the people who provide continuity, understand NSF structure, contribute to NSF’s scientific and intellectual mission, and see new ideas through. Rotators, however, are equally essential for their perspective on where the discipline is going. These are NSF’s eyes and ears into the research community. Only when program directors are intellectually involved in mathematics does NSF have the insight it needs to pursue the most promising directions.

There is no doubt that the rotator’s job is demanding. DMS receives about 2,000 proposals a year and supports about 60 percent of the nation’s mathematics research at universities. Each program director handles about one hundred proposals a year—choosing reviewers, getting proposals out for review, deciding on awards, documenting decisions, and writing well-documented (and diplomatic) refusal statements.

This heavy workload is one reason it is difficult to recruit top-caliber rotators, but the commonest reason is that people don’t want to interrupt their research at what may be the height of their careers. Most rotators find some time for their own work (they get one day off a week for research, which some save to use in the summer), but they need determination to sustain research momentum.

Even so, most rotators find that their time in Washington is immensely valuable. For some, the greatest benefit is to their own research, which is often enriched by reading proposals and working on new initiatives. Others find rewards in broadening their understanding of their field and helping to define the future of mathematics. Still others find new professional contacts and career opportunities; learning how to evaluate programs outside one’s specialty and how to secure funding is excellent preparation for a chairship or other senior position. And no one takes a pay cut to come to NSF; after cost-of-living grants, some people actually experience salary increases.

For some, the broader rewards are equally meaningful. They gain a new view of how the mathematics community is viewed in Washington and a chance to correct misperceptions. They also learn empathy for the people submitting proposals and find chances to build bridges between the research community and a bureaucracy of daunting size. We all hear complaints about the handling of grants, the size of awards, and so on; it is the rotators, with roots in the research community, who can best explain the system from the inside and press for changes where they’re needed.

Most of all, it is necessary for the good of the discipline that knowledgeable individuals active in research help manage DMS funding. If the best among us step forward, the Division can do a better job in both allocating grant money and securing it through the budget process. For example, NSF selected mathematics as one of its budget priorities for the FY1999. This was a direct response to a presentation by rotators and other program officers who clearly demonstrated the exciting and deep research being carried on by U.S. mathematicians.

In the last three years, DMS has recruited top-notch rotators, and the satisfaction of the community has increased. There is more confidence that proposals are receiving thoughtful and informed reviews. Don Lewis has been creative and forceful in getting ideas from the mathematics community to the budget table. There could be no better legacy for his time at DMS than a stronger involvement by the research community in supporting and volunteering for a task that can strengthen the mathematical enterprise as a whole.

—Phillip A. Griffiths
Letters to the Editor

NSF Funding Not the “Most Promising Investment”

I’d like to take issue with the “Testimony on Behalf of the JPBM” (September 1998 Notices), specifically the following paragraph:

We believe that what mathematics, science, and engineering represent is a top priority for investment in the future of our country. However, the NSF budget has seen no real growth since FY 1995 and was part of the almost threefold decline in R&D budget as an overall percent of GDP over the past thirty years. Thus we have been short-changing the most promising investment in our country’s future. Moreover, given the extraordinary importance of the NSF’s mission, we believe the need for a full appropriation transcends any particular approach to budgeting.

I won’t argue with the first sentence. However, is real growth since 1995 necessary? If the 1995 NSF budget was a reasonable one, why should we expect subsequent NSF budgets to do more than keep pace with inflation? Recall also that the U.S. government has made great efforts over the last several years to balance its budget. Given the cuts that have been made in other parts of the budget (e.g., welfare reform, which dramatically affected a population much more vulnerable than mathematicians), is it proper to argue that the NSF should be exempt? As to the comparison with the situation thirty years ago, that was during the height of the cold war. While the NSF is one of my favorite relics of the cold war, I do think that the cold war skewed government spending in ways that are no longer appropriate (if they ever were); thus, a large reduction in NSF spending since 1968 seems proper to me.

Moving on, of course fundamental science and mathematics is a good investment. However, if I were to choose a candidate for “most promising investment”, I would vote for trying to ensure the education, health, and general welfare of our children; I’m sure that other readers could come up with other similarly worthy projects. Even if the “Testimony” is correct in its later attribution of our “unparalleled prosperity” to investment in basic research, that doesn’t mean that we should continue to funnel huge amounts of money into basic research. Perhaps if that money had been spent on other areas (e.g., the arts, social justice, education), we would still have “unparalleled prosperity today”, albeit of a different nature, as a result of that investment. Shouldn’t we consider trying that?

Finally, the argument that the NSF “transcends any particular approach to budgeting” is almost ludicrous. Proponents of the EPA, the FDA, the DoD, the NIH, the NEA, welfare, social justice, education, tax reform, or indeed almost anything that the government does or could do could make similar claims for the importance of their cause. There are lots of things that the government could spend money on to great benefit; why should the NSF be so transcendentally special?

This is the crux of the matter. I am not arguing that NSF funding should be cut or that it shouldn’t increase: I think that spending money on the NSF could do a lot of good. But I think that spending money on lots of things could do a lot of good, and I’m afraid that, as a mathematician, I am inherently biased towards spending more money on mathematics. Thus, I would like to see a discussion of the budget that takes a broader point of view. While the “Testimony” wouldn’t be an appropriate place for a broader discussion, it should be able to fit into such a discussion; I found it far too mathematics-biased to do so.

—David Carlson
Stanford University

(Received September 14, 1998)

Warnings about Forecasting Trends

In the “Forum” section of the August Notices, the item “Possible Trends in Mathematics in the Coming Decades”, by M. Gromov, was published. Here I would like to draw attention to two weaknesses we should try to avoid when presenting such contributions.

First, mathematics today is widely and diversely specialized and most mathematicians are narrowly focused. Thus, the danger of special interest pleading. Second, mathematics is very dependent on outside funding. Thus, arguments about utilitarian aspects of it must be developed and presented both forcefully and persuasively and also as to avoid harming the inner life of mathematics.

A way to deal with these two issues is to focus deeper than the views originating from any particular set of fields of mathematics or from any recent select list of major scientific and technological breakthroughs in which mathematics happened to play a critical role. And if we go deeper, then since Galileo and Newton, general modus operandi of science and technology can offer a trenchant picture, one that can also be more easily understood by the wider public. In Galileo’s words, the book of Nature is written in the language of mathematics, Or we may say that till the emergence of computers, we witnessed the interaction pattern: Laws of Nature -- Mathematics -- Humans, in which we humans have used and developed mathematics as a main tool in our formulation of, dealing with, as well as
Finally, we should not forget that the more serious science, as well as technology, is merely three centuries old. And contrary to what we may often like to believe, during this short period, we humans—both as individuals and as societies—have not yet managed to understand to a satisfactory extent the ways scientific research may really work. It may indeed happen that when studying the history of science during this period, one may easily get the feeling that, well, science is not done scientifically. Such a feeling may be even stronger among those of us who happen to be older and thus may have pursued science for about one sixth of the mentioned period. With respect to mathematics, for instance, this feeling can only get reinforced when reading a survey such as the 1972 paper of Freeman Dyson, entitled “Missed Opportunities”, and published in the Bulletin of the AMS. As far as science in general is concerned, the 1962 book of Thomas Kuhn on The Structure of Scientific Revolutions contains examples from the history of science which will also strengthen the mentioned feeling. All this should further serve as a warning to those who are involved in forecasting the trends of science, or in funding it, and intend to do so in a responsible manner.

—James Chaffee
Austin, TX

(Received October 7, 1998)

Another View of Laurent Schwartz and Vietnam
It was with great dismay that I read your review of The Autobiography of Laurent Schwartz. He may have been a great mathematician, but he was no hero. Together with the likes of Sartre and de Beauvoir, Bertrand Russell, Jane Fonda, Tom Hayden, and a host of other American and European Marxists, his support of the Stalinist North Vietnamese regime helped condemn hundreds of thousands of Vietnamese to summary execution, oppression, economic destitution, and imprisonment in the gulag of “Re-education Camps”. The diaspora of boat people who gave up all their worldly possessions, and sometimes their lives, to flee this regime provided the world vivid testimony as to its brutality. The ravage of the community of scholars at Hue during the 1968 occupation by the North Vietnamese and their Viet Cong minions rivals the decimation of Polish intellectuals by occupying Nazis several decades earlier. It is telling that Schwartz condemned the Soviets for their oppression of Jewish mathematicians while saying nothing about the oppression of thousands of Vietnamese Buddhists, Catholics, small landowners and businessmen, and anyone too interested in self-determination. This is nothing more than blatant racism.

—Elemer E. Rosinger
University of British Columbia

(Received September 10, 1998)
EMPLOYMENT OPPORTUNITIES
DIVISION OF MATHEMATICAL SCIENCES

POSITIONS. Several of the technical staff of the Division of Mathematical Sciences of the National Science Foundation serve on 1-2-year “Visiting Scientist” or “Intergovernmental Personnel Act” appointments as program directors while on leave from universities, colleges, industry, or national laboratories. Since the timing of these positions is staggered, the Division continually seeks talented applicants. In 1999 the Division will be seeking to make appointments in all areas. “Permanent” Program Director appointments will be considered.

The positions involve responsibility for the planning, coordination, and management of support programs for research (including multidisciplinary projects), infrastructure, and human resource development for the mathematical sciences. Normally, this support is provided through merit-reviewed grants and contracts that are awarded to academic institutions and nonprofit, nonacademic research institutions.

QUALIFICATIONS. Applicants should have a Ph.D. or equivalent training in a field of the mathematical sciences, a broad knowledge of one of the relevant disciplinary areas of the Division of Mathematical Sciences, some administrative experience, a knowledge of the general scientific community, skill in written communication and preparation of technical reports, an ability to communicate orally, and several years of successful independent research normally expected of the academic rank of associate professor or higher. Skills in multidisciplinary research are highly desirable.

Qualified individuals who are women, ethnic/racial minorities, and/or persons with disabilities are strongly urged to apply. No person shall be discriminated against on the basis of race, color, religion, sex, national origin, age, or disability in hiring by the National Science Foundation.

Applicants should send letter of interest and vita to:

Dr. Bernard R. McDonald, Executive Officer
Division of Mathematical Sciences
National Science Foundation
4201 Wilson Boulevard, Suite 1025
Arlington, Virginia 22230
Phone: 703-306-1870
FAX: 703-306-0555

For additional NSF information, see http://www.nsf.gov/.
Mathematics to the Rescue
(Retiring Presidential Address)

Cathleen Synge Morawetz

I should like to dedicate this lecture to my teacher, Kurt Otto Friedrichs. While many people helped me on my way professionally, Friedrichs played the central role, first as my thesis advisor and then by feeding me early research problems. He was my friend and colleague for almost forty years. As is true among friends, he was sometimes exasperated with me (I was too disorderly), and sometimes he exasperated me (he was just too orderly). However, I think we appreciated each other's virtues, and I learned a great deal from him.

Sometimes we had quite different points of view. In his old age he agreed to be interviewed, at Jack Schwartz's request, for archival purposes. I was the interviewer. At one point I asked him about the role of modern computation and, I think, the computational significance of his early work on difference schemes. He just would not bite. He had worked on those things to prove existence theorems, and he had not been interested in the business of modeling on computers.

Computing PDEs

I began to think about the origins of finding solutions to physical problems by computational methods. This is not really a case of mathematics coming to the rescue, as I promised in the title, but that will come later. If I could rewrite history, I would have it begin with people solving for the first time some time-dependent hyperbolic partial differential equation by a simple difference scheme and getting nonsense because the scheme is unstable. The answers blow up. The white knights—Courant, Friedrichs, and Lewy (CFL)—would then step in and show them that mathematics could cure the problem. That was, however, not the way. But first, what is the CFL condition? It says [1] that for stable schemes the step size in time is limited by the step size in space. The simplest example is the difference scheme for a solution of the wave equation

$$u_{tt} - u_{xx} = 0$$

on a grid that looks like the one in Figure 1. Second derivatives are replaced by second-order differences with $$\Delta t = \Delta x$$.

The sum of the values at 1 and 4 is the sum of the values at 2 and 3. It is not hard to show that this is marginally stable in the following sense. If the scheme is stretched so that $$\Delta t/\Delta x > 1$$ and is adjusted (it will...
I did not get back to reading Laplace, because I got hung up reading about Boole’s hard life until he got to Cork in Ireland at the age of thirty-four. I also discovered that my father, J. L. Synge, in a foreword to McHale’s biography [2] wrote of Boole: “An Englishman, a stranger to Cork (which he found strange), a kindly man, a methodical man, a quarrelsome man when rubbed the wrong way, a victim of his own excessive sense of duty.”

Except for the wave equation, the first application of difference schemes in time-dependent problems seems by all accounts to be in the work of the meteorologist Lewis Fry Richardson [3, 4], who set out to predict weather during World War I. He had a complicated time-dependent problem with real data at hand. Not to my surprise (I identify the middle name Fry with good English chocolate and Quakers), Richardson was a pacifist in the British ambulance corps. On a rest leave, while lying in a pile of hay, he wrote out a numerical scheme for his problem. The equations are in two-dimensional space, and then there is time. A shallow water theory has gotten rid of the height variable. The unknown $u$ is a vector, $\nabla$ is a vector of partial derivatives in space, and the equation is

$$\frac{\partial u}{\partial t} = F(u, \nabla u, \nabla^2 u, x).$$

One marches forward in time with a forward difference step. So in the approximation form,

$$\frac{U_{n+1} - U_n}{\Delta t} = F(U, DU, D^2 U, x),$$

where $D$ is some space difference.

It is in fact virtually impossible to see, except in a preliminary example, exactly what the difference scheme is. Richardson set up and computed by hand the first time step using a latitude-longitude checkerboard grid based on European weather stations. This was too big to handle along with the edges, and he reduced his grid to that of Figure 2.

He took a time step of six hours and some historical data for the initial values. He had to extrapolate his data to get a Cauchy problem. His answer was, alas, dead wrong. It did not check. First, his model was bad; his grid size impossible for the phenomena he wanted to include. But even if all that had worked, his numerical scheme was probably unstable. Richardson’s scheme, in fact, looks not unlike a leapfrog method, such as we showed for the wave equation. He could compute by hand only one time step, and that had to be six hours. His mesh size was about 220 kilometers. If we assumed a speed of propagation for the weather of about 40 kilometers per hour, a very rough guess, then the CFL condition with two space variables would say that the time interval had to be less than four hours. So the scheme would be unstable. Richardson was off, but he was in the right ballpark. What Richardson really did was to break the

\[\begin{align*}
\frac{dy}{dx} &= f(x, y), \quad 0 \leq x \leq a, \quad y(0) = y_0, \\
n_{n+1} - n &= f(n, y, n), \quad n = 0, 1, \ldots,
\end{align*}\]

or some better difference scheme. One solves by stepping from one value of $n$ to the next.

It seems to have been Laplace who brought differences to elliptic partial differential equations, especially through probability and random walks. George Boole, better known to us for Boolean algebra and the logic of computers, did a great deal with the calculus of finite differences and wrote a treatise on it in 1860, including a method for solving the wave equation by differences. He does have some questions about singular solutions, but not about stability.
ice, recognize the problems except for stability, and set up a kind of spreadsheet, a Lotus 1-2-3 for human beings to use in solving large difference problems by hand. But most of all, he drew to the attention of meteorologists the problem of trying to compute and predict the weather by a difference scheme.

CFL were not aware of Richardson's work when they wrote their paper in 1928. During World War II, the CFL condition was rediscovered by von Neumann while computing for the atom bomb. Von Neumann also became deeply interested in weather forecasting by computer after the war and looked at length into Richardson's efforts, noting that Richardson had not studied stability. It was von Neumann who really laid the mathematical basis for weather forecasting by large computers.

Let me add that Richardson was highly literate. He described a huge parallel human computer in graphic terms, applied a well-known poem of Swift's to turbulence, and acknowledged his wife's help in doing the arithmetic in much of his work.

**Scattering**

My next subject has to do with scattering. When I asked Friederichs for a thesis topic in 1948, he suggested perhaps nine. I forget the nine topics, but I think one of them was on scattering, probably in the quantum mechanical framework that Friederichs was very interested in at the time. I did not like any of the topics, and he was very disappointed at my lack of enthusiasm. So I picked one anyway. Perhaps fortunately, shortly thereafter I got pregnant. So we switched to a problem in fluid dynamics, a subject I was more familiar with, as I had helped to edit the Courant-Friedrichs book on compressible fluid dynamics and shock waves.

However, the problem in scattering I want to speak of reached me from a very different source. My husband had a well-known crystallographer, Isidore R. Fankuchen, as a colleague. I frequently met him socially. He never failed to launch a great tirade at applied mathematicians for failing to solve the central problem of crystallography: determining the atomic structure of a molecule from scattered data. One needed to do this for molecules, small and large.

In the kind of forward scattering problem Friederichs looked at, there is a wave coming in from infinitely large negative time, say, a solution of the wave equation. It hits an obstruction, which alters it, and then at infinitely positive time the solution again satisfies the wave equation.

If the obstruction satisfies reasonable conditions, there is a nice map from the incoming wave to the outgoing wave, and the change is called the scattered wave. The study of scattering is the study of the map. The inverse problem is to give the incoming and outgoing wave (or some of it) and find the obstruction: e.g., an obstacle, a change of speed of propagation, a bunch of atoms if it is the Schrödinger instead of the wave equation.

Another well-known inverse scattering problem is for variable frequency, say, $\omega$; consider a solution $u$ of

$$\omega^2 u + u_{xx} + q(x)u = 0,$$

$q(x)$ of compact support, that looks like $u = e^{i\omega x} + R(\omega)e^{-i\omega x}$ at, say, $x = -\infty$ and like $A(\omega)e^{i\omega x}$ at $x = +\infty$.

What is needed to find $q(x)$? Sometimes $R(\omega)$ suffices. But Fankuchen's universal all-important crystallographic problem, although steady, was different.

A crystal is a periodic structure of molecules: for simplicity, one molecule to a box. The incoming wave provided by an X-ray source is a plane wave in three dimensions. It has a fixed frequency, but its direction can be changed.

Let $r = (x, y, z)$. The quantity we want to find is the density of the atoms:

$$\rho(r),$$

which by the periodicity has a Fourier series:

$$\rho(r) = V^{-1} \sum_{all h} F_h \exp(-2\pi i h \cdot r),$$

where $h$ is a vector with integer components and

$$F_h = |F_h| \exp(i\phi_h).$$

The Fourier coefficient of the scattered wave at high-frequency approximation is proportional to $F_h$.

**Measurements** can be made only of $|F_h|$. True, these are made for all $h$, but this does not look like sufficient data to determine $F_h$ and hence to find $\rho(r)$. What can one do? Assume analyticity of $\rho$? Are there better asymptotic formulas? Higher order terms? None of these has helped.

The answer was produced by an applied mathematician and a physicist, Jerome Karle and Herbert Hauptman [5], working closely with a chemist, Isabella Karle. The presence of a chemist was very important, because extra information is needed from chemistry about possible shapes, e.g., symmetry or limitations on angles among the atoms.

The first step is to replace the molecule by a collection of points for the atoms with unknown positions.

Thus the density is a finite sum of Dirac delta functions:

$$\rho(r) = \sum_{i=1}^{N} \rho_i \delta(r - r_i).$$

Here $\rho_i$, the number of atoms at $r_i$ times the weight, is known. Inverting the Fourier series and dropping the constant factors, we find...
\[ \int \rho \exp(2\pi i h \cdot r) \, dx \]

\[ \sim F_h = [F_h] \exp(i\phi_h) = \sum_{j=1}^{N} \rho_j \exp(2\pi i h \cdot r_j). \]

The problem is to find \( r_j \) (the position of the atoms) from the absolute value of \( F_h \). Nothing can be found experimentally about the phase \( \phi_h \). So we have the phases and 3\( N \) unknown position vectors and "as many as we like" of \( |F_h| \). The problem has a high degree of overdeterminacy.

To the mathematician, this overdeterminacy implies some sort of instability, which shows up in the fact that this inversion is very difficult except for \( N \) very small.

One needs some more clues, and Hauptman and Karle supplied many. They won their Nobel Prize [6] in 1985 by executing a computer program that made use of the clues and made it possible to find many molecular structures. Of course, the situation is more complex the bigger the molecule is, but the underlying principles remain the same. Today a bit of chemistry plus a dedicated computer does the job pretty routinely for a large class of molecules. The full story is complicated, and there are still many open problems in this area, especially for very large molecules ([7] and the references there). Not much scattering theory is involved, but what are involved in the clues are the properties of the Fourier coefficients of a positive function first established by Toeplitz in 1911.

Let us first examine the one-dimensional case for the basics and evaluate a certain quadratic form for arbitrary complex vectors \( \xi_h, \xi_j \):

\[ \sum_{h,j} \xi_h F_{h-j} \xi_j = \int \sum_{h,j} \rho e^{2\pi i h x} \xi_h \xi_j \, dx \]
\[ = \int \rho \sum_{h} e^{2\pi i h x} \xi_h \sum_{j} e^{-2\pi i j x} \xi_j \, dx \]
\[ = \int \rho \left| \sum_{h} e^{2\pi i h x} \xi_h \right|^2 \, dx \geq 0, \]

the inequality holding because \( \rho > 0 \). Similarly, \( \sum \sum \xi_h F_{h-j} \xi_j \geq 0 \) where \( h,j \) are vectors with integral coefficients.

If \( \sum \sum \xi_h F_{h-j} \xi_j \geq 0 \), then rewriting the inequality as

\[ E \xi^* E \geq 0, \]

we see that the eigenvalues of the matrix \( E \) are non-negative. Hence, \( \det E \), which is the product of the eigenvalues, is \( \geq 0 \), and every appropriate sub-determinant (obtained by setting appropriate components equal to 0) is \( \geq 0 \). Hence, in particular \( F_0 \geq 0 \),

\[
\begin{vmatrix}
F_0 & F_h & F_k \\
F_{-h} & F_0 & F_{k-h} \\
F_{-k} & F_{h-k} & F_0
\end{vmatrix} \geq 0, 
\]

and the inequality

\[ |F_h|^2 \leq |F_0|^2 = F_0^2. \]

So \( |F_h| \) could be as big as \( |F_0| \). If we digest the experimental data and pick out a component \( F_h \) that has a large absolute value close to \( F_0 \), what does the next inequality tell us? Writing it out, we have

\[ F_0^3 - F_0 |F_{k-h}|^2 - F_h (F_{-h} F_K - F_{k-h} F_{k-h}) + F_k (F_{-h} F_{h-k} - F_0 F_{k-h} F_{k} \geq 0 \]

or

\[ F_0^3 - F_0 |F_{k-h}|^2 + |F_h|^2 + |F_k|^2 \\
+ F_h F_{k-h} + F_k F_{h-k} F_{k-h} \geq 0. \]

If we now set \( |F_h| = F_0 \), we obtain

\[ -F_0 (|F_{k-h}|^2 + |F_k|^2) + 2 \text{Re} F_{h} F_{k-h} F_{k-h} \geq 0 \]

and

\[ -(|F_{k-h}|^2 + |F_k|^2) + 2 \cos(\phi_h + \phi_{k-h} + \phi_{k-h}) |F_K||F_{k-h} \geq 0. \]

This is possible only if \( |F_k| \) is close to \( |F_{k-h}| \) and \( \phi_h + \phi_{k-h} + \phi_{k-h} \sim 0 \).

Now we are at last getting some phase information.

This was the crucial first approximation relation between the phases. We are assuming \( F_k \) and \( F_{k-h} \) are not zero. Look for \( |F_h| \) close to \( F_0 \) and proceed. Now the problem is to use these inequalities to get a first guess at the values of \( r \). It is not completely straightforward from there on, but every Toeplitz inequality will give more information on these elusive phases. The inverse statement that all the Toeplitz inequalities are satisfied we get a positive density was first shown in the one-dimensional case by Caratheodory.

Thus, in this case, mathematics comes to the rescue! The true story is much more complicated, but this is the essence. Hauptman, it should be added, got his Ph.D. in the early 1950s from this result.

**Transonic Flow**

I come now to a subject which I have worked in a great deal and still work in and which I have spoken of before: transonic flow. We begin with an airfoil at rest, here reduced to a two-dimensional body. Past it flows a compressible gas. Sometimes it is a jet engine blade (see Figure 3).
Again, a little history: Already in the 1930s there was contradictory evidence about what happens when the speed (at \( \infty \)) of the flow comes close to the speed of sound. In wind tunnels the flow was very disordered, and yet there seemed to mathematicians no reason why the smooth flow (it was governed by elliptic equations with \( C^\infty \), even analytic, coefficients) would not go on in the same smooth way as the parameter, namely, the speed at infinity, passed through speeds that produced a small supersonic (hyperbolic) region in the flow.

In the late 1940s, in fact, M. J. Lighthill showed in principle that there could be a smooth object with some subsonic speed at \( \infty \) and a smooth supersonic bubble. Such a flow is called transonic. What would really happen? A smooth transonic flow? A flow with a shock? With many shocks? In the 1950s there were great arguments on the subject. Crucially, Clifford Gardner proposed that the boundary value problem was somehow ill-posed, and therefore in general there would be shocks. I learned at that time a story about von Karman, the mathematical physicist-turned-engineer and one of the fathers of the rocket industry in America. Friedrichs had worked with von Karman in Aachen for two years before the rise of the Nazis. The story is that in contemplating the transonic controversy, he told Friedrichs that applied mathematicians were not much help. They solve problems when engineers already have the answers, but now when they were needed they could not resolve the controversy.

Egged on by Friedrichs and Lipman Bers and some experience with equations that change type, I looked at the case of an airfoil with a symmetric cross-section (Figure 4). We also have a given speed at \( \infty \) and a symmetric supersonic bubble attached to the profile. The differential equation is for the potential \( \phi \), with the velocity \( \vec{u} = \nabla \phi \); it comes from the conservation of mass:

\[
\text{div} \rho \nabla \phi = 0.
\]

The density \( \rho \) is a function of \( q = |\nabla \phi| \) given by Bernoulli's law,

\[
\frac{1}{2} q^2 + \frac{\rho}{\rho_0} = K,
\]

where \( K \) is a given constant. Pressure \( p \) is a given function of \( \rho \), the speed of sound \( c^2 \) satisfies \( \frac{dp}{d\rho} = c^2 \), and \( \rho \) is equal to \( \int \rho_0 \, d\rho \). The equation for \( \phi \) is elliptic or hyperbolic depending on whether \( q^2 < c^2 \) or \( q^2 > c^2 \). The boundary condition on the profile is: no normal component of velocity,

\[
\frac{\partial \phi}{\partial n} = 0.
\]

The speed at \( \infty \) is, say, \( q_\infty \).

To show this boundary value problem is ill-posed, one has to wiggle the data and show that the perturbation problem is overdetermined.

We postpone what we will change. We hit with brute force and linearize about the given solution with \( \delta \) for perturbation:

\[
\text{div}(\rho \nabla \phi + \delta \rho \nabla \phi) = 0
\]

\[
(\delta q \text{ at infinity}) = \delta q_\infty
\]

\[
\frac{\partial}{\partial n} \delta \phi + \delta F = 0 \quad \text{on the boundary}.
\]

Here \( \delta F \) involves a perturbation of the boundary, and \( \rho \) and \( \nabla \phi \) are given by the undisturbed flow.

It is plainly a mess to show that there is some perturbation of the data in \( \delta q_\infty \) or \( \delta F \) that will show that this problem has no solution, i.e., that the problem is an ill-posed boundary value problem according to Hadamard.

First consider making just \( \delta q_\infty \neq 0 \). It is still impossible to prove ill-posedness that way. It is probably not true. So wiggling the boundary is the main possibility. But \( \rho \) and \( \nabla \phi \) are a mess, too. They are some of the functions that come from the undisturbed flow. What saves the day is the hodograph variables. These are the two components of velocity \( \nabla \phi \) of the undisturbed flow or, alternatively, of its speed and flow angle.

I laboriously transformed the differential equation so the independent variables became the hodograph variables of the undisturbed flow and found that \( \delta \phi \) satisfied a simple Tricomi-like equation

\[
K(\mu) \frac{\partial^2}{\partial \mu^2} \delta \phi + \frac{\partial^2}{\partial \mu^2} \delta \phi = 0.
\]

Here \( \mu = \mu(q) \) and \( K(\mu) \sim \mu \) near \( q = c \) in the undisturbed flow.

Such things are no coincidence. This one is due to a simple connection found by Guderley between
Figure 5. A schlieren photograph of the wing section of Figure 3 in a wind tunnel. The sharp lines are an indication of shocks. There is a wake from the trailing edge.

the disturbance potential \( \delta \phi \) and the Legendre potential.

From there on it was almost clear sailing. The ultimate result is that there is a way of smoothly changing the profile so that the boundary value problem is overdetermined. The method is to use quadratic integrals of the derivatives to find a contradiction. The idea of using quadratic integrals goes back to either Noether's conservation law or Friedrich's a-b-c method.

While this result [9] was generally accepted, many engineers had a tough time. I was shown many computations that showed very smooth perturbations. In the long run it turned out that the mesh size in those computations (shades of Richardson!) was too coarse. Another school of thought went back to the idea that the Taylor series for the flow would continue to converge for some sufficiently small supersonic region. Eventually the theorem was accepted.

The next step was the recognition—in particular, by Paul Garabedian—that if a flow with a smooth supersonic bubble was perturbed, the nearby flow would have only weak shocks, so that the airfoil could still be useful. (I have tried unsuccessfully to prove this.) Garabedian started a program to compute a profile with a smooth flow with a specified speed at \( \infty \) that could fly or at least be put in a wind tunnel. Lighthill's early work had led Neuwland in Holland to try such a computation. Garabedian's ingenious and extremely mathematical method was successful.

The method is to go from two independent variables, \( x \) and \( y \), to complex coordinates \( x = x_1 + ix_2 \) and \( y = y_1 + iy_2 \). Make the gas law \( p = p(\rho) \) analytic. (Garabedian had already used this method on another problem.) So now the potential \( \phi \) is a complex function that has to be real if \( x \) and \( y \) are real.

In the late 1960s one could not solve a problem in so many independent variables: \( x_1, x_2, y_1, y_2 \). This problem could be reduced to three variables, but then it was just barely possible on the CDC 6600 computer. There was a catch: one was solving an elliptic Cauchy problem with analytic Cauchy data. The solution could develop a singularity. It could also develop a closed streamline (on which \( \frac{\partial p}{\partial \nu} = 0 \)), which would be the airfoil. In case 1, it would be necessary to go back and twiddle the Cauchy data and try again. In case 2, one had a closed wing, but it might not be at all the shape that was wanted. However, Garabedian succeeded. He had his own troubles convincing engineers, although many were very impressed. In the end it was in Canada that Kapcenski built a wing to Garabedian's specifications, and it tested well in a wind tunnel.

The Garabedian-Korn wing (see Figures 3 and 5) became a standard transonic wing. However, Garabedian's construction method was too mathematical in the long run, and engineers and applied mathematicians found and applied other conceptually simple methods. They also determined flows around fixed airfoils at different speeds at infinity by finite difference methods, which have the effect of inducing a suitable artificial viscosity.

About twelve years ago I turned to looking at existence proofs for weak solutions (i.e., those solutions that admit discontinuities in velocity and that satisfy an entropy condition). I have, of course,
never had any doubt that there would be an existence proof if one modified the equations
\[ \text{div } \rho \nabla \phi = 0 \]
and Bernoulli's law \( \rho = \rho_B(\nabla \phi) \) by adding an artificial viscosity. Pursuing an analogy to a difference method mainly generated by Anthony Jameson, I tried modifying Bernoulli's law by letting the density satisfy a first-order equation that retards the density
\[ \rho - \rho_B(\nabla \phi) = \nu \nabla \rho \cdot \nabla \phi. \]

In this work I was joined by Irena Gamba, and eventually we found [10] a simple third-order problem that could be solved for arbitrary \( \nu \), the artificial viscosity.

Proving that our solution can be carried to the inviscid limit \( \nu = 0 \) has proved elusive. (To begin with, I should say one does not use such a simple viscosity equation.) The convergence is very delicate, coming mainly from the methods of Tartar-Murat and DiPerna. So far it has been established only by assuming that the flow angle is bounded and that the flow neither stagnates nor cavitates (cavitation means that \( \rho \to 0 \), which is unfortunately a possibility). No computations reveal unlimited flow angles, cavitation, or stagnation except where one expects the last at the boundary. But that is not enough.

Now let me describe a last problem from transonic flow that should also have an existence proof. However, it has a peculiar phenomenon known as von Neumann's paradox. A shock is running along with a gas at constant pressure and zero velocity ahead of it, as in Figure 6.

It hits a wedge at time \( t = 0 \). What happens? First of all, again under modest hypotheses, the flow is self-similar (depends on \( \gamma, \gamma' \)). If the shock is strong, this flow has been computed, and there have existed for some years very good pictures of what happens. The problem itself goes back to World War II. The wedge is the corner of a building; the shock wave is a bomb blast. What von Neumann was worried about was that the flow patterns predicted mathematically for strong shocks did not check with experiments. Now we are interested in weak shocks (such as we might get in the flow past an airfoil). A transonic or "mixed" flow with a potential \( \phi \) occurs.

Thus, in self-similar variables we find that we have
\[ \text{div } \rho \nabla \phi + 2 \rho = 0, \]
Bernoulli's law
\[ \frac{1}{2} |\nabla \phi|^2 + \Phi(\rho) + \phi = \text{const}, \]
and the normal velocity zero, of course, on the wedge.

This looks so similar to our previous existence problem that everyone feels it is a safe bet that a weak solution exists. What does it look like?

So-called regular reflection is like light wave reflection. It occurs for a certain range of wedge angles (big enough) and certain speeds of the shock. On the other hand, if the wedge angle is very small, computations (and some studies of the linearized problem) show that the incident shock bends and reflects an infinitesimal shock.

However, there is a midrange of flow angle where neither of these possibilities can occur for essentially geometric reasons [11]. It is natural to expect from the strong shock case that the pattern will look like Figure 7.

This now is the paradox: For sufficiently weak incident shocks and an appropriate range of wedge angles, there can be no Mach shock configuration. But computations on very fine meshes with full Euler equations appear to contradict this. An analytic study of shock conditions shows that a configuration like this is impossible even for Euler equations. There is not time here to give all the arguments, but it is the mixed elliptic hyperbolic character that is making trouble. Far out, the equa-
This volume comprises an imaginative collection of pieces created in tribute to Martin Gardner. Perhaps best known for writing Scientific American's "Mathematical Games" column for years, Gardner uses his personal exuberance and fascination with puzzles and magic to entice a wide range of readers into a world of mathematical discovery. This tribute volume therefore contains pieces as widely varied as Gardner's own interests, ranging from limericks to lengthy treatises, from mathematical journal articles to personal stories. The reader will also find caricatures, mazes, riddles, and more to satisfy the liveliest imagination.

Selected papers from
The Mathemagician and Pied Puzzler:

The Odyssey of the Figure Eight Puzzle
by Stewart Coffin

Block-Packing Jambalaya
by Bill Cutler

O'Beirne's Hexiamond
by Richard K. Guy

From Euler to Ulam: Discovery and Dissection of a Geometric Gem
by Douglas Hofstadter

Biblical Ladders
by Donald E. Knuth

Three Limericks: On Space, Time and Speed
by Tim Rowett

This book makes a charming and unusual addition to any personal library.

References


The Work of
Richard E. Borcherds

James Lepowsky

Much of Richard Borcherds's brilliant work is related to the remarkable subject of Monstrous Moonshine. This started quietly in the 1970s when A. Ogg noticed a curious coincidence spanning two apparently unrelated areas of mathematics—the theory of modular functions and the theory of finite simple groups.

There are fifteen prime numbers $p$ for which the normalizer of the congruence subgroup $\Gamma_0(p)$ in $SL(2, \mathbb{R})$ has the "genus-zero property"; that is, the compactification of the upper half-plane modulo this normalizer is a Riemann surface of genus zero, so that the field of modular functions invariant under this discrete group is generated by only one function (a Hauptmodul). The surprise was that these coincide with the fifteen primes that di-vide the order of the "Monster" sporadic finite simple group $M$, a group of order about $10^{54}$ "dis-covered" by B. Fischer and R. Griess but not yet proved to exist at the time. Ogg offered a bottle of Jack Daniels whiskey for an explanation.

In 1978-79, J. McKay, J. Thompson, J. H. Conway, and S. Norton explosively enriched this numerology [CN] and in particular conjectured the existence of a natural infinite-dimensional $\mathbb{Z}$-graded representation (let us call it $V_G = \bigoplus_{n \geq -1} V^n_G$) of the conjectured group $M$ that would have the following property: For each of the 194 conjugacy classes in $M$, choose a representative $g \in M$, and consider the "graded trace" $J_g(q) = \sum_{n \geq -1} (\text{tr}_{V^n_G} g) q^n$, where $q = e^{2\pi i \tau}$, $\tau$ in the upper half-plane. Then the McKay-Thompson series $J_g$ should be a (specified) Hauptmodul for a suitable discrete subgroup of $SL(2, \mathbb{R})$ with the genus-zero property, and, in particular, $J_1$ (corresponding to $1 \in M$) should be the modular function $J(q) = q^{-1} + 196884q + \cdots$. This existence was soon essentially (and nonconstructively) proved by Thompson, A. O. L. Atkin, P. Fong, and S. Smith, and the problem was to uncover the deeper story.

Griess [Gr] then proved the existence of the Monster by constructing it as an automorphism group of a remarkable new algebra of dimension 196884. Later I. Frenkel, J. Lepowsky, and A. Meurman gave a construction, incorporating a vertex operator realization of the Griess algebra, of a "moonshine module" $V_G$ for $M$ whose McKay-Thompson series for $1 \in M$ was indeed $J(q)$. Only some, and far from all, of the McKay-Thompson series for this structure $V_G$ could be computed directly. This construction was reinterpreted by physicists, during the resurgence of string theory in the mid-

---

Richard E. Borcherds

1880s, as a “toy model” physical theory of a 26-dimensional bosonic string compactified on a 24-dimensional toral "orbifold" associated with the Leech lattice. Thus the Monster turned out to be the symmetry group of an idealized physical theory. The term "vertex operator" comes from the early days of string theory, when operators of this type were used to describe interactions at a "vertex". Affine Lie algebras were constructed via what turned out to be certain variants of physical vertex operators.

Then came a penetrating insight of Borcherds: He introduced his axiomatic notion of "vertex algebra" [B1] and perceived among many other things that the moonshine module could be endowed with an \( M \)-invariant vertex algebra structure. The concept of vertex algebra is a mathematically precise algebraic counterpart of the concept of "chiral algebra" in two-dimensional conformal quantum field theory as formalized by A. Belavin, A. Polyakov, and A. Zamolodchikov (a physical theory foundational in string theory and in two-dimensional statistical mechanics). This fundamental notion reflects deep features of the traditional notions of commutative associative algebra and \( \text{at the same time} \) of Lie algebra. A vertex operator algebra structure (a variant of vertex algebra structure) on \( V \) was given in [FLM] and allowed the possibility of characterizing \( V \), by a still-undefined conjecture, as the unique vertex operator algebra satisfying a short list of natural conditions. The Fischer-Griess Monster, then, is the automorphism group of a (conjecturally) unique new kind of mathematical object. The nonclassical flavor of the theory of vertex algebras in mathematics can be thought of as analogous to the nonclassical flavor of string theory in physics.

Borcherds was meanwhile developing his theory of generalized Kac-Moody algebras [B2], now also called “Borcherds algebras”. Kac-Moody algebras form a very important class of Lie algebras generalizing the class of finite-dimensional semisimple Lie algebras. Outside the fundamental class of affine Lie algebras, the infinite-dimensional Kac-Moody algebras have been notoriously difficult to construct concretely. Borcherds had the insight to study systematically the phenomenon of "imaginary simple roots", and the resulting algebras encompass a wide variety of striking examples whose root multiplicities Borcherds determined completely and which he in fact constructed directly from suitable vertex algebras. He established what are now called the “Weyl-Kac-Borcherds character” and “denominator formulas” for these algebras. Most importantly, he made the fundamental discovery that for suitable families of examples, the root multiplicities are exactly the coefficients of certain automorphic forms.

Borcherds’s remarkable achievement concerning moonshine followed, in his strikingly original proof [B3] that all of the McKay-Thompson series for \( V \) do in fact agree with the 194 series written down by Conway and Norton and in particular satisfy the genus-zero property; that is, the Conway-Norton conjecture holds for \( V \). His strategy was to tensor \( V \) with a rank-two vertex algebra to form a rank-26 vertex algebra on which \( M \) acts canonically, and he drew on a rich variety of ideas, among them ideas from vertex algebra theory, the theory of Borcherds algebras (particularly his singularly interesting “Monster Lie algebra”), string theory (especially, critical 26-dimensional string theory and the “no-ghost theorem” of R. C. Brower, P. Goddard, and C. Thorn), and modular function theory. He established a twisted denominator formula for the Monster Lie algebra by exploiting the homology of a suitable subalgebra, and he concluded that the series for \( V \) satisfy the “replication formulas” of Conway-Norton and thus, as a result of a verification of initial data, agree with the Conway-Norton series.

The fact that the root multiplicities of the Monster Lie algebra are the coefficients of \( J(q) \) and the relation of this fact to the denominator formula are just the tip of an iceberg: When Borcherds pursued this idea for a wide range of Borcherds algebras, he discovered a powerful and unexpected correspondence between certain classical modular functions and meromorphic modular forms associated with arithmetic subgroups of \( \text{SO}(n,2) \). The resulting infinite product expansions led to striking new results on moduli spaces of certain varieties. J. Harvey, G. Moore, Borcherds, and others have developed potentially far-reaching connections with mirror symmetry and string duality.

Borcherds’s insights have influenced a wide range of works. For example, the value of having a conceptual notion of vertex (operator) algebra has been immense. It becomes possible to formulate new questions and to address new problems. Here are some notable examples: the initiation of a program to construct (geometric) conformal field theory using vertex operator algebras (I. Frenkel), solution of the problem of constructing “tree-level” conformal field theory in the sense of G. Segal and M. Kontsevich (Y.-Z. Huang), a vertex-operator-algebra-theoretic proof of modular transformation properties of “characters” of modules (Y. Zhu), and a natural approach to the construction of vertex (operator) algebras and their modules (developed systematically by H. Li and others).

The deepest mysteries of moonshine are still not fully resolved. Some notable works in this direction are Borcherds’s and A. Ryba’s investigation of moonshine over finite fields and work of C. Dong,
H. Li, and G. Mason on Norton's generalized moonshine conjectures.

Only part of Borcherds's important work has been touched on here. Discussions and treatments of many facets of his accomplishments and his ideas can be found in, for example, [FLM], [Ge], [JLW], [K], and Goddard’s and Borcherds’s talks at the International Congress [Go], [B4]. These works include listings of many of Borcherds’s papers.

References


The Work of William Timothy Gowers

Joram Lindenstrauss

William Timothy Gowers has worked in two areas: Banach space theory and combinatorics. The main tools he used in his work in Banach space theory are also combinatorial in nature. I shall present here four of his main research achievements.

1. Counterexamples to the main open problems on the structure of infinite-dimensional Banach spaces.

It has become clear in recent decades that there is a rich structure theory for Banach spaces of a high finite dimension, as exemplified by the theorem of A. Dvoretzky on the existence of almost Euclidean sections. On the other hand, progress on the structure theory of infinite-dimensional Banach spaces was rather slow till recently, and many natural problems (most of them going back to Banach and his school in the 1930s) remained open.

Let me recall some background material. A sequence of vectors \( \{x_i\}_{i=1}^{\infty} \) is said to be a (Schauder) basis of a Banach space \( X \) if every \( x \in X \) has a unique representation of the form \( x = \sum_{i=1}^{\infty} a_i x_i \) with \( a_i \) scalars. The basis is called unconditional if for every choice of signs \( \vartheta = \{\vartheta_i\}_{i=1}^{\infty} \) the series \( \sum_{i=1}^{\infty} \vartheta_i a_i x_i \) converges whenever \( \sum_{i=1}^{\infty} a_i x_i \) does (or equivalently, the operator

\[
T \left( \sum_{i=1}^{\infty} a_i x_i \right) = \sum_{i=1}^{\infty} \vartheta_i a_i x_i
\]

is bounded). In the common separable Banach spaces it is quite easy to find bases, and it is also easy to prove that every infinite-dimensional Banach space has an infinite-dimensional subspace with a basis. A famous result of P. Enflo is that not every separable Banach space has a basis (and in fact does not even have the so-called approximation property which is implied by the existence of a basis). As for unconditional bases, it is not hard to prove that several common spaces (like \( L_1(0, 1) \) or \( C(0, 1) \)) fail to have unconditional bases. It was an open problem whether every infinite-dimensional Banach space has an infinite-dimensional subspace with an unconditional basis. For a long time it was hoped that every infinite-dimensional Banach space might even have the stronger property of containing a subspace isomorphic to \( c_0 \) or to \( l_p \) for some \( 1 \leq p < \infty \) (in some sense this could have been viewed as an infinite-dimensional version of Dvoretzky's theorem). This hope was put to rest by B. S. Tsirelson, who constructed a reflexive space not containing a subspace isomorphic to \( c_0 \) or to \( l_p \) for any \( 1 < p < \infty \). His construction had the remarkable feature that the space (or the norm) was not defined explicitly by some formula (as were all examples of Banach spaces till then), but rather by an implicit equation. (All the examples mentioned below are also constructed by a procedure of this type.) All this was known by the mid-1970s.

The recent development was started by a paper of T. Schlumprecht, who modified Tsirelson's ex-
ample and produced a space that is "arbitrarily distortable" (I do not define this notion, since it will not be needed in the sequel). Using Schlemppert's result, Gowers and B. Maurey [7] constructed a separable Banach space Y that does not have any infinite-dimensional subspace with an unconditional basis. In fact, this space Y turned out to have a stronger property: If Z is any subspace of Y, then any bounded linear projection on Z is trivial (i.e., either \( \dim PZ < \infty \) or \( \dim Z/PZ < \infty \)). If a space Z has an unconditional basis \( \{z_i\}_{i=1}^{\infty} \), then there are many nontrivial bounded projections on Z (for any subset \( M \) of the integers

\[
P_M \left( \sum_{i=1}^{\infty} a_i z_i \right) = \sum_{i \in M} a_i z_i
\]

is a bounded linear projection). A space Y with such a property was called in [7] hereditarily indecomposable (H.I.). Before [7] it was a well-known problem whether there exists at all an infinite-dimensional Banach space X that cannot be represented as a direct sum \( X = X_1 \oplus X_2 \) with \( \dim X_1 = \dim X_2 = \infty \) (i.e., on which there is no nontrivial bounded linear projection).

H.I. spaces have many additional unexpected properties. As shown in [7], if Y is an H.I. space and \( T \) is a bounded linear operator from Y into itself, then \( T = \lambda I + S \) for some scalar \( \lambda \) and a strictly singular \( S \) (an operator is called strictly singular if its restriction to any infinite-dimensional subspace is not an isomorphism). Thus every such \( T \) is either a Fredholm operator with index 0 (if \( \lambda \neq 0 \)) or is strictly singular and not Fredholm (if \( \lambda = 0 \)). Consequently, an H.I. space is not isomorphic to any of its proper subspaces. This solves in particular the classical "hyperplane problem", which asks whether any infinite-dimensional Banach space is isomorphic to its hyperplanes (it is trivial that all hyperplanes are mutually isomorphic, and it is easy to see that the common infinite-dimensional spaces are isomorphic to their hyperplanes). The hyperplane problem was actually first solved by Gowers [1] before it became clear that the example in [7] does contain an unconditional basis and other interesting properties.

It is a relatively easy result due to R. C. James that a space with an unconditional basis is either reflexive or it contains a subspace isomorphic to \( c_0 \) or \( \ell_1 \). A considerable amount of work was done on the question of whether every infinite-dimensional Banach space has a subspace that is either reflexive or \( c_0 \) or \( \ell_1 \). Several promising positive results were found on this question. However, Gowers [2] showed that in general the answer is negative and thus gave a stronger version of the result in [7] on unconditional bases.

Another well-known open problem in Banach space theory was the following: Assume that \( X \) and \( Y \) are Banach spaces, and assume that each of them is isomorphic to a complemented subspace (i.e., a subspace on which there is a bounded linear projection) of the other. Must \( X \) be isomorphic to \( Y \)? With mild additional assumptions it was known that the answer is positive (and this has many applications). Gowers [3] showed, however, that in general the answer is negative. He produced a Banach space \( X \) so that \( X \) is isomorphic to \( X \oplus X \) but not to \( X \oplus Y \).

In [8] Gowers and Maurey develop a general method for constructing Banach spaces for which a certain given class of linear maps (say, a shift in a sequence space) are bounded but so that any bounded linear operator on the space essentially belongs to the algebra generated by those given operators. This method has far-reaching implications and will certainly be of much use in the future. It is shown in [8] how to derive the results of [1] and [3] from this general method.

2. The dichotomy theorem.

In [4] Gowers proved a general dichotomy theorem for Banach spaces which, in particular, says the following: Every infinite-dimensional Banach space has a subspace that is either an H.I. space (i.e., a space with very few operators) or a space with an unconditional basis (i.e., a space with a very rich structure). The proof is combinatorial, using infinite Ramsey theory. The theory of finite-dimensional Banach spaces mainly uses arguments based on measure (volume) and probability. These tools are not naturally available in the infinite-dimensional setting. Ramsey type arguments turn out to be an important tool in the infinite-dimensional setting, where they can sometimes replace arguments using measure.

The dichotomy result makes it clear that H.I. spaces are of importance in the structure theory of general Banach spaces (and not just pathological counterexamples). The dichotomy result led immediately to the solution (this time in the positive direction) of the classical "homogeneous" problem. A Banach space \( X \) is called homogeneous if it is isomorphic to all its infinite-dimensional subspaces. A short time before the dichotomy result was proved, R. Komorowski and N. Tomczak-Jaegermann proved the following result: A Banach space \( X \) of "finite cotype" that does not contain a subspace isomorphic to \( \ell_2 \) must have a subspace without an unconditional basis. By combining this result with the dichotomy theorem, one deduces that the only homogeneous Banach space is \( \ell_2 \). Indeed, if \( X \) is homogeneous it must have "finite cotype" by known arguments related to the approximation property. Hence, if it is not isomorphic to \( \ell_2 \) (and thus does not contain \( \ell_2 \)), it must contain (and thus be) an H.I. space. But H.I. spaces are not isomorphic to any proper subspace of themselves and thus are certainly not homogeneous.

The theorem states the following: If $\delta > 0$ and an integer $k$ are given, then there is an $N(k, \delta)$ so that every subset of $\{1, 2, \ldots, n\}$ containing more than $\delta n$ elements must contain an arithmetic progression of length $k$ whenever $n \geq N(k, \delta)$. The theorem was proved for $k = 3$ by K. Roth using tools from analytic number theory. For $k > 3$ the theorem was proved first by E. Szemeredi using an extremely intricate and ingenious combinatorial argument. Some years later another proof was found by H. Furstenberg using the structure theory of ergodic measure preserving transformations.

The proof of Roth gave a reasonable estimate for $N(3, \delta)$. The proof of Szemeredi gave an enormous bound for $N(k, \delta)$. One reason for this is that Szemeredi used in his proof the (much weaker) Van der Waerden theorem. This theorem (in its quantitative form) states that in any partition of the integers into two sets one of those sets must contain arbitrarily long arithmetic progressions. The original proof of this result gave (in its quantitative form) huge upper bounds—what the logicians call an Ackerman function. A more recent proof of Van der Waerden's theorem, due to S. Shelah, gave a much improved upper bound which was, however, still enormous. Furstenberg's proof of Szemeredi's theorem gave no estimate on $N(k, \delta)$.

By using the basic approach of Roth, Gowers gave in [6] a proof of Szemeredi's theorem for every $k$. His main tool is a deep theorem of G. A. Freiman on the structure of sets of integers $A$ so that the cardinality $|A + A|$ of the sum set $A + A$ is at most $C|A|$ for some constant $C$. The proof of Gowers gives an estimate for $N(k, \delta)$ of the form

$$2^{2 \log |A| e^{3 + \epsilon}}$$

for some constant $C$. This gives in particular the first "reasonable" estimate for the constant in Van der Waerden's theorem.

The proof of Furstenberg led to the creation of an entire theory and to many generalizations of Szemeredi's theorem. It is expected that Gowers's proof will have a similar impact but in a somewhat different direction.

4. Szemeredi's uniformity lemma.

One of the tools used by Szemeredi in his proof of the result mentioned above is a result on partitioning general graphs into "uniform subsets", and it is called Szemeredi's uniformity lemma. This lemma found many other important applications in graph theory. The statement of the lemma involves three (small) parameters $\epsilon, \delta, \eta$ and an estimate $K(\epsilon, \delta, \eta)$ for the number of sets in the partition. The upper bound found by Szemeredi in the case $\epsilon = \delta = \eta$ is a tower of 2's of height proportional to $e^{-6}$.

In most cases in combinatorics such large estimates are just a consequence of the method of proof but do not describe the actual situation. This is the case, e.g., in Van der Waerden's theorem mentioned above. Very surprisingly, Gowers obtained in [5] a lower bound for $K(\epsilon, \delta, \eta)$ which is also of the form of a tower of 2's (but of a smaller height, proportional to $\log |\epsilon|$). The existence of such large lower bounds is of great significance in combinatorics and in the theory of complexity of computations.

References


The Work of Maxim Kontsevich

Yuri I. Manin

The mathematical achievements of Maxim Kontsevich have received worldwide recognition. He has influenced a considerable body of research in mathematical physics, topology, and algebraic geometry. What follows is a brief report on some of his work.

Kontsevich's most famous paper is probably "Intersection theory on the moduli spaces of curves and the matrix Airy function" (Comm. Math. Phys., 147 (1992), 1-23). It contains a complete proof of Witten's conjecture on the generating function of a family of characteristic numbers defined on the moduli spaces of curves with marked points. Such

Yuri I. Manin is a director of the Max-Planck-Institut für Mathematik in Bonn. His e-mail address is manin@mpim-bonn.mpg.de. Versions of this segment are being published simultaneously by the Notices and the Gazette des Mathématiciens.
a generating function appeared in the context of topological quantum field theory, and Witten's identities reflected a highly speculative conjecture that different approaches to the quantization lead to identical results.

To state a part of Kontsevich's results, we need some notation. Let \( \overline{M}_{g,n} \) be the moduli space of stable \( n \)-pointed curves of genus \( g \). The intersection theory of these spaces is understood in the sense of orbifolds, or stacks. The algebro-geometric study of the Chow ring of \( \overline{M}_{g,0} \) was initiated by D. Mumford.

Put
\[
\Psi_{n,t} := \xi_t^{\alpha}(c_1(\omega_{\alpha|M})) \in H^2(\overline{M}_{g,n}, \mathbb{Q}),
\]
where \( \xi_t : \overline{M}_{g,n} \to \mathbb{C} \) are the structure sections of the universal curve.

Following the notation of Witten, the integrals of top degree monomials in \( \Psi_{n,t} \) are denoted
\[
\langle \tau_{a_1} \cdots \tau_{a_n} \rangle = \int_{\overline{M}_{g,n}} \Psi_{n,1}^{a_1} \cdots \Psi_{n,1}^{a_n}.
\]

Kontsevich's Main Lemma gives an infinite family of identities that allows one to calculate these numbers algorithmically and to sum an appropriate generating function (I omit this part, but the result is extremely beautiful). The identities have the following structure. Fix \((g,n)\), put \( d = 3g - 3 + n \), and choose \( n \)-independent variables \( I_1, \ldots, I_n \). Then
\[
\sum_{d=d_1+\cdots+d_n} \langle \tau_{d_1} \cdots \tau_{d_n} \rangle \prod_{i=1}^n \left( \frac{2d_i - 1}{2d_i + 1} \right) ! = \sum_{\Gamma \in G_{g,n}} \frac{2^{-|V|}}{|Aut \Gamma|} \prod_{e \in E_{\Gamma}} \left( l^*(e) + l^*(e) \right).
\]

Here \( G_{g,n} \) is the set of the isomorphism classes of triples \( \Gamma = (\tau, c, f) \) where:

(i) \( \tau \) is a connected graph with all vertices \( v \in V_\tau \) of valency 3 and with no tails;

(ii) \( c \) is a family of cyclic orders on all \( F_\tau(v) \) where \( F_\tau(v) \) is the set of flags adjoining \( v \);

(iii) \( f \) is a bijection between \( \{1, \ldots, n\} \) and the set of all cycles of \( \tau \). A cycle is a cyclically ordered sequence of edges (without repetitions) \( e_1, e_2, \ldots, e_k \) such that for every \( i, e_i \) and \( e_{i+1} \) have a common vertex \( v_i \) and the flag \( (e_i, v_i) \) follows the flag \( (e_{i+1}, v_{i+1}) \) as specified by \( c \);

(iv) for any edge \( e \in E_\tau \), \( l^*(e), l^*(e) = \{a, b\} \), where \( \{a, b\} \subset \{1, \ldots, n\} \) are the \( f \)-labels of the two cycles to which \( e \) belongs.

If \( \tau \) is embedded into a closed Riemann surface \( X \) that is oriented compatibly with \( c \), the cycles of \( \tau \) become the boundaries of the oriented connected components of \( X \setminus |\tau| \) (2-cells). Then \( f \) labels these cells, and \( \{a, b\} \) become the labels of the cells adjoining \( e \).

To prove this, Kontsevich analyzes the remarkable cell complex representation of the moduli space and reinterprets complex analytic integrals via combinatorial data. A paradoxical property of his identity is the cancellation of poles in the right-hand side, which is not obvious even in the simplest cases.

The ideas contained in this paper were developed in many works of physicists; the matrix Airy function Kontsevich introduced in order to sum the generating function is an important ingredient of what are now called Kontsevich's models.

On the other hand, the experience he acquired in dealing with the geometry of moduli spaces allowed him to introduce several decisive ideas in the very active area of quantum cohomology and the Mirror Conjecture.

The Mirror Conjecture is by now a series of stunning, interrelated insights in the geometry of complex manifolds with vanishing canonical class, which are motivated by a conjectural duality in quantum string theory. Only some of these insights are formulated as precise mathematical conjectures. The first of them was what we call the Mirror Identity: an equality of two formal series, one of which is a generating function for the number of rational curves of various degrees on a three-dimensional quintic, and another is produced from periods of the mirror dual variety.

Kontsevich's paper "Enumeration of rational curves via torus actions" (The Moduli Space of Curves, R. Dijkgraaf, C. Faber, and G. Van der Geer, eds., Progress in Mathematics, vol. 129, Birkhäuser, Boston, 1995, pp. 120-139) consists of two parts. The first part contains the definition and study of what are now called Kontsevich stable maps. These systems are \((C; x_1, \ldots, x_n; f)\) where \( C \) is a projective curve with only cusps as singularities, \( x_i \) are pairwise distinct smooth points on \( C \), and \( f : C \to V \) is a map with infinitesimal automorphisms to a smooth projective manifold \( V \). Such maps with a fixed image \( \beta = f_x(C) \in H_2(V) \) form a Deligne-Mumford stack \( \overline{M}_{g,n}(V, \beta) \). Kontsevich's insight was that such a stack carried a Chow class that he called a virtual fundamental class. Using the image of this class as a correspondence between \( V^n \) and \( \overline{M}_{g,n} \), he defined the very strong motivic version of Gromov-Witten invariants. Some of these invariants are essentially numbers, among which the numbers of rational curves of various degrees on a quintic threefold are contained. The conjecture that an appropriate generating function for them expresses a variation of Hodge structure for the dual quintic was the first case of the Mirror Conjecture.

The second part of Kontsevich's paper gives explicit formulas for Gromov-Witten numbers for complete intersections in (products of) projective
In a recent preprint, "Formal quantization of Poisson manifolds", Kontsevich solved a long-standing problem showing that any Poisson manifold admits a formal quantization. In the flat case he produced an explicit quantization introducing a beautiful new class of integrals. This work has great potential.

The Work of Curtis T. McMullen

John Milnor

Curt McMullen has made important contributions to the study of Kleinian groups, hyperbolic 3-manifolds, and holomorphic dynamics. Indeed, following the lead of Dennis Sullivan, he clearly regards these three areas as different facets of one unified branch of mathematics. Following are descriptions of a few selected topics. I hope that these will illustrate the variety and depth of his work. However, by all means the reader should look at the original papers, since he is a master expositor. See especially his two books and his Berlin lecture [Mc10].

Solving the Quintic

His first work was on Smale’s theory of purely iterative algorithms. By definition, these are numerical algorithms which can be carried out by iterating a single rational function, without allowing any “if · · · then · · ·” branching. In [Mc1] he showed that the roots of a polynomial of degree n can be computed by a generally convergent, purely iterative algorithm if and only if n ≤ 3. With Peter Doyle [DMc] he showed that these roots can be computed by a tower of finitely many such algorithms if and only if n ≤ 5.

A Fat Julia Set

The Julia set J of a rational map f from the Riemann sphere C = C ∪ {∞} to itself can be described roughly as the compact set consisting of all points z ∈ C such that the iterates of f, restricted to any neighborhood of z, behave chaotically. It is not known whether such a Julia set can have positive area without being the entire Riemann sphere. However, McMullen [Mc2] produced very simple examples for the more general question, in which we replace the rational map by a transcendental function, such as the map $z \mapsto \sin(z)$ of

---

Curtis T. McMullen
Figure 1. The Julia set for $z \rightarrow \sin(z)$, shown in black, has positive area but no interior points.

Figure 2 (courtesy of David Wright). Dense cusps in the boundary of Teichmüller space for a punctured torus, using the Maskit embedding. Teichmüller space is the region underneath this boundary curve.

Figure 3. A quadratic map $f$, its iterate $f^3$, and its renormalization $R_3(f)$. The right-hand box is obtained from the small box in the middle by magnifying and rotating $180^\circ$.

The Kra Conjecture

To any Riemann surface $X$ one can associate the Banach space $Q(X)$ consisting of all holomorphic quadratic differentials $\Phi = \phi(z)dz^2$ for which the norm $||\Phi|| = \int |\phi(z)|dz$ is finite. Any covering map $f : X \rightarrow Y$ induces a push-forward operation $f_* : Q(X) \rightarrow Q(Y)$, where the image differential at a point $y$ is obtained by summing over the points of $f^{-1}(y)$. This operation can never increase norms, $||f_*(\Phi)|| \leq ||\Phi||$. In the special case of the universal covering $f : \hat{Y} \rightarrow Y$ of a hyperbolic surface of finite area, Irwin Kra conjectured in 1972 that there is always some definite amount of cancellation between the different preimages of a point of $Y$, so that $||f_*||$ is strictly less than 1. This was proved by McMullen [Mc4] in 1991, using a careful estimate for the change in the associated Kleinian group representation $\pi_1(S) \rightarrow \text{PSL}_2(\mathbb{C})$ as some simple closed curve in the surface $S$ shrinks to a point.

Thurston Geometrization

The still unproved Thurston Geometrization Conjecture asserts that every compact 3-manifold can be cut up along spheres and tori into pieces, each of which admits a simple geometric structure. For six of these eight geometries, the problem is now well understood, but difficulties remain in the hyperbolic case, while the spherical case, including the classical Poincaré conjecture, is still intractable. For references, compare [Mi2].

Thurston outlined proofs that a 3-manifold admits a hyperbolic structure in two important special cases. First suppose that $M$ is a Haken manifold, that is, suppose that $M$ is $S^2$-irreducible and can be built up inductively from 3-balls by gluing together submanifolds of the boundary, taking care that no essential simple closed curve in this submanifold bounds a disk in the manifold. Thurston showed that $M$ can be given a hyperbolic structure if and only if every $Z \otimes Z$ in its fundamental group comes from a boundary torus. McMullen [Mc6] used his work on the Kra conjecture to give a new and explicitly worked out proof of this theorem. (The details are quite complicated.) The second case handled by Thurston concerned 3-manifolds which fiber over the circle. Again, McMullen gave a new proof, which will be discussed below.

Renormalization

Let $f$ be a smooth even map from the closed interval $I = [-1, 1]$ into itself with a nondegenerate critical point at the origin and with no other critical points. We will say that $f$ is renormalizable if there is an integer $n \geq 2$ so that the $n$-fold iterate $g = f^n$ maps the subinterval $\{|x| \leq |g(0)|\}$ into itself with only one nondegenerate critical point. If we rescale by setting $f(x) = g(\alpha x)/\alpha$ where $\alpha = g(0)$, then $f$ will be a new map from the interval $I$ into itself satisfying the original hypothesis. This $f$ is called the renormalization $R_0(f)$. In 1978 Mitchell Feigenbaum, and independently Pierre Coullet and Charles Tresser, considered the special case $n = 2$ and studied maps $f$ which are infinitely renormalizable, so that we can form a sequence of iterated renormalizations $f, R_2f, R_2^2f, \ldots$, each mapping $I$ to itself with one critical point. They observed empirically that complex structures on a hyperbolic Riemann surface of finite area by adding an ideal boundary consisting of algebraic limits of associated Kleinian groups. He conjectured that the “cusps”, corresponding to ideal limits in which some simple closed curve has been pinched to a point, are everywhere dense in this boundary. (Compare Figure 2.) This was proved by McMullen [Mc4] in 1991, using a careful estimate for the change in the associated Kleinian group representation $\pi_1(S) \rightarrow \text{PSL}_2(\mathbb{C})$ as some simple closed curve in the surface $S$ shrinks to a point.

NOTICES OF THE AMS

VOLUME 46, NUMBER 1

24
this sequence of maps always seems to converge to a fixed smooth limit map. Their ideas, motivated by renormalization ideas from statistical mechanics and by attempts to understand the onset of turbulence in fluid mechanics, now occupy a central role in one-dimensional dynamics, since the infinitely renormalizable maps are the most difficult ones to understand.

This construction was extended to the complex case by Douady and Hubbard, using the idea of a quadratic-like map, that is, a proper holomorphic map \( f: U \to V \) of degree two, where \( U \) and \( V \) are simply connected open sets in \( \mathbb{C} \) and \( U \) is a compact subset of \( V \). This has led to important work by mathematicians such as Dennis Sullivan, Curt McMullen, and Mikhail Lyubich. Most subsequent progress in understanding the real case has been based on complex methods. (One exception is Martens [Ma].) McMullen's book [Mc7] provided the first careful presentation of the foundations of renormalization. As one example, he was the first to notice the possibility of an aberrant form of "crossed renormalization" in the complex case which does not fit into the usual pattern. He used his work on renormalization to obtain partial results on the generic hyperbolicity conjecture for real quadratic maps, that is, the conjecture that every such map can be approximated by one with an attracting periodic orbit. For example, he showed that every component of the interior of the Mandelbrot set which meets the real axis is hyperbolic. The full conjecture was later proved by Lyubich [L1] and by Graczyk and Świątek [GS].

McMullen's second book [Mc8] developed renormalization theory further and tied it up with Mostow rigidity and also with Thurston geometrization. (See also [Mc10, 11].) He introduced the concept of a "deep point" in a fractal subset \( X \subset \mathbb{C} \). By definition, \( p \) is deep if there are positive constants \( c \) and \( s \) so that the distance from an arbitrary point \( q \) to \( X \) is at most \( c(|p - q|)^s \). Taking \( p \to 0 \) for convenience, we can understand this concept by zooming in on the origin so as to magnify the complex plane more and more densely, with gaps which become smaller and smaller as \( \lambda \) becomes large. (Compare [M11].)

Now consider a hyperbolic 3-manifold which may have infinite volume. The convex core of such a manifold \( M \) can be described as the smallest geodesically convex subset which is a strong deformation retract of \( M \). Assuming both upper and lower bounds for the injectivity radius at points of the convex core, McMullen's inflexibility theorem asserts that two such manifolds \( M \) and \( M' \) which are "pseudo-isometric" must actually be related by a diffeomorphism which becomes exponentially close to an isometry as we penetrate deeper into the convex core. Closely related is the statement that actions of \( \pi_1(M) \) and \( \pi_1(M') \) on the 2-sphere at infinity for hyperbolic 3-space are quasiconformally conjugate and that this quasi-conformal conjugacy is actually conformal at every deep point of the limit set for this action.

As an application, McMullen gave a new proof of the second Thurston geometrization theorem. To any surface diffeomorphism \( \psi: S \to S \) we can associate the mapping torus \( T_\psi \), that is, the quotient of \( S \times \mathbb{R} \) under the \( \mathbb{Z} \) action which is generated by \( (x, t) \mapsto (\psi(x), t + 1) \). If \( S \) has genus two or more and \( \psi \) is pseudo-Anosov, then Thurston showed that \( T_\psi \) is a hyperbolic 3-manifold. McMullen proved this by using his inflexibility result to construct a hyperbolic structure on \( S \times \mathbb{R} \) which is invariant under the given \( \mathbb{Z} \) action.

Next he applied these ideas to renormalization. One basic result is a rigidity theorem for bi-infinite "towers" of renormalizations. We can think of such a tower as a bi-infinite sequence \( (\cdots, q_{-1}, q_0, q_1, q_2, \cdots) \) of quadratic-like maps \( q_j: U_j \to V_j \), where each \( q_{j+1} \) is a renormalization \( \mathcal{R}_{q_j}(q_j) \). He showed that if the renormalization periods \( n_j \) are bounded and if the annuli \( V_j \setminus U_j \) have modulus bounded away from zero, then the entire tower is uniquely determined up to a suitable isomorphism relation by its quasiconformal conjugacy class.

Consider an infinitely renormalizable real quadratic map \( f \) with periodic combinatorics. Using the complex theory, McMullen showed that the successive renormalizations converge exponentially fast to a map which is periodic under renormal-
ization. Closely related is the statement that the critical point is a deep point for the Julia set of f. (Figure 4.)

Now consider a quadratic map \( f(z) = z^2 + c \) which has a Siegel disk of rotation number \( \rho \). That is, choose the constant \( c \) so that the derivative of \( f \) at one of its two fixed points is equal to \( e^{2\pi i \rho} \), where \( \rho \in \mathbb{R} \setminus \mathbb{Q} \) satisfies a suitable Diophantine condition. McMullen used similar ideas in [Mc9] to show that this Siegel disk is “self-similar” about the critical point 0 (the central point in Figure 5) if the continued fraction expansion of \( \rho \) is periodic. In fact, his argument can be used to show that the entire Julia set \( J \) of \( f \) is asymptotically self-similar in the following sense: There is a scale factor \( \lambda \) with \( |\lambda| > 1 \) so that the magnified images \( \lambda^n J \) converge to a well-defined limit set \( K(f) \subset \mathbb{C} \) as \( n \to \infty \), using the Hausdorff topology for compact subsets of the Riemann sphere. (In this particular example, \( \lambda = 1.8166 \cdots \) is real.) The corresponding limit for the boundary of the Siegel disk is a quasicircle contained in \( f \), while the corresponding limit for the filled Julia set \( K(f) \) (the union of bounded orbits for \( f \)) is the entire sphere \( S \).

There has been very significant subsequent work in renormalization, based in part on McMullen’s ideas. Compare the discussion in [Mc10]. Note in particular [Mc8], which implies that the boundary of the Mandelbrot set is asymptotically self-similar about the Feigenbaum point, and [Mc3], which proves existence of a full horseshoe structure for the real renormalization operator and uses it, together with work of Martens and Nowicki, to prove that every real quadratic map outside a set of measure zero has either a periodic attractor or an absolutely continuous asymptotic measure.

References


[Mi2] ———, The fundamental group, Collected papers, Publish or Perish, Vol. II, 1995. See pp. 93-95; but note that unpublished claims in the spherical case have not been substantiated.

About the Cover

Curt McMullen has shown that a quadratic Siegel disk is asymptotically self-similar about its critical point whenever the continued fraction expansion for its rotation number is periodic. (Compare the discussion on this page.) The cover figure (a color version of Figure 5) illustrates this result by showing part of the filled Julia set (the union of bounded orbits) for the quadratic polynomial map \( f(z) = z^2 - (0.3905 \cdots + 1.5867 \cdots) \), which has a Siegel disk with rotation number equal to the golden mean \( \rho = (\sqrt{5} - 1)/2 \). The critical point lies at the center of this picture, while the Siegel disk is the large region to the lower left with emphasized boundary. Under \( f \), this disk maps homeomorphically onto itself with rotation number \( \rho \), and the symmetric region to the upper right folds onto it. If we expand this figure repeatedly by a fixed scale factor of \( 1.8166 \cdots \), keeping the center point fixed, then the expanded images will converge to a well-defined limiting shape.

— John Milnor
A WM in the 1990s: A Recent History of the Association for Women in Mathematics

Jean E. Taylor and Sylvia M. Wiegand

Ever since its founding in 1971, the Association for Women in Mathematics (AWM) has been a passionate organization with a mission: to encourage women to study and to have active careers in the mathematical sciences. Largely through the devotion and energy of a few overcommitted but determined individuals, especially its past presidents and officers, AWM has flourished for almost three decades. The inexhaustible enthusiasm and inspiring example of the early AWM volunteers (e.g., first founding president Mary Gray) set the standard for extensive donations of time and energy by those who followed. As a result, the Association has become an effective voice and vehicle for the advancement of women in the mathematical sciences.

At the outset, the initials AWM stood for the “Association of Women in Mathematics”, but soon “of” was changed to “for”. Men have been instrumental in the growth and prestige of AWM; about seven percent of the approximately 4,500 members are male. Men give varied reasons for their membership, such as “to help me see what is available for women in mathematics and enable me to better mentor female students”, or “to show support for women in mathematics”. Many are motivated by a basic sense of justice and/or the belief that all of society stands to benefit from developing the mathematical talents of women. As one member explains, “If any group is subjected to willful or accidental discrimination, all of society is the victim [because society is deprived of the talents and potential accomplishments of that group].”

To commemorate the twentieth anniversary of AWM, Lenore Blum wrote an exuberant article for the Notices in which she described how AWM grew from a small, shaky beginning in 1971, when women were “invisible”—jobs were scarce for women, as were positions on the programs of meetings and conferences—to 1991, when, according to Carol Wood, women were “everywhere dense”. Blum’s article recorded the dramatic improvements in the situation for women since 1971 and described the activities of AWM that contributed to these improvements. By 1991 the Association was a widely respected organization with a large influence internationally: AWM had a professional newsletter, an extensive program at the

---

Editor’s Note: Jean E. Taylor is president-elect of the AWM, and Sylvia M. Wiegand is president of the AWM. The authors are writing as individuals and not as representatives of the AWM.

---

2 September 1991, Volume 38, Number 7, pages 738-774; the article was also printed in the November-December 1991 and January-February 1992 issues of the AWM Newsletter, and it is accessible through the AWM Web site, http://www.awm-math.org/.
January Joint Meetings, and various projects for encouraging younger women to study mathematics. As AWM nears the end of its third decade, it is an opportune time to update that article.

A major source of information for the present article is the last decade of newsletters of the Association (referenced in abbreviated fashion, for example, with “[JF93]” signifying the January–February 1993 issue). Former AWM presidents and other AWM friends contributed information and verification. AWM member Elizabeth Allman conducted and transcribed interviews with several younger mathematicians. The choice of what to include, however, was that of the authors, and the opinions expressed here are those of the authors and do not necessarily represent AWM. The authors thank Elizabeth Allman, Lenore Blum, Anthony Knapp, Eric Macris, Judith Roitman, Roger Wiegand, and the reviewers for their help with this article.

Why AWM Is Still Needed

Since Blum's article, the participation of women in the mathematical community has increased. The percentage of women earning Ph.D.s in mathematics in the U.S. reached its highest level (25% overall, 29% of those granted to U.S. citizens) for the year of the latest published survey. Many more women hold entry-level positions now. Many more women speak at major meetings. In view of these improvements in the status of women in mathematics, is AWM still needed?

The answer is yes! Problems—sometimes more subtle than in the past—remain for women in mathematics at all levels. For example, the high point in the percentage of women receiving Ph.D.s in mathematics cited above masks the fact that the percentage varied considerably for the rest of the decade—about a mean several percentage points lower. Furthermore, the percentage of women entering graduate study has recently dropped at several institutions, as noted below. In spite of the description from Blum's article of women's participation in mathematics as "everywhere dense," sometimes it is "measure epsilon"; one young woman commented, "I was the most senior woman at the conference I just attended...and I was the only woman from the U.S. None of the twenty-plus speakers were women." As the data below indicate, the prediction at the end of Blum's article—that there would be significant numbers of tenured women in the U.S. top ten departments within five years—has not been realized. Although there is a welcome increase in numbers of new women mathematicians with academic positions, women are still scarce among tenured and full professors at most institutions, particularly those in the U.S. top ten. There remains evidence of discouragement, disparities, and lower expectations for women in mathematics at various levels, as the following snapshots reveal.

Social Unacceptability

Young women in high school and college still hear that "math isn't cool for women." Girls at a high school math camp for girls at Nebraska said they "could not" tell their peers that they were going to a math camp; it would be "socially unacceptable". Some high school guidance counselors still steer girls away from mathematics.

Teaching vs. Research

Many undergraduate women mathematics majors plan to become elementary and secondary teachers. Teaching is a rewarding and valuable occupation that both men and women should be encouraged to pursue. But sometimes even women who think their contribution would be greater or their life more rewarding with a research career are pressured to choose a career in teaching; this happens far more often for women than for men. Mathematically talented undergraduate women should be permitted to develop their talents and to pursue the career that suits them best.

Promotions and Rewards

Although entry-level job opportunities for men and women now seem equal, women are neither promoted nor rewarded as often as men. Generally, women are more numerous at the lowest levels of mathematical activity. AWM past-president Chuu-Lian Terng reported that in 1995 women in the U.S. earned 45% of the undergraduate degrees in mathematics and 23% of the Ph.D.s, but constituted only 6% of all tenured faculty. That is, of the 4,500 tenured faculty in 170 Ph.D.-granting departments, only 274 were women, or 1.6 per department [JF96]. Currently, published data show that 63 out of 1,231, or 5%, of tenured doctoral full-time math faculty at Group I public institutions are female; for Group I private institutions the numbers are 22/506, or 4.3%; and for Groups I, II, and III combined, 305/4714, or 6.5%. This represents a welcome increase of 31 tenured female faculty in the combined groups, but the ratio of the increase in tenured women to the total increase in tenured faculty is still only 31/214. By contrast, the numbers of part-time faculty for Groups I, II, and III combined are 347 female out of 941 total, or 37%.

An AWM panelist in January 1995 on the topic "AWM: Why Do We Need It Now?", Susan Landau located 65 of the 80 people awarded MIT Ph.D.s during 1980-84. Of these 65, 13 were women (plus

---

3A longer version of this article is posted on the AWM Website, http://www.awm-math.org/, with an opportunity for people to comment. Elizabeth Allman will moderate the discussion.


1 of the 15 she could not locate. She reported that 14 of the men were tenured at Group I institutions, but only 1 of the women; 25 of the men were tenured at Group I, II, or III institutions, but only 2 women; and overall 39 (out of 32) of the men had tenure, but only 7 (out of 13) of the women [MA95]. At the beginning of this decade there was roughly a 20% discrepancy between salaries for men and women in the mathematical sciences in the U.S. (see Table 1).

<table>
<thead>
<tr>
<th>Department</th>
<th>Total</th>
<th>Female</th>
<th>Tenure-Track</th>
<th>Total</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC-Berkeley</td>
<td>60</td>
<td>2 **</td>
<td>2</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Caltech</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Chicago</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>2</td>
</tr>
<tr>
<td>Columbia</td>
<td>14</td>
<td>1 **</td>
<td>1</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Harvard</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>MIT</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>38</td>
<td>4</td>
</tr>
<tr>
<td>Michigan</td>
<td>49</td>
<td>1</td>
<td>1</td>
<td>38</td>
<td>6</td>
</tr>
<tr>
<td>Princeton</td>
<td>31</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td>7</td>
</tr>
<tr>
<td>Stanford</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Yale</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>288</td>
<td>9</td>
<td>9</td>
<td>183</td>
<td>31</td>
</tr>
</tbody>
</table>

Table 2. Women in Mathematics, 1991-92.

Percentages at Elite Institutions
The percentages of women in mathematics departments at the elite institutions remain dismal, with a few bright spots. In 1991-92 there were five tenured women total in all of the top ten departments (National Academy of Sciences ranking) versus 288 tenured men, and a total of 27 untenured women versus 192 men [JF93]. There were no women at Caltech, and no tenured women at the University of Chicago, MIT, Princeton, Stanford, or Yale. (See Table 2.) Since then there have been notable changes at two institutions: Princeton University now has two tenured women, and the University of Michigan has four; MIT has an increased number of untenured women. Still, the total number of women is small. (See Table 3.)

Graduate School Attrition
Proportionately more women still drop out of graduate school than men. Furthermore, anecdotal evidence suggests that in some areas where the par-

---

6The authors have been unable to locate current data.
7Positions that could lead to tenure.
8In this table from [JF93], ** denotes "joint appointment with UCLA", *** denotes "tenured at Barnard", and "Un-
tenured" includes all full-time members of a department who do not have tenure—both tenure-track and non-
tenure-track positions. "Tenure-track", a subset of the untenured group, includes members of a department with appointments at the end of which the member must automatically be considered for tenure.
9This information was obtained from the departments by the authors. Again, *** denotes "tenured at Barnard".
It may seem that outstanding new women Ph.D.s who obtain jobs at top institutions no longer encounter any discrimination, but at least some of these women notice differences in their treatment from that of men. They report that male students and even colleagues accuse them of getting jobs, awards, and attention just because they are women. Some female students, perhaps expecting perfection when they finally see a role model, are also quite critical of women faculty. As for women who are not in top positions, they feel their faults are magnified and they are disparaged far more than comparable men.

As Melvin Rothenberg observed, “Thirty years ago discrimination against women was rampant and open. More than one distinguished colleague vowed never to accept a woman as a student. Now, discrimination is not open, if only out of fear of legal action. At the same time, I wonder how much better it is for women. The top five research departments have literally less than a handful of tenured women. ... There is no doubt that there exists an environment and attitude at our leading mathematical institutions that many women find hostile and alienating. ... This environment is deeply discouraging to women graduate students and is a significant factor in limiting their careers. ... We can and should regard the absence of women in our ranks as a weakness and take appropriate action” [ND93].

For these and other reasons AWM is still needed. Rather than emphasize negatives, however, this article focuses on the accomplishments and the spirit of AWM. AWM programs have been enormously helpful to younger women in mathematics. As Cheryl Grood says, “AWM helped bring me into the mathematical community at each different stage and level in my mathematical career.” Those interviewed for this article describe their experiences with AWM as “exciting and inspiring.”

AWM’s Activity List for the 1990s

During the 1990s, AWM has continued many of its earlier activities, described in Blum’s article, and it has expanded into new areas. A great deal of the work of AWM on these activities has been done by unpaid volunteers, notably meetings coordinator Bettye Anne Case, Newsletter editor Anne Leggett, the AWM presidents and treasurers (who are involved in every AWM project), and members of the various committees. Case and Leggett—energetic, dedicated women who have served AWM in their posts for twenty-three and twenty-one years respectively—have made enormous contributions to the continuation, the memory, the shape, and the dream of AWM.

Newsletter

AWM publishes its bimonthly Newsletter under the direction of Newsletter editor Anne Leggett. This publication regularly features informative articles about women in science and mathematics; reports of AWM events and other mathematical events; listings of jobs, both academic and nonacademic; short blurbs about members, women in mathematics, news, and upcoming events; an informal “President’s Report”; an “Education Column”; and book reviews. The Newsletter, widely read and enjoyed by the mathematics community, is praised for its interesting and valuable information and articles. Women members say each Newsletter “recharges” them and helps them fight feelings of isolation.

Web Site

In 1998 AWM established, through the efforts of volunteers Tamara Kolda and Barbara Ling, an award-winning Web site, http://www.awm-math.org/. It features announcements of up-
coming deadlines and events, articles (including an expanded version of this one), pictures from previous events, some of the AWM publications listed below, links to many resources on women in mathematics, information on applying for all programs AWM runs, information on ordering all of its publications, and other important information. AWM also sponsors AWM-Net, an electronic mail forum for AWM members that was started in 1994 by Diane O’Leary. AWM-Net is used for discussing issues and publicizing events related to the AWM mission. Information on joining the AWM-Net is available at the AWM Web site.

**Publications**

AWM has produced these publications: Profiles of Women in Mathematics: The Emmy Noether Lecturers; a career booklet, Careers That Count (produced in 1991); an older Careers for Women in Mathematics booklet [ND86]; a Directory of Women in the Mathematical Sciences; membership directories; an AWM membership brochure; and an extensive report from the 1997 SIAM workshop.\(^{10}\)

**AWM Workshops**

Begun in 1991 under the direction of AWM president Jill Mesirov, the AWM workshops highlight the achievements of outstanding new female mathematicians via talks by recent Ph.D.s and posters presented by graduate students. Currently funded by the National Science Foundation (NSF) and the Office of Naval Research (ONR), the workshops have continued each winter at the Joint Meetings and each summer at the SIAM meeting and are attended by both men and women. In the course of the workshops the new mathematicians are matched with mentors, established mathematicians who give career advice. Workshop organizers also arrange various sessions offering advice for new Ph.D.s on pressing issues. For example, the summer 1997 workshop featured a minisymposium on how to write mathematics and grant proposals [ND97]. At the January 1995 panel discussion “Launching a Career”, Dusa McDuff discussed her career path briefly and emphasized making mathematical connections [MA95]. Catherine Roberts described the importance of finding mentors and listed nine practical suggestions for new faculty members [MA95]. Other workshop panel discussions have included: getting started doing research without an advisor, mathematicians in government, presentations by undergraduate students from Mills College on the Summer Program for Women, graduate education, career experiences, and balancing career and family.

New mathematicians find the workshops valuable “for networking with each other, for discussing career difficulties, and for being inspired seeing so many women doing such excellent math-

\(^{10}\)This report, which was the center twelve pages of [ND97], is also available separately.
AWM Emmy Noether Lecturers during the 1990s
Bhama Srinivasan (1990, University of Illinois at Chicago)
Alexandra Bellow (1991, Northwestern University)
Nancy Kopell (1992, Boston College)
Linda Keen (1993, CUNY)
Lesley Sibner (1994, Brooklyn Polytechnic University)
Judith Sally (1995, Northwestern University)
Olga Oleinik (1996, Moscow State University)
Linda Preiss Rothschild (1997, University of California, San Diego)
Dusa McDuff (1998, SUNY at Stony Brook)

International Congress Emmy Noether Special Lecturers
Olga Ladyzhenskaya (1994, St. Petersburg Steklov Institute)
Cathleen Morawetz (1998, Courant Institute, NYU)


Travel Grants
Through a grant from the NSF, AWM administers a grant program to fund travel by women mathematicians to research conferences. This program, which was started in the mid-1980s by then-president Rhonda Hughes, has funded hundreds of travel proposals and provides a valuable opportunity to advance research activities and visibility of women in the research community.

Special Conferences
The tradition of holding special conferences in honor of famous women in mathematics, such as Sonya Kovalevsky and Emmy Noether, began in the early days of AWM. In 1996 AWM held another special conference, in honor of Julia Robinson, and the Association is currently organizing an Olga Taussky-Todd conference to be held July 16-18, 1999, at the Mathematical Sciences Research Institute (MSRI). Described by participants as wonderful, energizing, and empowering, the Julia Robinson conference featured talks on her life and work; other mathematical talks; poster presentations, and panel discussions on job hunting, building a career, and applying for grants. Sharon Frechette summarized her experience at the conference, “A panel discussion with women from different kinds of educational institutions, NSA, and industry was informative and interesting. ... A session on how to conduct a job search with a great mock interview with Q&A afterwards [was] incredibly helpful. ... Overall, I was impressed with the message AWM seemed to be sending to young women mathematicians: ‘Things might have been difficult for many of us as we were starting out, but it needn’t be that way, and we’re working to ensure that things continue to improve for women making a career in this field.’” Another young woman said the conference had a large impact on her cohort, “both in the number of beginning mathematicians who participated and the connections formed by each of them.”

Lectures
AWM sponsors and cosponsors lectures at the January Joint Meetings and the summer MathFests, including sponsoring the prestigious Emmy Noether lectures given in January. The Noether Lecturers have been women research mathematicians who have made fundamental and sustained contributions to the mathematical sciences. AWM, through its 1993-95 president Cora Sadosky, was instrumental in setting up similar lectures at the International Congress of Mathematicians.

11The guidelines for awards are the same as those for other NSF research awards.
12This conference was supported by NSA, NSF, MSRI, and the Rosenbaum Foundation.
AWM Awards
Each year at the January Joint Meetings prize session, AWM presents two awards. The Alice Schafer Undergraduate Prize for Outstanding Undergraduate Work by a Female Student, first awarded in August 1990, now includes established mathematicians among past recipients. The Louise Hay Award for Excellence in Mathematics Education was first given in 1991.

Panel Discussions
AWM holds panel discussions at the January Joint Meetings and at the SIAM Annual Meetings. As is evident from two of the topics, “Affirmative Action” and “How to Be a Successful Woman Mathematician”, these discussions concern issues of current interest in the profession as well as advice for young people. Sometimes controversial, always popular, they are among the most well-attended events at most meetings.

Other Societies, Public Relations, and Education Activities
The Association regularly participates in activities of other major organizations of the international mathematical and scientific community. AWM is a member of the Conference Board of Mathematical Sciences, a consultant and presenter for the Board of Mathematical Sciences, and an affiliate of the American Association for the Advancement of Science (AAAS). AWM has been a participant in all International Congresses of Mathematicians (ICMs) from 1974 onward, more recently helping to organize panel discussions among women of different countries and special Emmy Noether Lectures. It has participated in and organized symposia at the International Congress for Industrial and Applied Mathematics (ICIAM) since 1995. AWM has formed an Affiliated Research Group to assist with the national effort, led by the National Council of Teachers of Mathematics, to delineate standards for K-12 education in the U.S. At the 1998 Joint Meetings in Baltimore, AWM co-sponsored with the Mathematicians for Education Reform network (MER) a special session on evaluating faculty; another session is planned for 1999. The AWM president joins with officers of the other major mathematics, science, and engineering societies in activities to improve the public perception of mathematics and science and to increase federal (U.S.) support for research. In particular, AWM encourages members to speak with legislators about the importance of encouraging young women in science.

AWM Office
The AWM office has been at the University of Maryland since 1993. Judy Green, AWM treasurer from 1992 to 1996, helped set up the present office and its operations; meetings, membership, and marketing director Dawn Wheeler joined the staff at that time and conducted a major membership drive. After having a succession of various individuals and titles for the second full-time staff person, AWM recently hired a finances and grants administrator, Doug Farquhar, to work with the AWM treasurer, currently Amy Cohen. Some of the office expenses to support publications and programs are partially funded by unrestricted grants from the Exxon Education Foundation. Historical material about AWM continues to be kept at the Wellesley College Library under the supervision of AWM archivists Alice Schafer and Bettye Anne Case.

Speakers Bureau
AWM maintains a Speakers Bureau, a list of women in mathematics who are available to give talks to groups.

Networking Parties
Finally, AWM holds parties at meetings; these are large, joyful occasions with many opportunities for informal networking.

As former president Chuu-Lian Terng said, “The list of AWM activities is impressive, but many people probably do not realize that to continue having these programs requires enormous effort by the small AWM staff and by many women mathematicians writing proposals for funding, running the programs, and serving on various committees. During my term, I seemed to be constantly asking people to help AWM, and one of the most rewarding things about my job was that people would say yes and even seem honored to be asked. This says a lot about how our organization is perceived by the mathematical community.”

Issues of the 1990s
As we begin this section, it is important to note that some issues of AWM’s first twenty years seem to have almost disappeared in the 1990s. For example, in 1971 there were no invited addresses by women at the January Joint Meetings [ND91, p.12];
AWM Presidents of the 1990s and Their Initiatives

AWM presidents spend much of their terms (including when they are president-elect and past-president) applying for grants, consolidating the initiatives of previous presidents, and responding to various crises. Nevertheless, each has managed to put her own distinctive stamp on the organization. Here are the AWM presidents of the 1990s, their terms as president, and a few of the initiatives from their terms.

JILL MESIROV, 1989–91, began the ongoing AWM presence at SIAM Annual Meetings. She initiated AWM workshops, the Twentieth Anniversary Celebration, and revision of the AWM Resource Center at Wellesley College; and began the Schafer Prize and Hay Award.

CAROL WOOD, 1991–93, stabilized the organization through crises due to the growth in its activities, increased the influence of AWM in national policy, and led the Executive Committee in formulating its policy statement on conflict resolution. The booklet Careers That Count was produced and distributed to schools. At the end of Wood’s term, AWM had about 2,000 members.

CORA SADOFSKY, 1993–95, organized the move of AWM headquarters to the University of Maryland and the concurrent staff changes. She increased AWM’s international connections and involvement in science policy, in particular initiating (in coordination with other organizations) the first Emmy Noether Lecture at an ICM in 1994 and representing AWM at the International Congress of Mathematics Education in 1993.

CHU-LIAN TERNG, 1995–97, initiated a fund-raising drive (coordinated by Sylvia Wiegand), emphasized mentoring activities (including starting, with Karen Uhlenbeck and with liaisons to AWM, the Institute for Advanced Study/Park City mentoring program for women), and promoted discussion and writing about affirmative action. The Julia Robinson conference was held during this term.

SYLVIA WIEGAND, 1997–99, joined with officers of the AMS and other scientific societies to promote government funding for science and mathematics. One of the few presidents from the “heartland” of the U.S., she traveled and spoke on behalf of the AWM throughout the U.S., at the ICM, and elsewhere.

JEAN E. TAYLOR, 1999–2001, while president-elect, was a midwife to the creation of the AWM Web site, worked with others to strengthen the infrastructure of AWM, and is initiating a Corporate Task Force.

this was typical of the times, not an aberration. The “Milestones” section of this article demonstrates how different the 1990s have been in this regard. But some issues remain and others have surfaced.

Affirmative Action

In 1992, with a bad job market, some universities were rumored to be trying to make up for past inequities by offering no position unless a qualified woman could be hired; AWM president Carol Wood found this awkward for AWM and asked AWM members for advice on what to take [JF92]. Then, in January 1994, AWM president Cora Sadosky arranged an AWM panel on “Are Women Getting All the Jobs?”, which addressed the fear head-on that the job crisis, in Sadosky’s words, “would be much better if it were not for all those women and minorities or all those foreigners who are taking all the jobs” [MA94]. She added, “We strongly believe that this is false and dangerous, that pitting one group of under/unemployed mathematicians against another is just the old tactic of dividing people with similar interests in order to exploit them all.” Women were apparently not receiving preferential treatment: 18% of Ph.D.s from Group I mathematics departments went to women, but only 14% of those getting positions at Group I were women. Overall, 22% of all mathematics Ph.D.s were earned by women, and 21% of all entry-level positions at Ph.D.-granting institutions went to women [JF95]. Marie A. Vitulli and Mary E. Flahive’s article in the Notices (Vol. 44, March 1997) corroborates that women were not getting a higher percentage of entry jobs than men.

Affirmative action came under attack around the country in 1995. In response, the AWM published a series of articles in the Newsletter; the AWM Executive Committee passed an official AWM statement in support of affirmative action [JF96], and affirmative action was the topic of the 1997 January Joint Meetings panel discussion. A sampling of the opinions expressed follows: Mary Gray described how a program at American University had benefited many women and minority students; she asserted that such programs are necessary to combat years of discouragement [JA95]. Ronald Douglas observed that choices in hiring often are made to include less-represented disciplines and that when choosing speakers for conferences, a conscientious effort is made to achieve balance in fields and geography; these same arguments apply to achieving gender and ethnic balance [ND95]. Robion Kirby gave his view that “there is no significant discrimination on the basis of sex in mathematics” and that affirmative action programs for women are unnecessary” [RA95]. Hugo Rossi discussed the dilemma of an imaginary mathematics department that is concerned about maintaining “standards” and finds that this strict adherence to standards and consequent critical look at candidates results in the rejection of females and minorities, because it is assumed they are considered solely for diversification reasons [RA96]. In response to Rossi, Karen Tonso wrote that rigid adherence to fixed standards has historically kept the status quo for departments; it is necessary to analyze the contributions of diverse people in a new way [SO96]. Beth Ruskin described the success of certain policies for women and then answered Kirby with some statistics: for example, “Women who received Ph.D.s in 1994 or 1995 were almost twice as likely as men to obtain their first position in a department [that offered only a bachelor’s degree]” [MA96].

13This article is posted at the AWM Web site.
Two-Body Problem
The two-body problem of professional couples seeking jobs together is of particular concern for women mathematicians, who are frequently paired with men mathematicians. Enlarged and rephrased as "Is Geography Destiny?", this topic was discussed by a panel at the San Antonio meeting in January 1993 [MJ93]. Susan Landau praised departments with programs to assist spouses in finding positions, but concluded: "With rare exceptions, the problem of the two-career academic couple has been viewed as the problem of the individuals involved. That is a narrow view, as this complication affects a majority of women scientists" [MA94]. Beth Ruskai responded that single women also have difficulties and included some surprising data about their relative advancement, and James Humphreys pointed out the even greater difficulties faced by gay partners [MJ94].

Children
A central issue for nearly all professional couples, the child-care-maternity-leave policy issue has occasionally been addressed by AWM. In the beginning, when AWM was striving to be taken "seriously", there were doubts about whether this was a relevant subject for AWM. Now that women are more numerous in mathematics study and at entry levels of careers, this problem has become identified as an impediment to their advancement. The prime childbearing years often coincide with the years in which a female mathematician is establishing her career and working toward tenure. There is no consensus on an appropriate resolution to this conflict. Some women decide not to have children; others choose to give family concerns priority while hoping their careers will survive. Some couples postpone having children until after a tenure decision is made. Others manage reasonably successfully to combine two careers, marriage, and children. To young female professionals, this decision about childbearing may be serious and all-consuming. Some found the discussion between men and women mathematician parents of different ages in the January 1998 AWM panel on "Mathematicians and Families" to be particularly helpful [MA98].

From time to time, queries have come to AWM regarding child care at meetings, but the meetings staff at AMS say the need for liability insurance has made this cost prohibitive. Moreover, attempts by AWM to arrange cooperative child care have not received much business from parents. As for maternity leave, policies at most institutions have been nonexistent or haphazard; in 1991 a sample maternity leave policy to show employers was drafted by AWM [MJ91].

Nature vs. Nurture
AWM members and supporters have continually been obliged to expose pseudoscientific arguments that women have inherent mathematical deficiencies. There was a flurry of eloquent letters about this in the early 1990s, to the effect that cultural factors were sufficient to overwhelm any possible inborn component for differences in measured mathematical abilities between males and females [SO90, ND90, MA91, MJ91, JA91, JA92, MJ93, JA93].

AWM members, having fought to encourage young women in mathematics, were outraged when Mattel created a Barbie doll who said, "Math is tough"; the doll was eventually recalled (which probably made her especially valuable for collectors) [ND92, JF93].

Sexual Harassment
An AWM statement on sexual harassment was published in the Newsletter [ND93] and again in [MJ97]. The prominent case of Anita Hill, a female law professor at Oklahoma who testified at the confirmation of Supreme Court Justice Clarence Thomas that he had once sexually harassed her, was discussed in some Newsletters. In [JF92] a letter from Marjorie Senechal and Jean Taylor asserts: "Why did women mathematicians wait all these years to say anything about this issue, even to one another? Because, until Anita Hill's testimony, sexual harassment has been a private embarrassment."

Teaching Evaluations
In an article "Are student ratings unfair to women?" [SO90], Neil Koblitz analyzed data on student ratings of instructors by gender and concluded that students often rate the same performance differently for women and men. Women will be rated highly "only if they are especially accessible to the students and spend a lot of time with them, while men can receive equally high ratings while remaining more aloof." Also, "if an instructor feels compelled to put students under pressure [assigning a lot of homework, giving challenging exams], then...most students are inclined to 'punish' the instructor [by giving low ratings]. There is considerable evidence that the 'punishment' is more severe if the instructor is female." A psychologist agreed, "Female professors...appear to be evaluated according to a heavier set of expectations than are male professors, and these expectations affect student ratings. ... Those of us who evaluate female faculty must be alert to the various and subtle ways in which gender bias can affect perceptions and evaluations" [SO94]. Koblitz's article has been widely circulated by women mathematicians, who have found it useful in conversations with chairs, deans, and other administrators, not to mention graduate students and their fellow mathematicians.

Policy Matters vs. Individual Cases
The case of Jenny Harrison, a University of California at Berkeley mathematics department faculty member who was denied tenure and fought the decision, shook up the academic community and
commanded media attention. AWM members were divided about the case but were united in the opinion that AWM takes positions on policy matters, not individual cases [ND92, S093, ND93].

**Lobbying**
The 1990s have been marked by increasing activism within AWM to encourage adequate funding for mathematics by the U.S. government. In 1997 AWM officials joined with officials of the AMS, SIAM, MAA, and a hundred other scientific societies in a concerted effort to lobby the U.S. government in support of science (including mathematics) and education. AWM representatives participated in a press conference; spoke to congressional representatives, senators, and aides; and encouraged AWM members to help with this effort. Before this lobbying effort, funding in stable dollars had been decreasing for science and technology. Some legislators adopted science as something positive to promote, something that inspires general approval by the public, and as a result the NSF fared better than expected with a 4.7% increase (in real dollars) for 1998 over 1997. (For research the increase was 5% [MA97].)

**International Issues**
AWM's membership is international, and many of the issues it addresses are of concern outside of America. European women were inspired by AWM activities at the ICM in Berkeley in 1986 to found a sister organization, the European Women in Mathematics (EWM). At many ICMs, AWM has discussed problems encountered by women with other groups of women in mathematics. As a result of one of these discussions, EWM compiled a list of the percentages of women mathematicians as of 1994 in each of the various European countries [ND94]. The highest percentages of women in mathematics were in Portugal (40%-50%), Georgia (40%), Italy (35%), Poland (30%), and Bulgaria (30%). The lowest were in Iceland (0%), Finland (2%), Switzerland (2%), The Netherlands (4%), Ireland (5%), and Sweden (5%). In the Italian education system, typically a mathematics student begins advanced, specialized work at an earlier age; this makes it easier for women to combine a career in mathematics with having children. Terz described her impressions of the situation for women mathematicians in China, where changing education and other policies seem to have caused the percentage of women in mathematics to decline [JA95]. There are few women in mathematics in South Africa [S097] and Morocco [IF98].

**Milestones of the 1990s**
The following milestones show that the climate and the opportunities for women in mathematics in the 1990s are much brighter than in the past. Credit for the many wonderful accomplishments being made by individual women mathematicians goes to these individuals, although AWM can certainly claim credit for bringing to public awareness the previous lack of women.

**Speakers at ICMs**
Before the 1990s, Emmy Noether (in 1932) had been the only female Plenary Lecturer at an International Congress of Mathematicians (ICM). Then in 1990 (Kyoto) Karen Uhlenbeck was a Plenary Lecturer, in 1994 (Zurich) Ingrid Daubechies and Marina Ratner both were, and in 1998 (Berlin) Dusa McDuff was one of 21 Plenary Lecturers that year. In 1994, 8 other women delivered Invited Addresses at the ICM (out of a total of 152); in 1998, 11 did (out of a total of 165). Furthermore, in both 1994 and 1998 AWM and EWM jointly sponsored an Emmy Noether Special Lecture at the ICM, which was given by Olga Ladyzhenskaya in 1994 and Cathleen Morawetz in 1998. In the U.S. each January Joint Meeting from 1993 to 1998 has featured at least four invited hour addresses by women (including the AWM Noether Lecture as one of these); the specific numbers are five, four, eight, four, five. At the summer Mathfests in the 1990s, the Hedrick Lectures have twice been given by women. In fact, the major mathematics organizations have established guidelines that encourage organizers to include women; women often have leadership positions in these organizations or serve on program committees for meetings.

---

14The only data found for West Germany were from 1987, when the percentage was 3%.
15Some Italian women have added that mathematics in Italy has less prestige than in other countries and that mathematicians' salaries are low, and these could be results of or reasons for more women.
Governance by Women in Mathematical Organizations
In 1996 Cathleen Morawetz and Margaret Wright, presidents of AMS and the SIAM respectively, were part of an even more remarkable phenomenon: during that year women presided over eleven major organizations for mathematical scientists and educators in North America plus the umbrella scientific society, the American Association for the Advancement of Science. A number of these women were not the first female presidents of their organizations (for example, Julia Robinson was the first female AMS president, and mathematician Mina Rees the first female AAAS president), but it was extraordinary that so many women were presidents simultaneously. Many women mathematicians are active in all these organizations, as well as in the MAA (which had three female presidents in previous years), both in governance positions and as organizers and speakers at meetings.

Mathematics Competitions
For the first time in the twenty-four years of U.S. participation in the Olympiad, the 1998 U.S. team included a young woman, Melanie Wood, a silver medalist from Indiana. For the first time, the Canadian team included two young women: Mihaela Enachescu of Westmount, Quebec, and Yin (Jessie) Lei of Windsor, Ontario. Among the top twenty countries there were thirty-eight women.

Summing Up: The Effect and the Future of AWM
In its twenty-seven years of existence, AWM has helped, encouraged, and inspired many female mathematicians in the early years of their careers. AWM has poured an enormous amount of energy and resources into programs improving the representation and climate for women in mathematics. As past-president Terng said recently, "As a result of AWM] about half of the undergraduate degrees in math are now women, and there are many more strong young women researchers. Many departments are more conscious about the need for putting more effort into nurturing their women students." The AWM Sonya Kovalevsky Days, the publications, and all the efforts by AWM to make women more visible in mathematics have been effective.

Men Special to AWM
Many men have participated in AWM panels, contributed articles to the AWM Newsletter, and nominated women for AWM prizes (particularly the Schaefer Prize). Many male officers and employees of mathematical societies and government agencies have been extremely supportive of AWM activities. But four men have been especially praised in the Newsletter during the 1990s for their contributions to AWM and the advancement of women in mathematics. The first two are Lee Lorch and Chandler Davis for their support, advice, and assistance to AWM. "While our founding mothers were creating AWM, twenty-one years ago, Chandler was at their side," said the AWM message honoring Davis at his retirement party [ND92], and he quietly continues his assistance to this day. AWM honored Lee Lorch with a citation in January 1992: "To Lee Lorch, a founding member of AWM. ... Lee has often been a thorn in the side of the mathematical establishment. But then, to its credit, so has AWM. ... That mathematics has become more receptive to women and minorities owes much to Lee" [MA92].

The late Lipman Bers and Wilhelm Magnus were both eulogized in Newsletter's of the 1990s for their remarkable mentoring and success with women graduate students. Of Bers's 48 Ph.D. students, 16 were women [MJ94]; Magnus had 14 women Ph.D. students among his total of 62 [JA91].

There are still many ways that the situation for women in mathematics could be improved through further efforts by AWM. The current and future plans for AWM are in three areas: (i) infrastructure and funding, (ii) outreach projects, and (iii) networking.

In order to achieve results for women in mathematics and even to continue past successes, the infrastructure of AWM must be maintained and improved. AWM must have a well-functioning office, with its finances in good order, and operate with a good governance structure. AWM must also continue to pursue funding for its current high-quality programs.

In the area of outreach, AWM hopes to expand its high school programs, such as the Sonya Kovalevsky Days and the Careers That Count booklet, and to extend its efforts to the elementary grades. AWM hopes to cooperate more with other organizations to increase the participation of women in mathematics and science. At the undergraduate level, AWM hopes to help persuade more women undergraduates to study mathematics, to expose them to more women in mathematics, and to aid them in the process of learning mathematics so that they can succeed at a wide variety of graduate programs. At the graduate level, AWM will continue to encourage and assist with the formation of Noetherian Ring chapters (support groups for graduate students). AWM hopes to offer better mentoring of more recent
Solicitation for Applications

Visiting Research Professorship at MSRI

A joint project of the Mathematical Sciences Research Institute and the Hewlett-Packard Laboratories

The Mathematical Sciences Research Institute in Berkeley, California (MSRI) and Hewlett-Packard Laboratories in Palo Alto, California (HPL) seek to establish a position of HPL/MSRI Visiting Research Professor (VRP). The VRP will be housed at MSRI. The VRP will have no official duties, but will be expected to participate in the mathematical life and mentor postdocs at MSRI, and to interact with the mathematical staff at HPL.

The VRP should be a senior mathematical scientist who is internationally recognized as a leader in the discipline. No particular field of mathematics, pure or applied, is specified for the appointment, but preference will be given to candidates with wide-ranging interests, who can contribute in one or more of the upcoming programs at MSRI and the current areas of interest at HPL.

The upcoming programs planned at MSRI for 1999-2000 are "Galois Theory and Fundamental Groups", "Noncommutative Algebra", and "Numerical Applied Mathematics". MSRI is also interested in encouraging increased interaction of mathematics with other sciences such as physics and biology. More on these programs can be found at http://www.msri.org.

The current mathematical interests at HPL include information theory, source coding, error correcting codes, cryptography, computational number theory, finite fields and elliptic curves over them, analysis of algorithms and complexity, operations research, mathematical economics, probability theory and statistics, sequential decision problems, quantum physics, quantum computation, foundations of quantum physics, discrete mathematics, graph partitioning, graph matching, combinatorial optimization, theoretical materials science, random networks and percolation, distance geometry, computational biology and bio-informatics.

A one-year position will be offered this year, with starting date August 16, 1999. Future appointments may be from one to four years. Salary range for this position will be commensurate with the candidate's previous experience and with the intention to hire a mathematical scientist of the highest standing. Applications should be sent to the Director, MSRI, 1000 Centennial Drive, Berkeley CA 94720, before February 15, 1999. Applications will be processed as they come in. If you intend to apply, please let us know by January 25. Applications should include a curriculum vita and a statement of how the applicant views the possibilities for interaction with the mathematical programs at MSRI and HPL. Applications may also include a list of suggested references to which the search committee could write.

MSRI and HPL support the principles of equal opportunity and affirmative action.

Ph.D.s and advanced graduate students, and, in particular, to set up more mentoring pairs at the annual meetings. Such a mentoring program might also involve midcareer women.

As for networking, AWM intends to expand its efforts to connect women in mathematics at all stages, from K-12 students on up. It hopes to strengthen communication between AWM and the mathematical community, between women in industry and labs and women in academia, and between AWM volunteers and people from around the world. Furthermore, AWM intends to continue to enlist the aid of other organizations to monitor and speak out about inequities for women and underrepresented minorities and to work to reduce them.

Finally, here are some ways that people can assist AWM and the status of women in mathematics:

- Support and mentor women—junior faculty, undergraduates, and graduate students.
- Offer rigorous undergraduate programs and encourage women to take them.
- Encourage undergraduate women to apply for Research Experience for Undergraduates programs.
- Form support groups for women graduate students (e.g., a "Noetherian Ring").
- Join and help AWM, contribute articles to the Newsletter, and encourage others, especially young women, to join AWM.

Senior mathematicians may not realize the marvelous effect an encouraging comment can have on the ego of a young woman (or man) versus the negative effect of a tepid or disparaging comment. Our whole profession benefits from helping beginning and midcareer mathematicians attain their potential. AWM, or any organization that assists in developing future mathematical talent using the experience and expertise of established mathematicians, makes an outstanding contribution to our profession.

As Cora Sadosky observed, "Our Association really makes an impact on the situation of women in mathematics. And it is a great privilege to work for something that matters. ... Many gains have been made in the twenty-two years of existence of AWM. Still, women continue to face formidable problems in their development as mathematicians—from elementary school to graduate school to the National Academy and beyond. To successfully confront these problems, we need the ideas and the work, the enthusiasm and the commitment of all—students and teachers and researchers and industrial mathematicians—of every woman and every man who stands for women's right to mathematics" [MA93].
International Congress of Mathematicians

The lecture hall at the Technical University of Berlin, site of the Plenary Lectures for ICM98.

About 3,500 people attended the 1998 International Congress of Mathematicians (ICM98) in Berlin last August. The tremendous variety on the program ensured that there was always something interesting to do, leaving participants exhausted but satisfied. The meeting was in many ways a marvel, combining Germany's legendary efficiency with its deep cultural heritage.

Berlin's Culture on Display

It has been ninety-four years since the ICM was last held in Germany. The reason, of course, is that German mathematics nearly died out during World War II, when many of the country's best mathematicians fled the Nazi regime. ICM98 clearly meant a great deal to German mathematicians, as it provided an opportunity to heal the wounds of the past and to show the world that their country has regained some, if not all, of its mathematical strength. At the Congress, the chilling facts of Germany's past were not glossed over, but confronted directly. At the Opening Ceremonies, ICM Honorary President Friedrich Hirzebruch, who has been a central figure in the rebuilding of mathematics in postwar Germany, devoted nearly his entire speech to the subject. In particular, he called attention to a special ICM event organized by the Deutsche Mathematiker Vereinigung (German Mathematical Society) called "Terror and Exile: Berlin Mathematicians under the Nazi Regime 1933-1945".

Of all German cities, Berlin perhaps most potently symbolizes how much the country has changed in the past several decades. At times Berlin feels like one gigantic construction site, with new buildings going up everywhere. The western and eastern parts of the city have long since re­integrated, but there are many reminders of the Berlin Wall, from streets that dead-end in peculiar ways to memorials to those who perished trying to cross to the other side. Still, the city retains a great deal of old world elegance and grandeur, as well as a high degree of cultural sophistication, which was amply showcased during the Congress. It happened by chance that on the Saturday night during the ICM, Berlin held an event called "The Long Night of Museums", for which museums all over the city stayed open until 2 a.m. and offered special programs of music and dance. One of the main events on the ICM social program was a performance of The Magic Flute by the Deutsche Oper Berlin, for which ICM participants could purchase specially priced tickets.

In celebration of the ICM, the Berlin-Brandenburg Academy of Science sponsored a public lecture by the noted German writer Hans-Magnus Enzensberger. The title of his lecture was "Zugbrücke außer Betrieb, oder die Mathematik im Jenseits der Kultur: Eine Außenansicht" ("Drawbridge Out of Order, or Mathematics Outside of Culture: A View from the Outside"). Enzensberger pondered

Photographs used in this article are courtesy of Gerd Fischer.
ICM Honorary President Friedrich Hirzebruch (left) and Andrew Wiles.

the strange position of mathematics in today's society, in which people proudly proclaim their ignorance of mathematics but would never take the same attitude toward other parts of human culture, such as music. The lecture, which presented a view of mathematicians that was at once sympathetic and unsparing, drew rave reviews. "It was marvelous," said Hermann Karcher of the University of Bonn. "It is amazing that someone outside of mathematics could have so much insight into the field itself and its communication problems."

Mathematics für Alles

The Enzensberger lecture was part of an extensive program for the general public that took place in the Urania, a public lecture institute in Berlin. The stereotype of Germans as a dour, serious lot might lead one to suspect that this part of the ICM program would be filled with stuffy, instructive lectures. Quite the opposite was true. Fun and whimsy prevailed in the lobby of the Urania, where groups of young and not-so-young people gathered around the many mathematical games and puzzles on display. There was one contraption that makes enormous soap bubbles: Pull a cord, and a hula hoop-sized ring rises from a circular vat of soap solution, leaving a shimmering, tubular trail of a soap bubble. There was a festival of mathematical videos, as well as public lectures on such topics as mathematics and sculpture, and financial mathematics.

The ICM organizers worked hard in advance of the Congress to ensure that there was plenty of media coverage. Their work paid off in daily articles in the local German newspapers, as well as in a half-hour television broadcast about the Congress. To give reporters time to get a handle on the work of the Fields Medalists, the organizers gave newspapers information several months in advance. To keep the names secret, each medalist was initially given a code name, like "Quantum" and "Moonshine", but these were changed to numbers when it was realized they were too obvious. Generally the press was favorable toward mathematics, but there was at least one exception. Der Spiegel, one of the main nationwide news magazines in Germany, ran an unsigned article entitled "Nobelpreis für Quatsch" ("Nobel Prize for Nonsense"). The title referred to the work of Fields Medalist Richard Borcherds on the "moonshine" conjectures in the theory of finite simple groups. The story ridiculed the work of Borcherds and of Andrew Wiles (who received a special one-time award at the Congress) as lacking practical applications. Even when the story grudgingly acknowledged that the work of Fields Medalist Maxim Kontsevich was interesting, the jeering tone remained, as the story referred to Kontsevich as a "Milchgesicht" ("babyface"). Fields Medalists William Timothy Gowers and Curtis McMullen fared better, as they were not mentioned in the piece.¹

Efficiency Pays Off

Many at the Congress remarked on its efficient organization. This showed in many small ways—such as the fact that water, fruit juice, coffee, and tea were always available for free outside the lecture rooms—and in many large ones too—such as the extensive use of e-mail and the Web to communicate information about the Congress and to register participants. Another organizational feat was getting two of the three proceedings volumes published in time for participants to pick them up with their registration packets. The efficiency attracted some jokes: The ICM "circular letters" sent out in e-mail during the preceding year or so by Martin Grötschel, president of the organizing committee, were said to number in the thousands, but really totaled only thirty-four. In one of these letters Grötschel felt compelled to address complaints that the ICM was being "overorganized". But witnessing how smoothly the Congress ran, one might conclude that too much organization was just enough.

Consider the Opening Ceremonies, an especially complex event that was held in Berlin's International Congress Center. The musical interludes were accompanied by a light show projected onto a screen on the stage. There was a succession of speakers, some of whose presentations were accompanied by slides or short video programs, and all were flawlessly timed. (On the other hand, efficiency did not dictate every aspect: Two attractive young women with long blonde hair and very short skirts ferried the Fields Medals around the stage, calling to mind the presentation of trophies at an automobile race.) The most impressive display of efficiency came with the serving of a buff-

¹An article about the mathematical work of the Fields Medalists appears in this issue of the Notices. There was also a shorter report in the November 1998 issue, pages 1358-1361.
fet lunch to the 3,000 people who attended the Opening Ceremonies. The curtain on the stage went up, and a collective gasp rose from the crowd. There in the enormous backstage area stood a dozen or so waiters and waitresses, carrying trays of drinks, and behind them was the buffet lunch, laid out on several tables. No one had to leave the lecture hall to have lunch; they simply poured onto the stage. Although those who had sat in the far reaches of the auditorium had to wait in line quite a long time, everyone got fed.

The Scientific Program
The main part of the ICM scientific program consisted of twenty-one 1-hour Plenary Lectures, and more than one hundred fifty 45-minute Invited Lectures; there were also poster sessions and short communications of fifteen minutes' duration. Some participants commented that the Plenary Lectures were presented at just the right level for a general mathematical audience. Among the highlights was the lecture by Nevanlinna Prize winner Peter Shor of AT&T Labs. In the last few years, Shor has gained worldwide attention for his work on quantum computing, which he described in his lecture. His most famous result was to exhibit an algorithm that, if implemented on a quantum computer, could factor integers in polynomial time. Currently no such algorithm is known to exist for conventional computers. The simple and fundamental quality of the ideas in Shor's lecture appealed to many ICM participants. Some were so impressed that they said his work seemed more exciting than that of the Fields Medalists.

Quantum computing also arose in a highly speculative Invited Lecture by Michael Freedman of Microsoft Research, who spoke in the topology section. In recent years, Freedman, a 1986 Fields Medalist, has become interested in trying to use topology to address some of the central questions in theoretical computer science. He began his lecture by asking whether there is a "speed limit" on knowledge, akin to the limit on the speed of light: Is there inherent in the laws of nature an obstacle to solving certain very hard problems within a reasonable amount of time? Here "reasonable" means an amount of time that grows only polynomially with the size of the problem. After discussing the idea of quantum computing, Freedman proposed a new model called "quantum conformal field computing," which attempts to exploit connections between the Jones polynomial for knots and conformal field theory to attack hard computing problems that have not yielded to conventional algorithms.

The ICM organizing committee made room on the program for the Fields Medalists to present 45-minute ad hoc lectures (Curtis McMullen was already on the schedule to present an Invited Lecture in the dynamical systems section before the medals were announced). These lectures provided an opportunity for Congress participants to get a better understanding of the medalists' work. All of the medalists put in a lot of effort to make their talks comprehensible to a general mathematical audience. McMullen, known for being an excellent expositor, discussed the role that topological rigidity plays in dynamical systems. Borcherds provided an accessible lecture about his work on the "moonshine" conjectures in finite group theory and the development of the notion of vertex algebras. Rather than talk about his work in Banach spaces, which seems to be the reason for his getting a Fields Medal, Gowers spoke on his work on a problem of Szemeredi in arithmetic number theory. Kontsevich described some of his newest work concerning quantization of Poisson manifolds using ideas involving motives from arithmetic geometry.

The talks at the ICM demonstrated that classical questions in dynamical systems, such as questions about closed orbits, are alive and well. Examples include the Invited Lecture by Krystyna Kuperberg of Auburn University, who spoke on the real analytic counterexample she produced to the so-called Seifert Conjecture, a long-standing problem in this area, and the Plenary Lecture by Helmut Hofer of the Courant Institute, which approached these questions from the viewpoint of symplectic geometry. Christopher Deninger of the University of Münster presented an intriguing talk about an idea for a new kind of cohomology theory in number theory that has parallels to the cohomology theory that already exists for dynamical systems associated with foliations. If the theory works out as Deninger hopes, it would produce a vast generalization of the Weil conjec-
Fields Medalist Maxim Kontsevich, left, with Clifford Taubes of Harvard University, who spoke on Kontsevich's work.

Fields Medalist Richard Borcherds, left, with Peter Goddard of the University of Cambridge, who spoke on Borcherds's work.

Influence of physics was also notable in the Plenary Lecture of Peter Sarnak of Princeton University. He discussed the close parallels between the statistics of the spacing of the zeroes of the Riemann zeta function and the statistics of the distribution of eigenvalues of certain matrices, which physicists refer to as the Gaussian Unitary Ensemble. The picture of a phase transition familiar from physics—which shows a graph that is horizontal, suddenly dips sharply, and then becomes horizontal again—arose in surprising places, such as in the lectures of Freedman and McMullen. It also showed up in the Plenary Lecture by Persi Diaconis, in which he described a model for understanding the probabilities of distribution of cards after shuffling. It turns out that 6 shuffles tend to leave the cards in almost the same order, but there is a "phase transition" between 6 shuffles and 7, after which the cards tend suddenly to become randomly mixed. Diaconis described how the card-shuffling model can be generalized to more complicated problems, such as random walks on buildings.

The Plenary Lectures were held in a large auditorium in one of the buildings of the Technical University of Berlin, and the Invited Lectures were in smaller rooms in this building as well as in the mathematics building across the street. Some of these smaller rooms were packed to the rafters, with people sitting or standing in the aisles. In such cases it was clear that the talks were attracting specialists and nonspecialists alike, making it hard for speakers to know which group to address. As a result, there were some complaints that the Invited Lectures were not as understandable to nonspecialists as were the Plenary Lectures.

There were also complaints about scheduling conflicts among the Invited Lectures, which were presented in parallel sessions. There were a number of cases in which speakers in related areas were scheduled for the same time slot. Such conflicts are unavoidable, but they seemed especially abundant at this Congress and afflicted several areas, from geometry to fluid dynamics. One especially odd case concerned the talks of three geometers who work in very closely aligned areas: Yakov Eliashberg and Simon Donaldson, both of Stanford University, and Clifford Taubes. Before the Congress, Eliashberg complained to the organizing committee that Taubes and Donaldson had been scheduled to speak at the same time. Eliashberg hoped to attend both his colleagues' talks, but it was not to be. The organizing committee eliminated one conflict but created another: It moved Eliashberg to Donaldson's time slot, thereby putting Eliashberg at the same time as Taubes. After it became clear that there were many problems with conflicts between the talks in the geometry and topology sections, the organizers attempted to reschedule them in separate weeks of the Congress. However, the attempt came too late, as many of the speakers had already purchased nonrefundable plane tickets.

Although it was supposed to be a secret until the Closing Ceremonies, the fact that the next Congress will take place in Beijing in 2002 was widely known. (It had even been mentioned in the Notices [August 1998, p. 864].) Glossy posters announcing the event, which will take place in the Great Hall of the People in Tiananmen Square, were available well before the end of the Berlin Congress. Some expressed discomfort about holding the ICM in a country where human rights abuses have been a continuing problem. It is also not clear whether mathematicians from countries such as Taiwan would be allowed to attend. But perhaps Berlin will prove an exemplar for Beijing. ICM98 provided an opportunity for Germany to examine how the country's past abuses afflicted its mathematicians and to make a commitment to renewal. There could be no better precedent for the Beijing Congress.

—Allyn Jackson
Visual Explanations
Reviewed by Bill Casselman

Visual Explanations—Images and Quantities, Evidence and Narrative
Edward R. Tufte
Graphics Press, Cheshire, CT, 1997
ISBN 0-961-39212-6
156 pages; Hardcover, $45.00

Edward Tufte is a member of the political science department at Yale University whose work has apparently always had a mildly mathematical flavor. In 1975, while at Princeton University, he was asked to teach a seminar on statistics and statistical graphics. This seems to have been a turning point in his career. The eventual outcome was a series of three extremely attractive and intriguing books on what he calls information graphics—The Visual Display of Quantitative Information (1983), Envisioning Information (1990), and Visual Explanations (1997). Tufte was so concerned with quality and cost that he established his own press, which is dedicated exclusively to the publication of these books.

Pleasant books to look at, certainly. Not very expensive, considering the quality, which has been improving as new volumes appear, presumably because the endeavor has proven itself financially. And obviously not without relevance to at least some fields of applied mathematics and statistics, because much space in these books is spent discussing how to display large, complicated data sets. That was a major theme in the earlier volumes and still plays a role in the most recent one. But there is another theme of interest to a wider range of mathematicians. It started off modestly earlier in the series but has come to be more important in the most recent volume—how to use illustrations to explain complicated, even abstract, ideas effectively. For a mathematician, the most intriguing possibility that comes to mind is how to use illustrations in explaining mathematical proofs.

The first really striking example of this occurred in Envisioning Information, where Tufte spent several pages discussing Oliver Byrne's remarkable and appealing edition of Euclid's first six books. Briefly, what Byrne did in his edition of Euclid was to rewrite the arguments in pictures rather than in words whenever possible. But there are other examples in Tufte's books, much simpler ones, taken from the mathematics literature—notably the popup tetrahedron from the Billingsley 1570 translation of Euclid into English (Envisioning, p. 16), the illustration from Descartes's Principles of Philosophy (Explanations, p. 61), Mosteller's advice on lecturing (Explanations, pp. 69-70), and the diagrams of light passing through a prism illustrating Joseph Lohne's observations on the corruption in time of Newton's originals (Explanations, p. 83). A more curious, even tantalizing, connection with mathematics is the title page of Margaret Norris's The Notation of Movement "with an Introduction by H. Levy, M.A., D.Sc., F.R.S., Professor of Mathematics, Imperial College of Science & Technology". However, it is important to realize that much of what Tufte says about good graphic design in general applies to mathematics in particular and that there are lessons here for all of us who incorporate figures in our work. I want to illustrate this by working out in detail, in one relatively simple example, how one might apply Tufte's principles. I want to make clear in advance that I have

Bill Casselman is professor of mathematics at the University of British Columbia, Canada. His e-mail address is cass@math.ubc.ca.
no pretensions to expertise here, but offer the following exercise as an experiment, to be criticized freely.

In the example I want to show how graphics can be used to explain in an elementary way that the golden ratio is irrational. This is, of course, one of the oldest mathematical discoveries and perhaps the first truly astonishing one. There is much discussion in the literature—almost entirely speculative, of course—as to how this irrationality was first found. One common and reasonable speculation is that it was arrived at by geometric reasoning—not that geometry provided at first a completely rigorous proof in view of the then primitive state of Greek mathematics, but that at least provided a convincing chain of reasoning of some kind leading to the result.

The golden ratio is also the ratio between the side and diagonal of a regular pentagon, and what we shall actually prove is that the side and diagonal of a regular pentagon are incommensurable. Very briefly, the idea of the argument used here is to see that if the side and diagonal are both multiples of an interval $\epsilon$, then so are the side and diagonal of the smaller pentagon at the center of the five-sided star whose vertices are those of the original pentagon. Recursion leads to a contradiction.

I will begin by quoting a very traditional approach to this question from a 1945 paper by Kurt von Fritz on the discovery of incommensurability. Keep in mind throughout what is to follow that the point, as von Fritz says, is not merely to prove the result, but to make it “almost apparent at first sight.” My copy of the figure drawn by von Fritz appears below.

Here is what he writes:

... the diameters of the pentagon form a new regular pentagon in the centre, ... the diameters of this smaller pentagon will again form a regular pentagon, and so on in an infinite process. It is easy to see that in the pentagons produced in this way $AE = AB'$ and $B'D = B'E'$ and therefore $AD = AE = B'E'$, and likewise $AE = ED' = EA'$ and $B'E' = B'D = B'E$ and therefore $AE - B'E' = B'A'$, and so forth ad infinitum, or, in other words, that the difference between the diameter and the side of the greater pentagon is equal to the diameter of the smaller pentagon, and the difference between the side of the greater pentagon and the diameter of the smaller pentagon is equal to the side of the smaller pentagon, and again the difference between the diameter of the smaller pentagon and its side is equal to the diameter of the next smaller pentagon and so forth in infinitum. Since ever new regular pentagons are produced by the diameters it is then evident that the process of mutual subtraction will go on forever, and therefore no greatest common measure of the diameter and the side of the regular pentagon can be found.

There is nothing wrong in the logic of this treatment, although it does stumble around a bit. What we are interested in right now, however, is how the argument relates to the figure. The answer, I think it is fair to say, is “not well”. Reading the original article is even more difficult than apparent here because, as often happens, the text and figure are on separate pages. What I claim is that von Fritz stumbles precisely because he is trying to put in words what could have been far better put in pictures. His one figure is not really used in a serious way and essentially does no more than make the argument unambiguous. I also think it is fair to say that von Fritz is far from making the result apparent at first sight. Contrary to what he wants to do, he is preaching to the converted.

Of course, one might object that a paper over fifty years old cannot be held completely responsible for its graphics, but actually von Fritz does better than most. At least one much more recent example (pp. 31–32 in Peter Cromwell’s otherwise admirable book Polyhedra) is, as far as this matter goes, worse.

Let us see what help Tufte might be able to offer. The first step is to decide to take the graphics more seriously—to make the graphics the main part of the narrative rather than subsidiary to it. The next step is to integrate text and graphics better. This is von Fritz’s major failing, because in reading his argument, you are constantly forced to go back to the diagram, relocate yourself there, etc. A third is to determine which elements of the illustrations are important and then to emphasize them. In von Fritz’s figure there are only the la-

![Von Fritz's figure.](image)
belling of the vertices to orient the reader. But in fact the entities involved are not really the vertices at all, but instead various edges and subregions of the pentagon.

Perhaps the most succinct application of Tufte's principles is found in Chapter 4 of *Visual Expla­nations*, "The Smallest Effective Difference". It opens with a diagram of the ear taken from the *Random House Dictionary of the English Language*, which has a remarkable resemblance to von Fritz's diagram! Tufte redraws it to make it clearer by carrying through the following ideas:

- Tone down the secondary elements of a picture in order to reduce visual clutter, to clarify the primary elements of the figure, and also to eliminate unwanted visual interactions. Tufte calls this *layering* the figure to produce a visual hierarchy.
- Reduce discontinuity in the exposition by replacing coded labels in the figure by direct ones. The general principle is to integrate text and graphics. One point is that unnecessary eye movements are fatal to easy comprehension.
- Produce emphasis by using the smallest possible effective distinctions. In practice this often, but not always, means replacing bold, strongly contrasting colors by quieter shades. This is perhaps the hardest of all sins to avoid, since it is often extremely tempting for the beginner to introduce strong colors when possible.

To this list might be added a few ideas from elsewhere in Tufte's books:

- Eliminate parts of the figure that do not actually add to its content.
- Use what Tufte calls small multiples: numerous repetitions of a single figure with slight variations.
- Make the graphics carry a story.

All of these are nearly self-evident principles, and if the use of graphics in mathematics were more sophisticated than it is now, one might consider this an objection to Tufte's books. Here now is the argument I have made up in an attempt to apply these principles:

The basic fact is that in a regular pentagon a diagonal and the side opposite to it are parallel. This property in some sense characterizes the regular pentagon.

As a consequence, the shaded region shown at right is a parallelogram all of whose sides are equal (a rhombus).

Assume now that the side $s$ and diagonal $d$ are commensurable, which is to say that they are both multiples of a common interval $e$.

Then $d - s$ is also a multiple of the interval $e$.

And so is the interval we get in the middle of the diagonal, which has length $d - 2(d - s) = 2s - d$.

But this interval is the side of the smaller pentagon at the center of the star we get by drawing all diagonals.

The figure emphasized in the diagram to the right is a parallelogram, since opposite sides are parallel to the same side of the pentagon. Therefore the quantity $d - s$ is the diagonal of the smaller pentagon.

Therefore under the assumption that the diagonal and side of a pentagon are multiples of a common interval $e$, we deduce that so are the side and diagonal of the smaller pentagon inscribed in it.

We can reason in the same way about the pentagon in its interior in turn, etc. The interval $e$ will divide all the sides and diagonals of the infinite series of pentagons we get. But eventually the sides of those pentagons will be smaller than $e$, a contradiction.
I imagine that some readers will find my argument distasteful. I am, however, in good company. It is no less than J. E. Littlewood who points out (p. 54 of the Miscellany).

A heavy warning used to be given that pictures are not rigorous; this has never had its bluff called and has permanently frightened its victims into playing for safety.

The validity of using pictures in proofs goes back to the origins of Greek mathematics and indeed to the origin of the word "graphics" in a Greek word that, there is reason to believe, had the double meaning of "picture" and "proof" (Heath I, p. 203). In my experience, criticism to the effect that pictures are not proofs usually means that the critic is accustomed to some kinds of picture proofs but not others. I have yet to see an explanation of Pythagoras's Theorem, for example, without a picture—and the clearest proofs are certainly those which would be almost impossible to reduce to mere words. Such criticism also often means that the critic cannot imagine constructing the pictures accompanying the proof, but that is another problem—a question of time, energy, and skill rather than capability. As I have said elsewhere, it is unfortunate that the revolution in mathematical typesetting brought about by \TeX\ has not been matched by one in mathematical graphics. It is not easy to see how to make the right technology available to those who can use it and how much work or even artistic talent one can reasonably expect from an author. Tufte says in the \verb+www.amazon.com+ interview about why he found himself in a new career: "I could both see and count. Usually those skills are not found together." It may very well be true that many mathematicians are skillful at visualization, but this does not mean they can see what is in front of them.

Because of computers we are now in an era where art and mathematics can collaborate in a way not seen since the Renaissance and where it does not take the skills and imagination of Leonardo to do interesting and valuable work. The opportunity of the moment is probably unique. It may not be long before exploration is replaced by settlement.

Final Remarks about Tufte's Books
If you want only one of the three books, then Visual Explanations is probably the most useful, although Envisioning is arguably the most attractive. There is a noticeable redundancy among the books, which is mildly annoying. On the other hand, each of the three contains a few unique gems.

Technical Remark
The pictures in this note were produced directly in PostScript. The advantage of doing this is that one has virtually complete control over the final product, albeit with a fair amount of work. There are other possibilities—one very fine recent example of mathematical graphics at a high level is Needham's Visual Complex Analysis, which used quite different tools.

References

Also of interest are the interviews with Tufte on the Internet at \verb+www.amazon.com+ and \verb+http://www.ercb.com/feature/feature.0008.2.html+. 
The thesis of this interesting and provocative book is that modern civilization is largely distinguished by its successful efforts first to understand and then to control risk. These efforts use, in part, tools of risk management that only became possible after the development of the mathematical subjects of probability and statistics. The author's method is largely historical and biographical: the five parts of the book cover the periods before 1200, 1200–1700, 1700–1900, 1900–1960, and 1960 to the present; the chapters in each part contain a series of one or more vignettes of important contributors to the subject. Many familiar names crop up—Cardano, Pascal, Fermat, Graunt, the Bernoullis, De Moivre, Bayes, Laplace, Galton, Keynes, and von Neumann—but also a number of individuals who will be less familiar: Baumol, Knight, Markowitz, Leland, Rubinstein, and Thaler.

Peter L. Bernstein is the president of a consulting firm for institutional investors and the author of six books on economics and finance. He brings an unusual and novel perspective to his historical survey of the development of the mathematics of chance and uncertainty. In the same chapter in which he discusses the work of John Graunt, for example, whose Natural and Political Observations Made upon the Bills of Mortality (1662) stands as the first great example of modern statistical data analysis, Bernstein also spends some time telling us about the genesis of Lloyd’s of London, the famous insurance firm. This weaving of topics that are standard in the history of probability and statistics with many that are not is one of the strengths and attractions of the book. Another is the obvious zest with which Bernstein describes the many intriguing people and tantalizing mysteries so peculiar to the mathematics of chance.

The subject is certainly not lacking in its mysteries. The first great puzzle in its history is just why it took so long for the mathematics of chance to develop. The ancient Greeks certainly had both the necessary mathematical abilities and recreational interests, and yet there is not a hint of a systematic mathematical treatment of gambling in either their literature or that of the Middle Ages. Many explanations—mathematical, conceptual, and economic—have been proposed for this. The philosopher Ian Hacking, for example, whose influential and important book The Emergence of...
Probability (1975) created a resurgence of interest in the history of probability, suggested that a necessary and special concept of evidence, absent before the seventeenth century, had been a necessary precursor for the development of the mathematics of chance. This provocative if not entirely convincing thesis was inspired by the ideas of the controversial French structuralist philosopher Michel Foucault. Bernstein opts for a much more standard explanation: that a suitable notion of chance event was lacking.

The first book on the mathematics of games of chance in fact dates to the sixteenth century: the Liber de Ludo Alaeae of Girolamo Cardano. Cardano was, by any account, a most curious figure. In his day a famous physician, he was also a mystic, a polymath, and a prolific author, best remembered by mathematicians today as the author of the Ars Magna (1545), which contains the first general discussion of the solution of the cubic equation. Mathematicians often live relatively uneventful lives, but Cardano did not. After persuading a reticent Nicolo Tartaglia to divulge his solution of the cubic under a strict pledge of secrecy, Cardano many years later described it in the Ars Magna. Even though Cardano acknowledged Tartaglia's priority, this incident sparked an extended and venomous exchange between the two. (Cardano's brilliant student Ferrari went on to provide a similar solution for the quartic.) Perversely, Cardano did not publish his own discoveries in the mathematics of gambling; they first appeared in print nearly a century after his death.

The colorful Cardano is by no means unusual, for probability has, by any measure, a history replete with curious figures. There is the ascetic Blaise Pascal, who abandoned mathematics and the world to spend his last years as a Jansenist monk penning the Pensees that would win him immortality. There is the secretive James Bernoulli, a member of an enormously gifted but highly competitive family, whose proof of the law of large numbers (the first major limit theorem in mathematical probability) in his Ars Conjectandi (written around 1685) languished for nearly twenty years while he pondered its significance and ultimately appeared in 1713, eight years after his death. There is the Huguenot refugee Abraham De Moivre, who fled France in 1688 after the revocation of the Edict of Nantes three years earlier, but who, despite his membership in the Royal Society and friendship with Newton, was unable to obtain a university position and ended up spending his days teaching students and consulting at Slaughter's Coffee House in the Strand. Cardano and Bernoulli were not the only two who published only after they perished. There is the mysterious (but "ingenious", as many later described him) Thomas Bayes, whose mathematical works—published only after his death by his friend Richard Price—included both a short note pointing out for the first time the divergent nature of the asymptotic series for log n, as well as his longer and more famous "Essay towards solving a problem in the doctrine of chances", later to bring him eponymous fame as the founder of "Bayesian statistics".

Following de Moivre and Bayes, dominance in mathematical probability (as in so many other mathematical subjects after the death of Newton) passed from England to France. The Marquis de Condorcet, one of the philosophes, enthusiastically argued for the uses of probability in arriving at a more rational judicial system before he, like the chemist Lavoisier, perished in the irrational terror of the French Revolution. (The Marquis was the victim of his aristocratic background and perhaps also of his fondness for omelettes: legend has it that his lineage was betrayed at a country inn by the large number of eggs he requested in an omelette). Condorcet's younger contemporary, Pierre Simon, the Marquis de Laplace, was at once both more politically agile and more mathematically powerful. He survived the Revolution and so lived to write his masterpiece, the Théorie Analytique des Probabilités, in 1812—a work whose subjective view of the nature of probability dominated the subject for nearly a century. Then the pendulum finally swung back to England and the English school of biometricians—Galton, Edgeworth, Pearson, Gosset, and Fisher—who, eclectically building on these foundations, crafted the beginnings of modern statistical science, applying the mathematics of chance to the collection, summarization, and analysis of data.

This initial part of Bernstein's book is related with vigor and enthusiasm. It is not the work of a professional historian, but this does not seem particularly important; the book is for the most part accurate in its details and certainly accurate in the overall picture it conveys. There are some minor errors of fact (for example, Cardano, who was born in 1501 and died in 1576, is reported to have been born "about 1500 and died in 1571"). Such errors as exist, however, are neither particularly serious or pervasive, and to harp on them would be churlish and misleading. Bernstein's purpose is to depict the rise of risk management, combining many different strands in a long and complex story, and in this he certainly succeeds.
Perfect PDE Texts

Have you ever wished for the “perfect” PDE text? What would you want it to include? Would you expect a detailed and comprehensive overview, covering historical as well as contemporary advances? Would you want the book to be useful for a broad audience, including theorists, applied scientists and/or professors? How would you face such a demanding task? Read on to see how the AMS defined the “perfect” PDE presentation and met the challenge of making it accessible.

First, what would the book contain? Start with the general theory: the Dirichlet and Neumann problems, Cauchy’s problem, characteristics, etc. Add any significant advances made since the sixties. Include today’s cutting-edge research developments: results on nonlinear PDEs, the modern interplay between functional analytic insights, calculus-type estimates within the context of Sobolev spaces, etc. Once you’ve compiled this extensive information, you would present it in a way that would appeal to a wide audience with different approaches to one topic—PDEs. Sounds like you’ve got potential for the perfect PDE book, doesn’t it?

Such a detailed and comprehensive tome would be invaluable. Postdocs, researchers, lecturers, pure and applied mathematicians and physicists would clamoring for a copy; correct? Not really. The practical considerations of producing this “perfect” PDE text render the idea unrealistic. This “perfect” text would be a monumental undertaking that would be exhausting, overly expensive, and run to several thousand pages! The “perfect” PDE text sounds great in theory, but the reality of preparing the actual book seems more prohibitive than utilitarian!

The AMS has an alternate solution to the single “perfect” PDE text. It is a solution that is both economical and practical: three outstanding volumes containing detailed and comprehensive information for a broad readership. The texts span PDE research from historical development through current results. The volumes outline PDE development and offer a unique perspective illustrating how we got from “there” to “here”. The texts are suitable for research needs, applied purposes and/or classroom instruction. Each volume is affordably priced and elegantly produced by the AMS. Ordering and AMS contact information is listed below.

Harold Levine, Stanford University, CA

Partial Differential Equations

The book by Levine is a classical approach to PDEs, treating the fundamental general questions and covering the core equations derived from mathematical physics.

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

AMSTP Studies in Advanced Mathematics, Volume 6; 1997; 706 pages: Hardcover; ISBN 0-8218-0775-7; List $65; All AMS members $55; Order code AMSTP/6NA

P. R. Garabedian, New York University, New York

Partial Differential Equations

Garabedian’s treatment includes the classical topics, but is, at heart, informed by the needs of the applied mathematician. In particular, he has chapters on the method of finite differences and on fluid mechanics.

AMS Chelsea Publishing; 1994; 672 pages: Hardcover; ISBN 0-8218-1377-3; List $68; All AMS members $51; Order code CHEL/68NA

Lawrence C. Evans, University of California, Berkeley

Partial Differential Equations

Evans takes the most modern approach to the subject, but without becoming diverted into a course on functional analysis. Roughly one third of the book deals with nonlinear equations. There is also an emphasis on understanding generalized solutions.

Graduate Studies in Mathematics, Volume 19; 1998; 662 pages: Hardcover; ISBN 0-8218-0772-2; List $75; All AMS members $60; Order code GSM/19NA

More fine PDE texts from the AMS

Basic Partial Differential Equations

David Bleecker and George Csordas, University of Hawaii, Honolulu

A publication of International Press.

This book is for those who believe that a PDE course should do more than disseminate facts and recipes. There are approximately 280 examples worked out in detail, and 600 exercises ranging from routine to quite challenging. All graphs of mathematical functions of one or several variables were computer-generated, including surfaces of various spherical harmonics, Bessel functions, and nodal curves for vibrating drums.

Distributed worldwide, except in Japan, by the American Mathematical Society.

International Press; 1996; 735 pages: Hardcover; ISBN 1-57146-039-5; List $99; All AMS members $47; Order code INPR/23NA

Fully Nonlinear Elliptic Equations

Luis A. Caffarelli and Xavier Cabré, Institute for Advanced Study, Princeton, NJ

The book marks an important stage in the theory of nonlinear elliptic problems. Its timely appearance will surely stimulate fresh attacks on the many difficult and interesting questions which remain.

—Bulletin of the London Mathematical Society

Well written, with the arguments clearly presented. There are helpful remarks throughout the book, and at several points the authors give the main ideas of the more technical proofs before proceeding to the details… will certainly be of interest to researchers and graduate students in the field of nonlinear elliptic equations.

—Bulletin of the American Mathematical Society

This book is suitable as a text for graduate courses in nonlinear elliptic partial differential equations.

Colloquium Publications, Volume 49; 1995; 164 pages: Softcover; ISBN 0-8218-0457-5; List $29; All AMS members $23; Order code COL/49NA

Lectures on Elliptic and Parabolic Equations in Hölder Spaces

N.V. Krylov, University of Minnesota, Minneapolis

The author has fully achieved his goal… and has written an impressive book that presents nice material in an interesting way… this book can be recommended as a thorough, modern and sufficiently broad introduction to partial differential equations of elliptic and parabolic types for graduate students and instructors (and also for individual study) in mathematics, physics, and (possibly) engineering.

—Mathematical Reviews

Graduate Studies in Mathematics, Volume 12; 1996; 164 pages: Hardcover; ISBN 0-8218-0569-X; List $29; All AMS members $23; Order code GSM/12NA

All prices subject to change. Charges for delivery are $3.00 per order. For optional air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from American Mathematical Society, P.O. Box 6931, Providence, RI 02940-0693, USA. For credit card orders, fax 1-401-455-4446 or call toll free 1-800-321-AMS (4447), in the U.S. and Canada 1-800-453-4000 worldwide. Or place your order through the AMS bookstore at www.ams.org/bookstore/. Residents of Canada, please include 7% GST.
This is, of course, a very broad canvas to depict, and it is not surprising that some parts of his synthesis are more effectively drawn than others. It is in the second half of the book that Bernstein seems particularly in his element, as he discusses the work of Arrow, Keynes, Knight, and von Neumann on game theory (Chapter 14); Harry Markowitz on portfolio selection (Chapter 15); Kahneman and Tversky on prospect theory (Chapter 16); Thaler, Shefrin, and Statman on behavioral finance (Chapter 17); and the use of derivatives and other financial instruments in risk management (Chapter 18). The author tells this part of his history with an attractive verve, and, if anything, one finds oneself wishing that he had spent even more time on this portion than he does.

The book does have some weaknesses. One is that its presentation of certain topics in statistics is occasionally confused or confusing. (The discussions of normality and its relationship to independence on pp. 144-150 and of regression to the mean on pp. 167-170 and 173-174 are two examples.) On the other hand, Bernstein's discussion of many other topics (for example, the binomial distribution and the work of Kahneman and Tversky) are models of clarity, outstanding examples of popular exposition. The book also resorts on a number of occasions to an unnecessary hyperbole. Is it really the case that "Nothing is more soothing or more persuasive than the computer screen" (p. 336) or that "Proponents of chaos theory ... claim to have revealed the hidden source of inexactitude" (p. 332)? Surely not.

But these are minor blemishes. Bernstein has written an interesting, amusing, unpretentious, and attractive book. It discusses a number of neglected topics, provides a fresh outlook on some of the more standard ones, and should stimulate many of its readers to go further into both the fascinating literature of the history of probability and statistics and modern economic applications of these subjects.

### IAS/PARK CITY
#### MATHEMATICS INSTITUTE

A three-week summer program for:
- undergraduate students
- graduate students
- high school teachers of mathematics
- mathematics researchers
- undergraduate mathematics faculty
- researchers in mathematics education

**Organizers:**
- Karl Rubin, Stanford University
- Brian Conrad, Harvard University

**Lecturers:**
- Graduate Summer School: Fernando Quedras Gouveia, Colby College; Joe P. Buhler, Reed College; Ralph Greenberg, University of Washington; Kenneth Ribet, UC Berkeley; Alice Silverberg, Ohio State University.
- High School Teacher Program: Susan Addington, California State University at San Bernardino; Cynthia Hays, McCallum High School (Texas); James King, University of Washington; John Polking, Rice University.

**Organizers:**
- Undergraduate Program: Robert Bryant, Duke University.
- Undergraduate Faculty Program: Daniel Goroff, Harvard University.
- Mathematics Education Research Program: Timothy Kelly, Hamilton College.

Contact: IAS/PCMI, Institute for Advanced Study, Olden Lane, Princeton, NJ, 08540; 1-800-726-4427; email: pcmi@math.ias.edu; url: http://www.ias.edu/park.htm.

PCMI is a program of the Institute for Advanced Study, Princeton, NJ, and receives major funding from the National Science Foundation.

Financial support is available.

### New in General Interest

**M-Theory**

Edward Witten, Institute for Advanced Study, Princeton, NJ

The problem of unifying quantum mechanics and gravity in a single coherent theory represents an enormous obstacle to full understanding of the forces of nature. The mysterious M-theory has emerged as a likely candidate for such a unifying theory. Whether the “M” stands for “matrix” or “membrane”, one can see in the area of research is among the most exciting and most profound in all of science today. Edward Witten, one of the world’s boldest innovators in this field, provides insights into this extraordinary development in a completely expository presentation. Students and researchers specializing in mathematics and physics will find this lecture especially appealing. However, because it is completely non-technical, large parts of it can easily be appreciated by viewers with little or no scientific or mathematical training.

1996; NTSC format on one-half inch VHS videotape, approximately 60 minutes; ISBN 0-8218-1350-1; List $34.95; Individual member $31.45.

Order code VIDE0101NA
Mathematics People

Copley Medal Awarded to Lighthill

The 1998 Copley Medal of the Royal Society has been awarded posthumously to M. James Lighthill. The award recognizes his profound contributions to many fields within fluid mechanics, including important aspects of the interaction of sound and fluid flow and numerous other contributions that have had practical applications in aircraft engine design. He is also noted for his groundbreaking work on both external bio-fluid dynamics, the analysis of mechanisms of swimming and flying, and internal bio-fluid dynamics, including flow in the cardiovascular system and the airways and cochlea mechanics and other aspects of hearing.

—From a Royal Society announcement

Visiting Mathematicians

(Supplementary List)

Mathematicians visiting other institutions internationally during the 1998-99 academic year were listed in the June/July 1998 issue of the Notices, pp. 730-31; August 1998 issue of the Notices, p. 885; the September 1998 issue of the Notices, p. 994; and the October 1998 issue of the Notices, p. 1177. The following is an update (home country is listed in parentheses).

MARCIA D'ELIA BRANCO (Brazil), University of Connecticut, Bayesian Modeling, 9/98-8/99.
TATHAGATA BANDOPADHYAYA (India), University of Windsor, Analyses of Count Data, 5/99-10/99.
SARJINDER SINGH (India), University of Windsor, Statistics, 8/98-2/99.

Deaths

STEFAN DRIBOT, Ohio State University, Columbus, died on September 29, 1998. Born on August 7, 1913, he was a member of the Society for 23 years.

ALFRED GRAY, professor at the University of Maryland, College Park, died on October 27, 1998. Born on October 22, 1939, he was a member of the Society for 36 years.

PATRICIA JAMES EBERLEIN, professor emeritus at SUNY at Buffalo, died on August 31, 1998. She was a member of the Society for 45 years.

ANZELM IWANIK, professor at Wroclaw University of Technology, Poland, died on September 28, 1998. He was a member of the Society for 17 years.

ERNEST JUCOVID, professor at PJ Safarik University, Kosice, Slovak Republic, died on October 21, 1998. He was a member of the Society for 23 years.

Grundman Named Bunting Scholar

HELEN GRUNDMAN of Bryn Mawr College has been selected as a Science Scholar for the 1998-99 academic year at the Mary Ingraham Bunting Institute of Radcliffe College. Her area of research is the rationality of Hilbert modular varieties. She will deliver a Colloquium Lecture at the Institute in February of 1999 on the topic “Using Number Theory to Study Certain Six-Dimensional Objects”.

The Bunting Institute is a multidisciplinary research center for women scholars, scientists, artists, and writers and provides one of the major fellowship programs for the support of women doing advanced study in the United States. For further information about Bunting Institute programs, consult the World Wide Web page http://www.radcliffe.edu/bunting/index.html, or contact the Bunting Institute, 34 Concord Avenue, Cambridge, MA 02138; telephone 617-495-8212.

—From a Bunting Institute announcement
Mathematics Opportunities

IBM Herman Goldstine Fellowship in Mathematical Sciences

The Mathematical Sciences Department of the IBM T. J. Watson Research Center invites applications for its 1999-2000 Herman Goldstine Fellowship in Mathematical Sciences for research in mathematical and computer sciences. 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 experience on technical problems arising in industry.

Candidates must have a doctorate and not more than five years of postdoctoral professional experience at the time the fellowship begins. The fellowship covers a period of one year and may be extended an additional year by mutual agreement. It carries a stipend of at least $70,000; the actual amount will depend on the experience of the recipient. An allowance for moving expenses is included.

The deadline for application is January 8, 1999. Further information is available by e-mail from mathfell@us.ibm.com or by writing to Herman Goldstine Fellowship Committee, Department of Mathematical Sciences, IBM Research Division, T. J. Watson Research Center, P. O. Box 218, Room 31-210, Yorktown Heights, NY 10598.

—From an IBM T. J. Watson Research Center announcement

Mittag-Leffler Institute Postdoctoral Grants

The Mittag-Leffler Institute announces a number of grants for the year 1999-2000. The program of the Institute starts on September 1 and ends on May 31. The grants are intended for recent Ph.D.s or advanced graduate students and amount to SEK 12,000 per month. Preference will be given to applications for longer stays, either for one semester or for the whole year.


The program committee consists of Mats Essen, Catherine Bandle, Björn Gustafsson, Vladimir Maz'ya, Henrik Shahgholian.

Applications should be submitted on an application form (obtainable from the Institute). Request for application forms can also be sent via e-mail to koskull@ml.kva.se. Applications should be sent to: The Board of the Mittag-Leffler Institute Auravägen 17 S-182 62 Djursholm, Sweden before March 31, 1999. Decisions on awards will be made by mid-April, 1999.

Inquiries may be directed to: Kjell-Ove Widman, Institut Mittag-Leffler, Auravägen 17, S-182 62 Djursholm, Sweden, widman@ml.kva.se, and Matts Essen, Dept. of Mathematics, University of Uppsala, P.O. Box 480, S-751 06 Uppsala, Sweden, matts.essen@math.uu.se.

—Mittag-Leffler Institute announcement

SIAM to Present Dahlquist Prize

The Society for Industrial and Applied Mathematics (SIAM) will present the Dahlquist Prize at the Fourth International Congress on Industrial and Applied Mathematics (ICIAM 99) in Edinburgh, Scotland, July 5-9, 1999. The award honors the contributions of Germund Dahlquist to numerical analysis and scientific computing.

The prize, established in 1995, is awarded to a young scientist (normally under age 45) for original contributions to fields associated with Germund Dahlquist, especially the numerical solution of differential equations and numerical methods for scientific computing. The award includes a certificate containing the citation and a cash prize of $1,000 plus reasonable travel costs to ICIAM 99. The recipient is expected to present a talk at the conference and is encouraged to submit a paper to an appropriate SIAM publication.

Letters of nomination, including a description of the nominee's achievements, should be sent by January 15,
1999, to the Dahlquist Prize Selection Committee, c/o Alison Bogardo, Society for Industrial and Applied Mathematics, 3600 University City Science Center, Philadelphia, PA 19104-2688. Supporting letters, or names of knowledgeable persons from whom such letters might be solicited, are also welcome.

—SIAM News Release

VIGRE Grants for Integrated Research and Education

The Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) has announced a new program solicitation for Grants for Vertical Integration of Research and Education (VIGRE). These grants provide support to Ph.D.-granting mathematics departments for the development of innovative educational programs that are integrated with research activities. The intent is to provide meaningful educational experiences for undergraduate and graduate students and to encourage professional development at the postdoctoral level and beyond.


There will be two competitions. Proposals for the first are due on February 16, 1999 (a letter of intent is due January 15, 1999); proposals for the second are due on July 19, 1999 (with letter of intent due June 18, 1999). The competition is open to all qualified departments that have not received VIGRE awards.

—Elaine Kehoe

EDGE Summer Program

Spelman and Bryn Mawr Colleges extend a special invitation to women who will be entering graduate programs in mathematics in the fall of 1999 to participate in a postbaccalaureate summer enrichment program. The Enhancing Diversity in Graduate Education (EDGE) Program will consist of a four-week summer session and an accompanying graduate school mentoring and support network component. The summer program consists of two core courses in analysis and algebra/linear algebra. A set of mini-courses in vital areas of mathematical research, short-term visitors from academia and industry, guest lectures, graduate student mentors, and problem sessions will round out the summer experiences.

Applicants to the program should be women who are (i) graduating seniors who have applied to graduate programs in the mathematical sciences, (ii) recent recipients of undergraduate degrees who are now entering graduate programs, or (iii) first-year graduate students. All applicants should have completed standard junior-senior level undergraduate courses in analysis and abstract algebra and have a desire to earn the doctorate degree. Women from minority groups who fit one of the above three categories are especially encouraged to apply. Final acceptance to the program is contingent upon acceptance to a graduate program in the mathematical sciences.

The 1999 summer session will be conducted on the campus of Spelman College, Atlanta, GA, June 14–July 9 and codirected by Sylvia Bozeman (Spelman College) and Rhonda Hughes (Bryn Mawr College). A stipend of $1,800 plus room and board will be awarded to participants.

The application deadline is March 1, 1999. Applications should be sent to: EDGE Program, Box 270, Spelman College, Atlanta, GA 30314.

Visit the program’s Web site at http://www.brynmawr.edu/acad/math/.

Major funding for this program is provided by the National Science Foundation.

—Sylvia Bozeman and Rhonda Hughes

News from MSRI

The Mathematical Sciences Research Institute (MSRI) in Berkeley, California, and Hewlett Packard Laboratories (HPL) are pleased to announce the beginning of the new Visiting Research Professor (VRP) program. This position, funded by HPL, is intended for a senior mathematical scientist, of the highest research qualifications, who can contribute to the programs at MSRI and HPL. The first VRP will be a one-year position beginning in fall 1999; subsequent appointments may be for longer duration. The program is similar to a program run by HPL jointly with the Isaac Newton Institute in Cambridge, England.

The VRP program extends a collaboration between MSRI and HPL that began in 1998 with the MSRI/HPL internships. Under this program an MSRI postdoc can spend the two summer months preceding his or her fellowship, three days per month during the fellowship, and possibly the two summer months after the fellowship consulting in one of HPL’s research groups. These postdocs are fully funded by HPL. The first two MSRI/HPL interns began last summer. They are Michael Rubinstein (elliptic curves and random matrix models) and Paul Gross (nonlinear dynamics). For the year 1999–2000 HPL intends to fund up to four such positions at MSRI. MSRI has initiated further internship programs with Microsoft Research and the National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratories; these will begin in the year 1999–2000 if there are suitable candidates.

Information on both these programs may be found on MSRI’s Web site, www.msri.org/. The postal address is MSRI, 1000 Centennial Drive, Berkeley, CA 94720-5070. The telephone number is 510-642-0143. Deadline for applications is February 15, 1999. Prospective applicants are requested to inform MSRI by January 25, 1999, of the intent to apply.

—MSRI
For Your Information

NSF-Funded Institutes Recompetition

In 1997 the Division of Mathematical Sciences (DMS) of the National Science Foundation (NSF) announced that it would open a new competition for the institutes it funds. Currently the DMS funds the Mathematical Sciences Research Institute (MSRI) in Berkeley and the Institute for Mathematics and its Applications (IMA) at the University of Minnesota. By the time the deadline for institute proposals passed in February of this year, the DMS had received between ten and twenty proposals. By the end of the summer, unofficial reports held that the field of candidates had been reduced to five: IMA, MSRI, the National Institute of Statistical Sciences in Research Triangle Park, Brown University, and the University of California, Los Angeles. At the time of this writing in early October, the DMS was conducting site visits. The number of institutes to be funded is not known. The final decision about which institutes NSF will fund will be made by the National Science Board, the policymaking body of the Foundation. This decision is expected in May 1999.

—Allyn Jackson

The National Registry of Women in Science

The Association for Women in Science (AWIS), with support from the Office of Naval Research, maintains the National Registry of Women in Science, a multidisciplinary database that is used to find candidates for award nominations, job openings, press inquiries, speaking opportunities, and more. The AWIS encourages all women in science to join the database; it is not necessary to be a member of AWIS to participate. For further information see the AWIS Web site at http://www.serve.com/awis/html/registry.html or contact Melissa Booker, 1200 New York Avenue, NW, Suite 650, Washington, DC 20005; telephone 202-326-8940; fax 202-326-8960; e-mail: booker@awis.org.

—From the AWIS Web site

National Conference on Graduate Education

The National Science Foundation, in conjunction with the University of Missouri, will sponsor a National Conference on Issues Related to Doctoral Programs in Mathematics Education. The conference will be held in the fall of 1999. Faculty of institutions offering doctoral programs are invited to contribute information about their program. A survey of faculty at institutions where students graduate with doctoral degrees in mathematics education or an emphasis in mathematics education at any level—elementary, secondary, or collegiate—will be conducted to provide background information for the conference. For anyone wishing to participate in this survey, a questionnaire will be posted after January 1, 1999, at www.showmecenter.missouri.edu/doctoralprograms.

For further information or questions regarding this conference please contact Robert Reys, University of Missouri,
Kiiti Morita Garden Dedication: The AMS Celebrates Mathematician's Rich Legacy

The Morita family from Japan recently visited the AMS to attend a dedication ceremony. The entranceway gardens of the Providence headquarters were named in memory of Kiiti Morita. His widow, Tomiko, was accompanied by her son, Yasuhiro; his wife, Hiroko; and son, Shigeo. Kiiti Morita was an eminent mathematician who combined profound work in topology with brilliant insights into algebra.

During the dedication ceremony attended by many AMS staff members, John Ewing presented a Board of Trustees' resolution, thanking the Morita family for establishing the Kiiti Morita Fund.

—Tim Goggins, AMS

Departments Plan to Coordinate Job Offer Deadlines

A group of major U.S. mathematics departments is developing an informal agreement to adopt common dates by which new doctorates are to accept or reject job offers. In addition, the Division of Mathematical Sciences of the National Science Foundation (NSF) has agreed to announce earlier the names of recipients in its postdoctoral program, to allow better coordination with the departments' agreement.

The agreement attempts to address the conflict that can arise when an individual is required to accept or reject, by a certain date, an offer of a postdoctoral position (i.e., a non-tenure-track assistant professorship or instructorship or a fellowship in a department or institute). It has sometimes happened that this date is earlier than the date by which the NSF Mathematical Sciences Postdoctoral Research Fellowships are announced. This can put an individual in the position of having to make decisions about offers from departments or institutes without knowing whether he or she might be selected for an NSF postdoctoral fellowship.

This situation can also create planning problems for mathematics departments. NSF postdoctoral fellowships ordinarily run for two years and require no teaching, but it is common practice for the fellows to do some teaching in order to lengthen the term of the fellowship to three years. If a department does not know how many NSF fellows are coming and how many wish to teach, then planning for teaching coverage is difficult. In addition, the hiring process has become increasingly rushed as institutions compete for candidates and make offers earlier and earlier in the hiring season.

As a result of discussions among department chairs and NSF staff, the NSF has now agreed to announce the names of the recipients of its postdoctoral fellowships by the last working day in January; for 1999, this date is Friday, January 29. The proposal now under consideration by the departments is that no candidate should be asked to respond to an offer of a postdoctoral position until about a week after the announcement date for the NSF postdoctoral fellowships; for 1999, this date would be Monday, February 8.

The agreement would apply only to postdoctoral positions and only to candidates who are no more than two years past the Ph.D., and it would specifically exclude tenure-track offers. There would be no restriction on how early offers may be made. Departments could continue to make offers in mid-January or earlier; the proposed agreement would say only that a department may not require an answer from the candidate prior to February 8. Of course, a candidate is free to accept an offer prior to that date if he or she wishes. Candidates accepting early offers are expected to inform as soon as possible all the other departments to which they applied. A department can make second-round offers before February 8 if any of its first choices have made other plans. In such cases the deadline for answers from candidates should not be prior to February 8.

At the time of this writing in mid-November, the agreement was still under discussion by the departments involved, but its adoption appeared imminent. Further developments will be announced in the Notices.

—Allyn Jackson
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.

Upcoming Deadlines

January 4, 1999: Deadline for receipt of applications for the NRC-Ford Foundation Postdoctoral Fellowships for Minorities. For more information consult the Web site http://www2.nas.edu/fo/2102.html; or contact the Fellowship Office, National Research Council, 2101 Constitution Avenue, NW, Washington, DC 20418; telephone 202-334-2860.

January 8, 1999: Deadline for applications for the Herman Goldstine Fellowship in Mathematical Sciences. For details see "Mathematics Opportunities" in this issue.

February 5, 1999: Deadline for receipt of proposals for MAA Grants for Women and Mathematics Projects. For more information consult the Web site http://www.maa.org/projects/solic_99.html; or contact Bernice Kastner, Mathematical Association of America, 1529 Eighteenth Street, NW, Washington, DC 20036; telephone 800-741-9415; e-mail: bkastner@maa.org.

February 16, 1999: Deadline for proposals for the first VIGRE Grant competition. For details see "Mathematics Opportunities" in this issue.

February 28, 1999: Deadline for proposals for the 2001-2002 scientific program of the Mittag-Leffler Institute. For more information consult the Web site http://www.ml.kva.se/proposals.html; or contact the director of the Institute, Kjell-Ove Widman, at widman@ml.kva.se.

March 1, 1999: Deadline for applications for the EDGE Summer Program. For details see "Mathematics Opportunities" in this issue.

March 31, 1999: Deadline for applications for the Mittag-Leffler Institute postdoctoral fellowships. For details see "Mathematics Opportunities" in this issue.

July 19, 1999: Deadline for proposals for the second VIGRE Grant competition. For details see "Mathematics Opportunities" in this issue.

Where to Find It

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

AMS e-mail addresses
November 1998, p. 1369

AMS Ethical Guidelines
June 1995, p. 694

AMS officers and committee members
October 1998, p. 1209

Board on Mathematical Sciences and Staff
May 1998, p. 632

Bylaws of the American Mathematical Society
November 1997, p. 1339

Classification of degree-granting departments of mathematics
January 1997, p. 48

Mathematical Sciences Education Board and Staff
May 1998, p. 632

Mathematics Research Institutes contact information
May 1997, p. 598

National Science Board of NSF
November 1996, p. 1380

NSF Mathematical and Physical Sciences Advisory Committee
May 1997, p. 597

Officers of the Society 1997 and 1998 (Council, Executive Committee, Publications Committees, Board of Trustees)
May 1998, p. 625

Program officers for federal funding agencies (DoD, DoE, NSF)
October 1998, pp. 1181-1183
## Book List

The Book List is a new feature in the Notices that will appear occasionally in this section. Readers will find listed here books that have mathematical themes and hold appeal for a wide audience, including mathematicians, students, and a significant portion of the general public. In cases where 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. While efforts are made to include as many books as possible, the list is necessarily limited to those books that have come to the attention of the Notices editors and that are deemed appropriate for inclusion in the list. Suggestions for books to include on the list may be sent to the managing editor, e-mail: notices@ams.org.


1999 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 1999. 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 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.

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, P.O. Box 6248, Providence, Rhode Island 02940, and must arrive by 28 February 1999.

2. The name of the candidate must be given as it appears in the Combined Membership List (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 the Providence office.

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. Copies may be obtained from the secretary; however, 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 M. Fossum is that of a member. The name R. Fossum 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 1999 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


Name and address (printed or typed)

________________________________________
Signature

________________________________________
Signature

________________________________________
Signature

________________________________________
Signature

________________________________________
Signature

________________________________________
Signature
How to use this form

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

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

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

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

JCEO Recommendations for Professional Standards in Hiring Practices

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

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

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

**AMS STANDARD COVER SHEET**

Last Name ____________________________  First Name ____________________________

Middle Names ____________________________

Address

Current Institutional Affiliation

Home Phone ____________________________

e-mail Address ____________________________

Work Phone ____________________________

Highest Degree and Source ____________________________

Year of Ph.D. (optional) ____________________________

Ph.D. Advisor ____________________________

If the Ph.D. is not presently held, date on which you expect to receive ____________________________

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

Primary Interest ____________________________

Secondary Interests optional ____________________________

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

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

University or Company ____________________________

Position Title ____________________________

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

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

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

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

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

☐ ____________________________

☐ ____________________________

☐ ____________________________

☐ ____________________________
## 1991 Mathematics Subject Classification

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>General</td>
</tr>
<tr>
<td>01</td>
<td>History and biography</td>
</tr>
<tr>
<td>03</td>
<td>Logic and foundations</td>
</tr>
<tr>
<td>04</td>
<td>Set theory</td>
</tr>
<tr>
<td>05</td>
<td>Combinatorics</td>
</tr>
<tr>
<td>06</td>
<td>Order, lattices, ordered algebraic structures</td>
</tr>
<tr>
<td>08</td>
<td>General mathematical systems</td>
</tr>
<tr>
<td>11</td>
<td>Number theory</td>
</tr>
<tr>
<td>12</td>
<td>Field theory and polynomials</td>
</tr>
<tr>
<td>13</td>
<td>Commutative rings and algebras</td>
</tr>
<tr>
<td>14</td>
<td>Algebraic geometry</td>
</tr>
<tr>
<td>15</td>
<td>Linear and multilinear algebra, matrix theory</td>
</tr>
<tr>
<td>16</td>
<td>Associative rings and algebras</td>
</tr>
<tr>
<td>17</td>
<td>Nonassociative rings and algebras</td>
</tr>
<tr>
<td>18</td>
<td>Category theory, homological algebra</td>
</tr>
<tr>
<td>19</td>
<td>K-theory</td>
</tr>
<tr>
<td>20</td>
<td>Group theory and generalizations</td>
</tr>
<tr>
<td>22</td>
<td>Topological groups, Lie groups</td>
</tr>
<tr>
<td>26</td>
<td>Real functions</td>
</tr>
<tr>
<td>28</td>
<td>Measure and integration</td>
</tr>
<tr>
<td>30</td>
<td>Functions of a complex variable</td>
</tr>
<tr>
<td>31</td>
<td>Potential theory</td>
</tr>
<tr>
<td>32</td>
<td>Several complex variables and analytic spaces</td>
</tr>
<tr>
<td>33</td>
<td>Special functions</td>
</tr>
<tr>
<td>34</td>
<td>Ordinary differential equations</td>
</tr>
<tr>
<td>35</td>
<td>Partial differential equations</td>
</tr>
<tr>
<td>39</td>
<td>Finite differences and functional equations</td>
</tr>
<tr>
<td>40</td>
<td>Sequences, series, summability</td>
</tr>
<tr>
<td>41</td>
<td>Approximations and expansions</td>
</tr>
<tr>
<td>42</td>
<td>Fourier analysis</td>
</tr>
<tr>
<td>43</td>
<td>Abstract harmonic analysis</td>
</tr>
<tr>
<td>44</td>
<td>Integral transforms, operational calculus</td>
</tr>
<tr>
<td>45</td>
<td>Integral equations</td>
</tr>
<tr>
<td>46</td>
<td>Functional analysis</td>
</tr>
<tr>
<td>47</td>
<td>Operator theory</td>
</tr>
<tr>
<td>49</td>
<td>Calculus of variations, optimal control</td>
</tr>
<tr>
<td>51</td>
<td>Geometry</td>
</tr>
<tr>
<td>52</td>
<td>Convex and discrete geometry</td>
</tr>
<tr>
<td>53</td>
<td>Differential geometry</td>
</tr>
<tr>
<td>54</td>
<td>General topology</td>
</tr>
<tr>
<td>55</td>
<td>Algebraic topology</td>
</tr>
<tr>
<td>57</td>
<td>Manifolds and cell complexes</td>
</tr>
<tr>
<td>58</td>
<td>Global analysis, analysis on manifolds</td>
</tr>
<tr>
<td>60</td>
<td>Probability theory and stochastic processes</td>
</tr>
<tr>
<td>62</td>
<td>Statistics</td>
</tr>
<tr>
<td>65</td>
<td>Numerical analysis</td>
</tr>
<tr>
<td>68</td>
<td>Computer science</td>
</tr>
<tr>
<td>70</td>
<td>Mechanics of particles and systems</td>
</tr>
<tr>
<td>73</td>
<td>Mechanics of solids</td>
</tr>
<tr>
<td>76</td>
<td>Fluid mechanics</td>
</tr>
<tr>
<td>78</td>
<td>Optics, electromagnetic theory</td>
</tr>
<tr>
<td>80</td>
<td>Classical thermodynamics, heat transfer</td>
</tr>
<tr>
<td>81</td>
<td>Quantum theory</td>
</tr>
<tr>
<td>82</td>
<td>Statistical mechanics, structure of matter</td>
</tr>
<tr>
<td>83</td>
<td>Relativity and gravitational theory</td>
</tr>
<tr>
<td>85</td>
<td>Astronomy and astrophysics</td>
</tr>
<tr>
<td>86</td>
<td>Geophysics</td>
</tr>
<tr>
<td>90</td>
<td>Economics, operations research, programming, games</td>
</tr>
<tr>
<td>92</td>
<td>Biology and other natural sciences, behavioral sciences</td>
</tr>
<tr>
<td>93</td>
<td>Systems theory, control</td>
</tr>
<tr>
<td>94</td>
<td>Information and communication, circuits</td>
</tr>
</tbody>
</table>
Characters of Finite Groups. Part 2
Ya. G. Berkovich, University of Haifa, Israel, and E. M. Zhmud', Kharkov University, Ukraine

This book places character theory and its applications to finite groups within the reach of people with a comparatively modest mathematical background. The work concentrates mostly on applications of character theory to finite groups. The main themes are degrees and kernels of irreducible characters, the class number and the number of nonlinear irreducible characters, values of irreducible characters, characterizations and generalizations of Frobenius groups, and generalizations of monomial groups. The presentation is detailed, and many proofs of known results are new.

Translations of Mathematical Monographs, Volume 181; 1999; 333 pages; Hardcover; ISBN 0-8218-0532-0; List $89; Individual member $59; Order code MMONO/181

Rings and Things and a Fine Array of Twentieth Century Associative Algebra
Carl Faith

This book surveys more than 125 years of aspects of associative algebras, especially ring and module theory. It is the first to probe so extensively such a wealth of historical development. Moreover, the author brings the reader up to date, in particular through his report on the subject in the second half of the twentieth century.

Included in the book are certain categorical properties from theorems of Frobenius and Stickelberger on the primary decomposition of finite Abelian groups; Hilbert's basis theorem and his Nullstellensatz, including the modern formulations of the latter by Knut, Goldman, and others; Maschke's theorem on the representation theory of finite groups over a field; and the fundamental theorems of Wedderburn on the structure of finite dimensional algebras and finite skew fields and their extensions by Braver, Kaplansky, Chevalley, Goldie, and others. A special feature of the book is the in-depth study of rings with chain condition on annihilator ideals pioneered by Noether, Arlin, and Jacobson and refined and extended by many later mathematicians.

Two of the author's prior works, Algebra: Rings, Modules and Categories, I and II (Springer-Verlag, 1973), are devoted to the development of modern associative algebra and ring and module theory. Those works serve as a foundation for the present survey, which includes a bibliography of over 1,600 references and is exhaustively indexed.

In addition to the mathematical survey, the author gives candid and descriptive impressions of the last half of the twentieth century in "Part II: Snapshots of Some Mathematical Friends and Places".

Comments on the book:
Researchers in algebra should find it both enjoyable to read and very useful in their work. In all cases, [Faith] cites full references as to the origin and development of the theorem....

"I know of no other work in print which does this as thoroughly and as broadly." — John O'Neill, University of Detroit at Mercy

"Part II: Snapshots of Some Mathematical Friends and Places" is wonderful [it is] a joy to read! Mathematicians of my age and younger will relish reading "Snapshots."

— James A. Huckaby, University of Missouri-Columbia

Summer School in Group Theory in Banff, 1996
Olga Khariampovich, McGill University, Montreal, PQ, Canada, Editor

The third annual CRM Summer School took place in Banff (Alberta, Canada) and was aimed toward advanced students and recent PhDs. This volume presents surveys from the group theory part of the theme year and examines different approaches to the topic: a geometric approach, an approach using methods from logic, and an approach with roots in the Borel-Serre theory of groups acting on trees.

The text offers a concise introduction to current directions of research in combinatorial group theory. Surveys in the text are by leading researchers in the field who are experienced expositors. The text is suitable for use in graduate courses on geometric and combinatorial group theory.

CRM Proceedings & Lecture Notes, Volume 17; 1999; 165 pages; Softcover; ISBN 0-8218-0948-2; List $45; Individual member $27; Order code CRP/17NA

Des Catégories Dérivées des Catégories Abéliennes
Jean-Louis Verdier, University of Paris VII, France

A publication of Société Mathématique de France.

This volume contains Jean-Louis Verdier's thesis, never published nor circulated until now. The aim of this thesis was to create the appropriate homological framework to state and prove the generalizations of the duality theorems of Grothendieck. This framework is the theory of derived categories, whose foundations are put forth in this text. This notion, inspired by topological and cohomological examples, has proved to be extremely fruitful. The text is written in French.

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13324 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75243 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Astérisque, Number 239; 1997; 259 pages; List $69; Individual member $42; Order code AST/239NA

AMS
American Mathematical Society

All prices subject to change. Charges for delivery are $3.00 per order. For optional air delivery outside of the continental U.S., please include $5.00 per item. Prepayment required. Order from: American Mathematical Society, P.O. Box 6931, Boston, MA 02116-6931, USA. For credit card orders, fax 1-401-455-4046 or call toll free 1-800-321-4AMS (4267) in the U.S. and Canada, 1-401-455-4000 worldwide. Or place your order through the AMS bookstore at www.ams.org/bookstore/. Residents of Canada, please include 7% GST.
January 1999


Organizing Committee: The organizing committee consists of M. Essén (Univ. of Uppsala), C. Bandle (Univ. of Basel), B. Gustafsson (Royal Institute of Technology, Stockholm), V. Maz'ya (Univ. of Linköping), H. Shahgholian (Royal Institute of Technology, Stockholm).

Application deadline: For postdoctoral fellowships: March 31, 1999. Send applications to: M. I. Koskull, the organizing committee, Auravägen 17, S-182 62 Djursholm, Sweden.

Information: See our homepage at http://www.mlkva.se.

*15-16 ASL Winter Meeting (in conjunction with AMS annual meeting), San Antonio, Texas.

Program Notes: In the AMS meeting there will be an ASL/AMS Special Session on Model Theory and its Applications, organized by A. Pillay. Other AMS special sessions include: Algebraic and Analytic Geometry, Mathematics Education Reform, History of Mathematics, and Mathematics Education and Mistaken Philosophies of Mathematics.


Submission: Abstracts of contributed papers from ASL members should be sent by the deadline of October 9, 1998, to the ASL office.

Local Arrangements: Registration and hotel arrangements through the AMS.

Information: Association for Symbolic Logic, 1406 West Green Street, Urbana, Illinois 61801; tel: 217-244-7902; fax: 217-333-9576; e-mail: asl@math.uiuc.edu; http://www.math.uiuc.edu/~asl/.

*29-31 Symposium on Dynamical Systems, Princeton University, Princeton, New Jersey.

Sponsors: The symposium is jointly sponsored by Princeton University and the Center for Communications Research, a division of the Institute for Defense Analyses.

Speakers: D. Dolgopyat (Univ. of California, Berkeley), G. Forni (Princeton Univ.), V. Kaloshin (Princeton Univ.), Y. Katznelson (Stanford Univ.), D. Kosygin (NY Univ., Courant Inst.), I. Krichever (Columbia Univ.), M. Lyubich (SUNY Stony Brook), G. Marquis (Yale Univ.), J. Milnor (SUNY Stony Brook), D. Ornstein (Stanford Univ.), M. Shub (IBM, T. J. Watson Research Labs), J. Smillie (Cornell Univ.), V. Veech (Rice Univ.), and J. Xia (Northwestern Univ.).

Information: For more information and/or to let us know you are coming you may contact I. Smirag, Math at dona@princeton.edu or L. Neuwith at lpm@cr-p.ida.org, 609-279-6231.

February 1999

*1-28 Modeling of Biological Systems–An Interdisciplinary Course, Marine Biological Laboratory, Woods Hole, Massachusetts.

Alm: This intensive laboratory/lecture course is designed to train biologists and non-biologists to apply and adapt successful modeling approaches in biology to their own research. MOBS is for students in the biological, chemical and physical sciences, mathematics and engineering. The course is organized into thematic cassettes that focus on particular broad areas of biology.

Course Faculty: R. B. Silver, course director, J. Himmel (Argonne Nat. Lab.), P. Kollman (UCSF), S. Leibholz (Chesapeake TechLabs), J. Pearson (Los Alamos Nat. Lab.), G. Petsko (Brandeis Univ.), S. Ponce-Dawson (Univ. of Buenos Aires), M. Wastney (Georgetown Univ.), and others to be announced.

Information: Application deadline: December 10, 1998. Course fee: $3, 750 (room & 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 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, lists of meetings should be received in Providence six months prior to the scheduled date of the meeting.

The complete listing of the Mathematics Calendar will be published only in the September issue of the Notices. The March, June, and December issues will include, along with new announcements, references to any previously announced meetings and conferences 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 e-MATH on the World Wide Web. To access e-MATH, use the URL: http://e-math.ams.org/ (or http://www.ams.org/). (For those with VT100-type terminals or for those without WWW browsing software, connect to e-MATH via Telnet (telnet e-math.ams.org; login and password e-math) and use the Lynx option from the main menu.)
Program Calendar

Mathematics Calendar

*8-10 Large Scale Discrete Optimization in Logistics, DIMACS Center, Rutgers University, Piscataway, New Jersey.

Organizers: G. Nemhauser (Georgia Tech.) and M. Szwesler (Georgia Tech.)

Aim: This workshop brings together leading researchers in the fields of discrete optimization and logistics and presents state-of-the-art research in the area of large-scale discrete optimization in logistics. Applications domains that will be covered include network design, production planning, vehicle routing, and crew scheduling. Both exact and heuristic solution approaches will be presented. The workshop is intended for anybody interested in discrete optimization or logistics, from industrial practitioners to academic researchers. Ph.D. students and post-docs are also encouraged to attend. There will be five or six one hour invited lectures on Monday and Tuesday and four on Wednesday, with ample time for informal discussion and interaction among the participants. In addition, evening discussion sessions will be organized around themes of general interest to the participants.

Invited Speakers: M. Ball (Univ. of Maryland), D. Bienstock (Columbia Univ.), C. Cook (Rice Univ.), D. Johnson (AT&T Labs-Research), E. Johnson (Georgia Tech.), G. Laport (Univ. of Montreal), T. Magnanti (MIT), W. Powell (Princeton Univ.), M. Resende (AT&T Labs-Research), D. Shmoys (Cornell Univ.), D. Simchi-Levi (Northwestern Univ.), L. Wolsey (Catholic Univ. of Louvain-la-Neuve).

Contact: G. Nemhauser (Georgia Tech.), email: george.nemhauser@isye.gatech.edu

Local Arrangements: P. Pravato (DIMACS Center), email: pravato@dimacs.rutgers.edu; tel: 732-445-5039.


*12-13 Fifteenth Conference on Applied Mathematics (CAM), University of Central Oklahoma, Edmond, Oklahoma. (Nov. 1998, P. 1377.)

Program: An interdisciplinary conference on mathematics with applications, this year's CAM will feature J. Gallian of the Univ. of Minnesota at Duluth, who will speak on "The Mathematics of Identification Numbers." Also featured will be W. Briggs of the Univ. of Colorado, who will speak on "Differential and Difference Equations in Population Genetics." A special program on "Teaching Quantitative Reasoning to Liberal Arts Students" will also be provided by Dr. Briggs, based on ideas he incorporated into his recent textbook.

Conference Tracks: Applied mathematics, differential equations, and applied computer science. There will also be a session of student presentations.

Call for Papers: Abstracts should be postmarked by December 31, 1998, and mailed to the address below. As in past years, CAM will include a session for graduate and undergraduate student papers on mathematics and its applications and will provide Outstanding Student Presentation Awards for the best papers. Presenters should specify whether their paper is intended for the Session on Computer Science, the Session on Differential Equations, the Session on Applied Mathematics, or the Student Session.


Information: Conference on Applied Mathematics, College of Mathematics and Science, Univ. of Central Oklahoma, 100 N. University Edmond, OK 73034; tel: 405-974-5381; fax: 405-974-3824; e-mail: cam@axl.ucok.edu. More information about the conference (including local arrangements) can be found at http://dogbert.comsoc.ucok.edu/cam/.

March 1999


Focus: M/SET 99 is a unique conference focusing upon information technology in mathematics, science, and computer science, learning and teaching across all educational levels and settings, including elementary, secondary, college, and teacher education. This annual conference serves as a forum to discuss and exchange information on the current research, theory, issues, classroom applications, development and trends related to using information technology in mathematics, science, and computer science education.

Hosts: Hosted by the Univ. of Texas-San Antonio and the Univ. of Houston, M/SET 99 will be held concurrently with SITE 99, Society for Technology and Teacher Education International Conference. This offers participants an affordable opportunity to attend two conferences when in San Antonio. Both conferences are organized by the Association for the Advancement of Computing in Education (AACE). M/SET is sponsored by the Journal of Computers in Mathematics and Science Teaching (JCMST).

Information: For more information, contact D. Thomas, Dept. of Mathematical Sciences, Montana State Univ., Bozeman, MT 59717; email: dave@math.montana.edu; or visit the Conference Web page at http://www.aace.org/conf/mset/mset99call.htm.

20-23 ASL Annual Meeting, San Diego, California.

Invited Speakers: S. Friedman, J. Knight, S. Lempp, M. Magidor (retiring presidential address), T. Pitassi, H. Schouens, S. Thomas, V. Vianu, and J. Zapletal.

Program Notes: The program will represent a broad perspective of modern logic, and will include the Tenth Annual Gödel Lecture. R. Fagin will give two tutorial lectures on finite model theory. There will be five special sessions (organizers in parentheses): computability theory (C. G. Jockusch Jr.), finite model theory and stability theory (J. Baldwin), philosophical logic (V. McGee and G. Sher), proof theory and complexity (S. Buss), and set theory (G. Hjorrt).

Submission: Abstracts of contributed papers from ASL members should be sent by the deadline of January 15, 1999, to the Program Chair: S. Buss, Department of Mathematics, Univ. of California at San Diego, La Jolla, CA 92039-0112; e-mail: sbuss@ucsd.edu.

Program Committee: S. Buss (chair), B. Hart, C. G. Jockusch Jr., V. McGee, and W. H. Wood.

Travel Grants: Travel grants (partly supported by an NSF grant) are available to graduate students in logic. Applications should be sent by January 15, 1999, to S. Buss at the address above.

Information: Association for Symbolic Logic, 1409 West Green Street, Urbana, IL 61801; tel: 217-244-7902; fax: 217-333-9576; e-mail: aslmath.uic.edu; http://www.math.uic.edu/~asl/ Meeting Web site: http://www.math.ucsd.edu/~aal99/. A meeting poster may be printed out from this site.

April 1999


Topics: The meeting will focus on various aspects of multivariate scattered data fitting. This includes interpolation and approximation methods using splines, radial basis functions, wavelets, etc., as well as various applications in geology, geophysics, hydrology, image processing, meteorology, terrain modeling, and visualization.

Organizing Committee: P. Gonzalez-Casanova (UNAM, Cuernavaca), A. Le Méauté (Univ. de Nantes), L. L. Schumaker (Vanderbilt Univ.), L. Traversoni (Univ. Autonoma Met. Iztapalapa).

Participation: Sessions will be organized for contributed talks. Abstracts should be submitted via the Web page at http://aspm.nature.unam.mx/ or by e-mail to asmars.ca@vanderbilt.edu. Deadline is February 1, 1999.

Information: See the Web page or contact L. Schumaker, Dept. of Mathematics, Vanderbilt University, Nashville, TN 37240.


Goal: The goal of the workshop is to generate a lively discussion between researchers in finite-model theory and descriptive complexity and investigators in various areas
of cognitive science. Obvious areas of potential interaction include the study of constraint satisfaction problems, the analysis and application of modal and temporal logics, and the construction of adequate languages for knowledge representation in areas such as computational learning theory and robotics. It is our hope that the workshop will also bring to light further areas of potential interaction between finite-model theory and cognitive science.

Organizers: M. Vardi (Rice Univ.), e-mail: vardi@cs.rice.edu, S. Weinstein (Univ. of Pennsylvania), e-mail: weinstein@cis.upenn.edu.


Information: Contact M. Vardi (Rice Univ.), e-mail: vardi@cs.rice.edu; WWW: http://dimacs.rutgers.edu/Workshops/index.html.

22–24 Inverse Problems in Stratified Media, University of Aarhus, Aarhus, Denmark.

Sponsor: Mathys-Sci Centre for Mathematical Physics and Stochastics.


Information: For further information see the Web page located at http://www.mathys-sci.de/events/InvProb99/.

May 1999


Purpose: The aim is to bring together mathematicians and physicists with overlapping interests, in order to facilitate interdisciplinary collaboration. Topics of discussion will include string theory, condensed matter systems, gauge theory, differential and algebraic geometry. Principal speakers will deliver a series of three lectures.

Speakers: D. S. Freed (Univ. of Texas at Austin), D. H. Phong (Columbia Univ.), D. Thouless (Univ. of Washington), and C. Vafa (Harvard Univ.).


Information: Please see the Web site http://web.physics.uiuc.edu/mathphys99/ for more information.


Theme: Discontinuous Galerkin methods (DGM) have been developed only recently but have found use quickly in such diverse applications as aeroacoustics, semi-conductor device simulation, turbomachinery, turbulent flows, materials processing, MHD and plasma simulations, and image processing. While there has been a lot of interest in DGM, only scattered information is available and there has been no prior effort in organizing a conference and in publishing the existing volume of knowledge on this subject. We invite participation of mathematicians, physicists, and engineers working in this area for possible contributions, and plan to publish proceedings with selective contribution to serve as a reference on the subject.

Organizers: R. Cockburn (Brown University, C. W. Shu (Brown Univ.).

Scientific Committee: F. Brezzi (Univ. of Pavia, Italy), J. Flaherty (RIT, USA), C. Johnson (Univ. of Delaware, Sweden), K. Morton (Oxford Univ., UK), T. J. Oden (Univ. of Texas at Austin), M. Wheeler (Univ. of Texas at Austin).

Contact: M. Breustler (symposium secretary), tel: 401-863-1414; fax: 401-863-2722; e-mail: dgm@cfm.brown.edu; URL: http://www.cfm.brown.edu/dgm/.

*29–June 1 CMS Summer 1999 Meeting, Memorial University of Newfoundland, St. John’s, Newfoundland.

Program: This meeting will feature plenary speakers from a broad spectrum of mathematics by top mathematicians. It will also feature sessions in various areas of mathematics.

Plenary Speakers: E. Barbeau (Toronto), R. K. Blyth (Pennsylvania State), T. Koerner (Cambridge) and M. van den Bergh (Limburg/Belgium).

Prize Lectures: The Jeffery-Williams Lecture will be given by R. Friedlander (Univ. of Toronto). The Krieger-Nelson Prize will be given by N. T. J. Jerrenmann (Univ. of Alberta).

Sessions: Session titles and speakers are: Combinatorics and its Applications (N. Shaalaby and D. Stinson, organizers): F. Bennett (Halifax), C. Colbourn (Unine), K. Helrich (SFU), A. Rosa (McMaster), D. Stinson (Waterloo), L. Vinet (Montreal); Education: What Mathematical Competitions Do for Mathematics (R. Shawyer and E. Williams, organizers): E. Barbeau (Toronto), R. Dunkley (Waterloo), T. Gardiner (Birmingham), R. Jones (Director of NCTM), and S. Sullivan (MUN student).

June 1999

*1–3 International Conference on Differential Equations and Related Topics, Pusan National University, Pusan, Korea.

Purpose: The aim of the conference is to present recent advances in the fields of nonlinear ordinary, partial or functional differential equations, theory of nonlinear operators and broad applications of related areas.

Speakers: Invited speakers include H. Brézis (Univ. Paris VII), J. Goldstein (Univ. of Memphis), A. G. Kartsatos (Univ. of South Florida), V. Lakshmikantam (Florida Inst. of Tech.), J. Mawhin (Univ. de Louvain), H. Tanabe (Otonom Gakuin Univ.), J. Ward (Univ. of Alabama, Birmingham), B. G. Zhang (Ocean Univ. of Quindao).

Call for Papers: Contributed talks of 30 minutes in length in all areas of differential equations are invited. If you would like to contribute a talk, you may submit your title and abstract on the registration form. Please request the registration form from the organizing committee.


Information: For further information, please contact one of the organizing committee: K. S. Ha, e-mail: ksha@hyowon.pusan.ac.kr; Y. H. Lee, e-mail: yhlee@hyowon.pusan.ac.kr; J. Y. Park, e-mail: jypark@hyowon.pusan.ac.kr; Department of Mathematics, Pusan National Univ., Pusan 609-735, Korea; fax: +82-51-581-1458; updates will be posted on the conference Web site: http://www.pusan.ac.kr/~ksha/.

*3–5 Applications of Heavy Tailed Distributions in Economics, Engineering and Statistics, American University, Washington, DC.

Objective: Heavy tailed distributions are being used in a large variety of problems in economics, finance, engineering, statistics, and other areas. It is evident that many important problems are poorly described by standard Gaussian models. This conference will draw together experts from a range of disciplines to describe the methods used to analyze such processes.


Organizers: J. P. Nolan (American Univ.), jpnolan@american.edu, A. Swami (Army Research Labs), aswami@arl.mil or a.swami@ieee.org.

Information: For additional information please visit our Web page at: http://www.cas.american.edu/~jpnolan/HeavyTails.html.

*4–9 Geometry, Analysis & Mathematical Physics: Analysis & Geometry, Oberlin (near Strasbourg), France.

Speakers: D Auroux (École Polytechnique), P. Biran (Stanford), Y. Chekanov (Moscow), R. Dijkgraaf (Amsterdam), R. Fintushel (Michigan), E. Getzler (Northwestern), E. Giroux (Lyon), V. Givental (Berkeley), L. Jeffrey (Toronto), Y. Karshon (Jerusalem), M. Kontsevich (Bures/Yvette), S. Kulik (Heriot-Watt), G. Liu (UCLA), E. Meinrenken (Toronto), T. Mrowka (MIT, Cambridge), W. Nahm (Bonn), L. Polterovich (Tel-Aviv), Y. Ruan (Wisconsin), M. Schwarz (Stanford), P. Seidel (MPI-MP-Bonn), J.-C. Sikorav (Toulouse), K. Uhlenbeck (Austin), S. T. Yau (Harvard).

Scope: The purpose of the meeting will be to review recent developments on symplectic geometry; contact geometry and Floer homology; Gromov-Witten invariants and mirror symmetry; Donaldson and Seiberg-Witten invariants; symplectic analysis in infinite dimensions; moduli spaces. The
conference is open to researchers worldwide, whether from industry or academia. Participation will be limited to 100. The emphasis will be on discussion about new developments. Poster sessions will be organized. The registration fee covers full board and lodging. Grants will be available for younger scientists, in particular those from less favored regions in Europe.

**Deadline:** Application deadline: February 15, 1999.

**Information:** For more information and application forms, contact J. Hendekovic, European Science Foundation, J. leay-Marnéa, 67080 Strasbourg Cedex, France; tel: +33-3-88-76-71-35, fax: +33-3-88-36-98-87; e-mail: euresco@esf.org; on-line information and application on WWW at [http://www.esf.org/euresco/](http://www.esf.org/euresco/).

**7-11 International Society of The Arts, Mathematics, and Architecture (ISAMA99), San Sebastian, Spain.**

**Call for Papers:** Papers are invited that relate the arts and architecture with mathematics.

**Information:** For details, contact N. Friedman, e-mail: artmath@cc.asc.albany.edu, tel: 518-442-4621, fax: 518-442-4731, or see [http://www.sc.ehu.es/ISAMA99/](http://www.sc.ehu.es/ISAMA99/).

**20-24 The Sixth Conference of The Canadian Number Theory Association (CNTA '99), University of Manitoba, Winnipeg, Canada.**

**Organized By:** Institute of Industrial Mathematical Sciences (IIMS).

**Topics:** This conference will include topics in all aspects of modern number theoretic investigation, in particular: combinatorial/computational number theory, analytic number theory, diophantine problems and arithmetic geometry. All of these areas have seen rapid development in recent years, both in Canada and internationally.

**Information:** Contact P. N. Shivakumar, iiamath@umanitoba.ca, tel: 204-474-6724, fax: 204-474-7602, IIMS Web page: [http://www.iims.umanitoba.ca/](http://www.iims.umanitoba.ca/).

**21-July 2 Computational Algebra With Applications, University of Wyoming, Laramie, Wyoming.**

**Aim:** Computational algebra and algebraic geometry is a very active and rapidly growing field, with many applications to other areas of mathematics, as well as computer science and engineering. Easily accessible without extensive specialized mathematical expertise, the theory very quickly leads to new research problems as well as realistic applications to other subjects. This conference will treat the theory and the applications of computational algebra and algebraic geometry. After working through the theoretical foundations, most importantly the theory of Groebner bases for collections of polynomials, we will develop the necessary specialized algebra and geometry for the applications on which the second part of the program will focus. We plan on presenting applications to other areas of mathematics as well as realistic problems from engineering, Hands-on computations with several common computer algebra systems will play an important role in the workshop.

**Speakers:** J. Breman (North Dakota State Univ.) and R. Laubenbacher (New Mexico State Univ.).

**Sponsors:** Rocky Mountain Mathematics Consortium and the University of Wyoming.

**Deadline:** For application/abstracts of talks: April 1, 1999.

**Information:** A. D. Porter, Mathematics Department, Univ. of Wyoming, Laramie, WY 82071; e-mail: adporter@uwyo.edu.

**23-25 Bar-Ilan Symposium on The Foundations of Artificial Intelligence (BI-FAI 99), Ramat Gan, Israel.**

**Theme:** Bridging theory and practice: theory-based practical implementations and commercial applications.

**Scope:** The symposium is international in scope, with invited lectures by leading researchers and contributed papers on foundations of AI.

**Invited Speakers:** The invited speakers for BI-FAI 99 include: S. Rosenbom (Stanford Univ.) and L. Jockovicz (Hebrew Univ.).

**Call for Papers:** We solicit substantial research papers in all areas of Artificial Intelligence, including but not limited to, automated reasoning, data mining, information retrieval, intelligent agents, knowledge-based systems, knowledge representation, machine learning, mathematical and philosophical foundations, natural language processing, planning, probabilistic reasoning, robotics, search. We especially encourage papers on the theme of this year's symposium. Authors should submit papers (preferably postscript files via e-mail) by March 2, 1999, together with a text version of the title and abstract, to either of the program chairs, J. Morgenstern (joeara@watson.ibm.com) or E. Shimony (shimony@cs.bgu.ac.il). Papers should be at most twelve pages in length, excluding references. Questions on content, format, or appropriateness should be addressed to the program chairs. Authors will be notified of acceptance by April 12, 1999. A final version of the accepted papers will be available at the BISFAI-99 website. Selected refereed full-length papers will be published in Special issue of the Annals of Mathematics and Artificial Intelligence as a permanent record of the symposium. These should be submitted shortly after the completion of the symposium.

**Call for Demos:** We solicit proposals for demonstrations of innovative applications of artificial intelligence. Details can be found at [http://www.cs.biu.ac.il:8080/bisfa99/cfd.html](http://www.cs.biu.ac.il:8080/bisfa99/cfd.html) or at [http://www-formal.stanford.edu/leora/bisfa99/cfd.html](http://www-formal.stanford.edu/leora/bisfa99/cfd.html).

**Program Committee:** L. C. Aiello (Univ. Rome-La Sapienza, Italy), R. Ben-Eliyahu (Ben-Gurion Univ., Israel), V. Choueka (Bar-Ilan Univ., Israel), E. Davis (New York Univ.), R. Dechter (UC Irvine), R. Feldman (Bar-Ilan Univ., Israel), N. Friedman (Hebrew Univ., Israel), H. Geffner (Simon Bolivar Univ., Venezuela), D. Geiger (Technion, Israel), S. Kraus (Bar-Ilan Univ., Israel), D. Lehmann (Hebrew Univ., Israel), S. Markovitch (Technion, Israel), J. McCarthy (Stanford Univ.), J. Minker (Univ. Maryland at College Park), J. Rosen (Hebrew Univ., Israel), E. Sandewall (Linkoping Univ., Sweden), E. Santos (Univ. of Connecticut), U. Schild (Bar-Ilan Univ., Israel), M. Tennenholtz (Technion, Israel), B. Webber (Univ. of Edinburgh, Great Britain).

**27-July 1 1999 Summer Conference on Brauer Groups, University of Montana, Missoula, Montana.**

**Organizers:** S. Liedahl (sliedahl@charlestown.net), N. Vossen (vossen@econ.montana.edu). Department of Mathematical Sciences, The University of Montana, Missoula, MT 59812-1032.

**Information:** The meeting will be held at the Lubrecht Experimental Forest, about 30 miles from Missoula. Families are encouraged to attend. Detailed information, including a preregistration form, is at [http://www.math.umt.edu/~vossen/conference/1999brauer.html](http://www.math.umt.edu/~vossen/conference/1999brauer.html). Tentative room/cabin assignments will be made beginning December 1998.

**27-August 1 1999 ACACSE'99: Applied Clifford Algebra in Cybernetics, Robotics, Image Processing and Engineering International Workshop as a Special Parallel Session of the 5th International Conference on Clifford Algebras and their Applications in Mathematical Physics, Ixtapa, Zihuatanejo, Mexico.**

**Organizers:** E. J. Bayro-Corrochano (Germany), M. Sobczyk (Mexico).

**Program Committee:** W. Baylis (Canada), V. Chernov (Russia), J. Lasenby (UK), P. Lourenco (Finland), T. Havel (USA), R. Hecht-Nielsen (USA), D. Hestenes (USA), J. M. McCarthy (USA), A. Naeve (Sweden), G. Sommer (Germany).

**Workshop Goals:** To gather scientists interested in the application of Geometric/Clifford algebras to various areas of applied mathematics and engineering. The growing interest in and successful applications of geometric algebra deserve the attention and recognition of the larger Scientific Community. This workshop is meant to energize and encourage discussion of the pertinent issues in the successful application of geometric algebra to wider and wider fields of interest, including but not limited to: cybernetics, computer science, artificial intelligence, quantum computing, robotics, image processing, computer vision, neural networks, brain and neuropsychics, electrical and electronic engineering, mechanical and control engineering, optimization, statistical geometry and geometric reasoning.
Jordan and SVD decomposition applied to multivectors.

**Deadlines:** December 15, 1998; submission of abstracts; March 15, 1999; submission of preliminary version; April 15, 1999; notification of acceptance; June 28–July 1, 1999; conference and workshop parallel special session; July 1, 1999; submission of camera ready copy.

**Information:** For more information please see http://www.math-inst.hu/erdos99.html.

**July 1999**

4-11 Paul Erdös and His Mathematics, Hungarian Academy of Sciences, Budapest, Hungary.

Program: Invited plenary speakers on the mathematics of Paul Erdös. In sections on the influence of his mathematics on today's research.

Topics: Basic fields that he contributed to: number theory, analysis, probability theory, combinatorial set theory and combinatorics.


Information: URL: http://www.math-inst.hu/erdos99.html; e-mail: erdos99@math-inst.hu.

9-17 Computation in Group Theory and Geometry, University of Warwick, Coventry, England.

Information: Please see the Web page http://www.maths.warwick.ac.uk/~dbs/\symposium99.html.

11-August 15 Seventh Annual Canada/USA Mathcamp, University of Washington, Seattle, Washington.

Program: Mathcamp is an intensive 5-week-long summer program for gifted students which incorporates the fun elements of Geometry, University of Warwick, England.

Program: Mathcamp is an intensive 5-week-long summer program for gifted students who love mathematics. At Mathcamp you will learn exciting mathematical ideas not usually covered in high school; gain in mathematical understanding, skills, and confidence—whether in preparation for a possible career in math or science, or training for math competitions, or simply out of interest for the subject; get a unique chance to study with some of the finest mathematicians of today; meet and make friends with the mathematicians and applied mathematicians of tomorrow; fellow mathcamp students coming together, discovering common interests and purposes, and learning from each other.

**Sponsor:** Canada/USA Mathcamp is conducted by the Mathematics Foundation of America (MFOA).

Information: Contact Mathematics Foundation of America, 3560 Pine Grove Ave., Port Huron, MI 48060; tel: 519-672-7990; fax: 519-434-6244; e-mail: info@mathcamp.org.

12-18 Third International Conference on Symmetry in Nonlinear Mathematical Physics, Kiev, Ukraine.

Organizing Committee: J. Beckers (Belgium), V. Boyko (Ukraine), G. Bluman (Canada), J.-M. Cervero (Spain), P. Clarkson (UK), H.-D. Doebner (Germany), G. Goldin (USA), B. K. Harrison (USA), N. Ibragimov (SAR), R. Jackiw (USA), M. Lakshmanan (India), A. Nikitin (co-chairman, Ukraine), P. Olver (USA), A. Samolenko (co-chairman, Ukraine), M. Shkil, I. Skrypnik, I. Yehorchenko, R. Zhidanov.

Topics: Classical Lie analysis of equations of mathematical physics, reduction techniques and exact solutions of nonlinear partial differential equations, multivectors.

Information: Contact A. N. Khmelnitsky Institute of Mathematics, National Academy of Sciences of Ukraine, 3 Tereshchenkivska Street, Kyiv 4, Ukraine; e-mail: nonlinear@arnet.freemet.kiev.ua, appeals@arnet.kiev.ua; fax: +38-044-225-20-10; tel: +38-044-244-2242 or 250-08-96.


Organizers: This conference is jointly organized by Tongji Univ. and City Univ. of Hong Kong.

Presentations: Presentations in all areas of applied partial differential equations are welcome.

Invited Speakers: X. Q. Ding (Academia Sinica, Beijing), A. Friedman (Univ. of Minnesota), Y. Giga (Hokkaido Univ.), R. Kersner (Academy of Sciences, Czech Republic), L. Fan (New York Univ.), J. McLaughlin (Rensselaer Polytechnic Institute), J. Ockendon (Oxford Univ.), A. Visintin (Univ. of Trento), A. Visintin (Univ. of Trento), Z. Xin (New York Univ.).

Scientific Committee: C. Gu (Fudan Univ.), L. Jiang (Tongji Univ.), T.-T. Li (Fudan Univ.), T.-P. Liu (Stanford Univ.), Z. Shi (Shanghai Jiaotong Univ.), R. Wong (City Univ. of Hong Kong).

Organizing Committee: H.-H. Dai (City Univ. of Hong Kong), Z. Huang (Tongji Univ.), Y. Y. Lu (City Univ. of Hong Kong), J. Zhao (Tongji Univ.).

Registration: The registration fee is USD 200. This includes (a) daily breakfast, lunch, and dinner and banquets; (b) a local tour in Shanghai.


16-18 ESA'99 - Seventh Annual European Symposium on Algorithms, Prague, Czech Republic.


Scope: The symposium covers research in the use, design, and analysis of efficient algorithms and data structures as it is carried out in computer science, discrete applied mathematics and mathematical programming. Papers are solicited describing original results in all areas of algorithmic research, including but not limited to: approximation algorithms, combinatorial optimization, computational biology, computational geometry, databases and information retrieval, graph and network algorithms, machine learning, number theory and computer algebra, on-line algorithms, pattern matching and data compression, symbolic computation. The algorithms may be sequential, distributed or parallel, and they should be analyzed either mathematically or by rigorous computational experiments. Submissions that report on experimental and applied research are especially encouraged.


Information: Contact: nasetril@kam.ms.mff.cuni.cz; Web page: http://www.ms.mff.cuni.cz/esa99/.

16-18 Olga Taussky Todd Celebration of Careers in Mathematics for Women, Mathematical Sciences Research Institute, Berkeley, California.

Sponsor: Association for Women in Mathematics.

Anne Taussky-Todd lecture will showcase the research of outstanding women in mathematics; talks and discussions by mathematicians with careers in government, business, industry and academia will focus on contemporary issues of concern. The primary goals of the celebration are to assist, encourage, and inspire the graduate student and recent Ph.D. participants, to provide a forum for networking between mathematicians at different career stages, and to promote the achievements of women in mathematics. Senior investigators will provide role models and offer mentoring. The beginning mathematicians who participate will find in the legacy of Olga Taussky a realistic
model and worthy goals for their lives. The scientific community is invited to talk.

Travel Support: Limited travel support is available, primarily for graduate students and recent Ph.D.s. Those awarded travel support will present their work in a poster or talk. Funded graduate students must have begun a dissertation problem; recent Ph.D.s will present their work in a poster session each of a cover letter, an outline of their research (1-2 pages), a curriculum vitae (1-2 pages), a list of their publications, and letter(s) of recommendation (from the advisor for a graduate student). All non-U.S. citizen applicants must have a current U.S. address. The materials must be received by February 19, 1999, and be addressed to: Olga Taussky Todd Celebration Selection Committee, Association for Women in Mathematics, 414 Computer & Space Sciences Building, University of Maryland, College Park, Maryland 20742-2461.


Information: More information about the conference and application procedures is available in the January-February AWM Newsletter and at the website: http://www.awm-math.org; http://www.anr1.org; e-mail: awm@math.umd.edu.

Mathematics Calendar

January 1999

NOTICES OF THE AMS

69
Mathematics Calendar

Information: For further information please contact tel: 7-383-2-356237, fax: 7-383-2-357806, e-mail: ryanakin@math.unc.edu.ru.

*20-26 Eleventh International Congress of Logic, Methodology and Philosophy of Science, Krakow, Poland.

New Travel Grants: The Association for Symbolic Logic intends to provide a program of travel grants to support participation by logicians in this International Congress. A grant from the U.S. National Science Foundation has been applied for, to provide the necessary funds. Only those who are contributing a paper to the Congress or otherwise are official participants are eligible for a travel grant. Recipients must be U.S. citizens or permanent residents or must be employed in a U.S. university or other institution. Recent Ph.D. recipients, women, and members of minority groups are especially encouraged to apply. Air travel must be on U.S. flag carriers. Application must be made on a special form, which may be obtained from the ASL office by the deadline of February 1, 2000. The form may also be printed out from the ASL Web site: http://www.aslonline.org/. Applications must be received at the ASL office by the deadline of February 1, 1999.

Information: More information about this Congress see the meeting home page: http://www.vuj.edu.pl/Phil/congress/.

*23-September 4 Generalized Dirac Operators and their Geometric Scattering Theory, Banach Center, Warsaw, Poland.

Organizing Committee: B. Bojarski (Warsaw, Poland), J. Brzeziński (Berlin, Germany), J. Eichhorn (Greifswald, Germany), Th. Friedrich (Berlin, Germany), R. M. Melnik (Cambridge, UK), W. Müller (Bonn, Germany).

Aims: The purpose of this workshop is to bring together researchers from both the mathematical physics and the geometric analysis branch of scattering theory in order to compare the methods and get an overview of the most recent results in both fields. Proposed Topics: Scattering and spectral theory on complete noncompact manifolds; harmonic analysis on locally symmetric spaces; Hodge and Betti cohomology of complete noncompact spaces; scattering theory for $N$-body Schrödinger operators; distribution of resonances.

Information: Please contact Th. Friedrich (e-mail: friedrich@mathematik.hu-berlin.de) or consult our Web site: http://www.im.mathematik.hu-berlin.de/~publish/Beanch-99.html.

*30-September 1 Sixth International Symposium on Generalized Convexity and Monotonicity, University of the Aegean, Karlovassi, Samos Island, Greece.

Topics: The Symposium will address problems related to theoretical, algorithmic, computational and modeling issues in connection with generalizations of convexity and monotonicity, as they arise in mathematical programming, economics, management science, engineering, numerical mathematics, variational inequalities, equilibrium problems, etc.

Program Committee: C. C. Berge (Montreal, Canada), R. Cambini (Pisa, Italy), B. D. Craven (Melbourne, Australia), J. C. Crouzeix (Lyon, France), J. E. J. Frenk (Rotterdam, the Netherlands), N. Hadjisavvas (Samos, Greece), S. Komlosi (Pecs, Hungary), D. T. Luc (Hanoi, Vietnam), J. E. Martinez-Legaz (Barcelona, Spain), P. Mazzoleni (Milan, Italy), J. P. Penot (Pau, France), S. Schaible (Riverside, USA).

Invited Speakers: T. Jahn (Univ. Erlangen, Germany), P. Paradou (Univ. Florida), A. Prekopa (Rotterdam, Netherlands).

Deadline: Early registration: March 31, 1999; late registration: June 30, 1999; final manuscripts of invited papers: at the symposium; titles and abstracts of talks: June 30, 1999; submission of manuscripts for publication in the symposium proceedings: September 30, 1999.

*September 1999

5-11 XX International Seminar on Stability Problems for Stochastic Models, Maria Curie-Skłodowska University, Lublin, Poland.

Sponsors: The 20th Mathematical Institute of the Russian Academy of Sciences, Moscow State University, and the Maria Curie-Skłodowska University in Lublin.

Scope: The scope of the seminar is traditional and embraces: limit theorems of probability theory and mathematical statistics, characterizations of probability distributions and their stability, theory of probability metrics, limit theorems and characterization problems in stochastic analysis, stochastic processes and queueing theory, applied statistics, actuarial and financial mathematics.

Program: The program will have invited and contributed paper sessions, and poster sessions.


Program and Organizing Committee: M. Aroian (Debrecen, Hungary), G. Balkema (Amsterdam, The Netherlands), V. E. Benning (Moscow, Russia), R. Jajte (Lodz, Poland), V. V. Kalashnikov (Moscow, Russia), A. V. Kolchin (Moscow, Russia), V. Yu. Korolev (Moscow, Russia), V. M. Kruglov (Moscow, Russia), K. Kubacki (Lublin, Poland), E. Oney (Brussels, Belgium), A. Pluncinska (Warsaw, Poland), Z. Rychlik (Lublin, Poland), L. Ste˛tnicz (Warsaw, Poland), D. Zysnial (Lublin, Poland), K. Urbanik (Czech Republic), V. M. Zolotarev (Moscow, Russia, chairman of the seminar).

Registration Fee: US $50 for the participants, US $30 for accompanying persons.

Accommodation: Approximately US $30 per day per person in a double room at the hotel (meals included).


Information: Institute of Mathematics, UMCS, Pl. Marci Curie-Skłodowskiej 1, 20-031 Lublin, Poland; e-mail: stablot@umcs.lublin.pl; Steklov Mathematical Institute of the Russian Academy of Sciences, 8 Gubkin St, 117966 Moscow, Russia; e-mail: kolchin@mi.ras.ru; http://stabil.umcs.lublin.pl or http://berounski.mi.ras.ru.

*14-18 International Conference on Analytic Methods of Analysis and Differential Equations (AMADE), Minsk, Belarus.

Organizers: Institute of Mathematics of the Belarusian National Academy of Sciences and Belarusian State University (BSU) together with Moscow State University and Computer Center of Russian Academy of Sciences.

Section Titles: Integral Transforms and Special Functions; Differential Equations of Functional Equations and Applications; Integral, Difference, Functional Equations and Fractional Calculus.

Proceedings: The length of plenary invited lectures is 45 min, reports—20 min, and short communications—10 min. The publication of the abstracts is planned. Proceedings of Conference are supposed to be published in the Journal "Integral Transforms and Special Functions".

Organizing Committee: L. V. Gaishun (Belarus), V. A. Plakh (Russia) and A. V. Kozulin (BSU).

Information: Let us know by the end of December 1998, of your intention to participate in the conference. Please send the following information: name, affiliation and position, address and telephone/fax, e-mail, section title, and title of report to: AMADE, Department of Math. and Mech., Belarusian State University, 220050 Minsk 50, Tr. Skaryny Avenue 4, Belarus; e-mail: amade99@math.unam.ac.by. The second announcement with preliminary list of participants, registration fee, travelling information, accommodation, etc. will be sent in March of 1999.
15-19 GD'99 - Seventh International Symposium on Graph Drawing, Strin Castle, Prague, Czech Republic.

Organizer: J. Kratochvil (chair), DIMATIA Charles Univ., Prague.

Scope: The symposium is a forum for researchers, practitioners, developers and users working on all aspects of graph visualization and representations. The range of issues considered in graph drawing includes algorithms, graph theory, geometry, topology, order theory, graphic languages, perception, applications, and practical systems. Much research in graph drawing is motivated by applications to systems for viewing and interacting with graphs. The interaction between theoretical advances and implemented solutions is an important part of the graph drawing field. Results on perception and visualization issues related to diagrams are relevant. Papers describing original research and surveys as well as demos of new graph drawing tools and techniques are being sought.

Topics: Topics of interest include, but are not limited to: Algorithms, models and techniques for drawing graphs, concepts for visualizations of structural information, perception issues related to diagram understanding; geometric and topological graph theory; planarity issues; intersection and visibility representations of graphs; tools and systems for graph drawing, user interfaces for viewing graphs, interactive exploration of large graphs, presentation of dynamic graphs and animation of graphs, applications of graph drawing to areas such as software visualization, user interface design and database query formulation.


Information: gd99@kam.ms.mff.cuni.cz or http://www.ms.mff.cuni.cz/gd99/.


Topics: Riemannian and pseudo-Riemannian geometry, complex and quaternionic geometry, symplectic and contact geometry, foliation theory, topological aspects.

Program: 30-minute and 30-minute invited talks. A limited number of short oral and poster communications are also envisaged. The proceedings will be published.

Call for Papers: Deadline for abstracts, July 1, 1999.

Grants: Fifteen grants (to cover lodging and meals) for young participants (under 35) will be offered. To obtain such a grant it is necessary to send a Curriculum Vitae et Studiorum to the organizers no later than July 1, 1999.

Information: R. Ioanauc (riordan@stoilov.imar.ro), Gh. Prîbs (gh.pritis@info.unitv.ro), D. Papuc (dampapuc@info.uvt.ro), D. Acu (dacu@science.sibiu.ro).

20-26 International Symposium on Classical Analysis, Kazimierz Dolny, Poland.

Organizer: The Technical University of Radom.

Topics: We would like to discuss the results and problems in such fields as: several complex variables (especially L2-methods); Riemannian and Hermitian geometry; spectral theory in Hilbert space; probability; mathematical physics. Particular consideration will be given to the interrelation of ideas from different areas and to promote wider knowledge of some important classical theories.


Scientific Program: The scientific program will consist of invited lectures and thirty 45-minute scientific communications in English.

Information: Information about registration fee, accommodation costs and submission of manuscripts for the Proceedings of the Symposium will be presented in the second announcement. For further information contact T. Maziur, Department of Mathematics, Technical University, Malczewskiego 29, 26-600 Radom, Poland; fax: 4848-23633 or 4848-23960; e-mail: maziur@tki.man.rad.on.pl or krupa@alpa.nigw.waw.pw.

January 1999

20-26 International Symposium on Classical Analysis, Kazimierz Dolny, Poland.

Organizer: The Technical University of Radom.

Topics: We would like to discuss the results and problems in such fields as: several complex variables (especially L2-methods); Riemannian and Hermitian geometry; spectral theory in Hilbert space; probability; mathematical physics. Particular consideration will be given to the interrelation of ideas from different areas and to promote wider knowledge of some important classical theories.


Scientific Program: The scientific program will consist of invited lectures and thirty 45-minute scientific communications in English.

Information: Information about registration fee, accommodation costs and submission of manuscripts for the Proceedings of the Symposium will be presented in the second announcement. For further information contact T. Maziur, Department of Mathematics, Technical University, Malczewskiego 29, 26-600 Radom, Poland; fax: 4848-23633 or 4848-23960; e-mail: maziur@tki.man.rad.on.pl or krupa@alpa.nigw.waw.pw.

October 1999


Topics: Riemannian and pseudo-Riemannian geometry, complex and quaternionic geometry, symplectic and contact geometry, foliation theory, topological aspects.

Program: 30-minute and 30-minute invited talks. A limited number of short oral and poster communications are also envisaged. The proceedings will be published.

Call for Papers: Deadline for abstracts, July 1, 1999.

Grants: Fifteen grants (to cover lodging and meals) for young participants (under 35) will be offered. To obtain such a grant it is necessary to send a Curriculum Vitae et Studiorum to the organizers no later than July 1, 1999.

Information: gd99@kam.ms.mff.cuni.cz or http://www.ms.mff.cuni.cz/gd99/.

4-8 Workshop on the Complexity of Multivariate Problems, Hong Kong Baptist University, Hong Kong, China.

Topics: Integration and approximation; average-case and worst-case analyses; the problem of high dimensionality; generation of low discrepancy sets and sequences.

Program: The workshop will include plenary talks by: K.-T. Fang, S. Heinrich, H. Hickernell, H. Niederreiter, E. Novak, A. Owen, I. Sloan, T. Siczek, R.-H. Wang, G. Wasilkowski, H. Wozniakowski. There will also be contributed talks. To present a talk submit an abstract of less than 300 words and including all contact information of the speaker to the address below, preferably electronically, by April 1, 1999. All speakers will be invited to submit papers based on their talks for publication in a special issue of the Journal of Complexity.

Organizers: This workshop is organized by H. Hickernell and H. Wozniakowski and will be held at Hong Kong Baptist University. It is part of the Hong Kong Fall 1999 Special Semester on Foundations of Computational Mathematics (FoCM) based at City University of Hong Kong.

Information: To find out the latest information on this workshop, please visit our Web page at the address below. There you can also sign-up to receive future announcements with details on registration and accommodations. Complexity '99, c/o Department of Mathematics, Hong Kong Baptist University, Kowloon Tong, Hong Kong, China; tel: 852-2339-7015; fax: 852-2336-1505; URL: http://www.math.hkbu.edu.hk/complexity99; E-mail: complexity99@math.hkbu.edu.hk.

The following new announcements will not be repeated until the criteria in the next to the last paragraph at the bottom of the first page of this section are met.

January 2000

17-21 International Conference on Mathematical Analysis and Its Applications, 2000 (ICMAA2000), National Sun Yat-sen University, Kaohsiung 804, Taiwan, R.O.C.

Topics: Banach spaces of analytic functions, functional spaces, ODE theory, convex analysis, Fourier analysis, KKM and fixed point theory, matrix analysis, non-linear analysis, non-linear PDEs, numerical ranges, optimization theory, stochastic analysis, value distribution theory and complex dynamics.


Registration Fee: US$100 (subject to change, and no charge for students).

Proceedings: The Proceedings of ICMAA 2000 will be published as a special issue of the Taiwanese Journal of Mathematics. All speakers are invited to contribute their papers to the Proceedings.


THE APPLICABILITY OF MATHEMATICS AS A PHILOSOPHICAL PROBLEM
MARK STEINER

This book analyzes the different ways in which mathematics is applicable to the physical sciences, and presents a startling thesis—the success of mathematical physics appears to assign the human mind a special place in the cosmos. Mark Steiner examines the semantic problems that arise from the use of mathematics in logical deduction; the metaphysical problems that arise from the alleged gap between mathematical objects and the physical world; the descriptive problems that arise from the use of mathematics to describe nature; and the epistemological problems that arise from the use of mathematics to discover those very descriptions.

$39.95 cloth

THE POLITICS OF LARGE NUMBERS
A History of Statistical Reasoning
ALAIN DESROSIERES

Translated by Camille Naish

In this sophisticated study of the history of statistics, which begins with probability theory in the seventeenth century and culminates in twentieth-century applied econometrics, Alain Desrosières shows how the evolution of modern statistics has been inextricably bound to the knowledge and power of governments.

"An impressive synthesis of technical, historical, and philosophical thinking on statistics and the state in the modern Western world, available nowhere else. It is destined to be a standard reference."
—Carol Blum, State University of New York at Stony Brook

$45.00 cloth

Mathematics Calendar

Harvard University Press
800 448 2242 • www.hup.harvard.edu

edl/maaa2000; e-mail: icmama2000@math.nyu.edu; fax: 886-7-5253809. One can e-mail to N-C. Wong at wong@math.nyu.edu or B. Lin at blin@pop.math.uiowa.edu for more information.


Submissions: Abstracts of contributed papers from ASL members should be sent by the deadline of October 1, 1999, to the ASL office.

Program Committee: J. Larson (chair). Information: Association for Symbolic Logic, 1409 West Green Street, Urbana, Illinois 61801; tel: 217-244-7902; fax: 217-333-9576; e-mail: aslm@math.uiuc.edu; WWW: http://www.math.uiuc.edu/~asl/

February 2000


Aim: Stochastic programming is the study of practical procedures for decision making under the presence of uncertainties and risks. Stochastic programming approaches have been successfully used in a number of areas such as energy and production planning, telecommunications, forest and fishery harvest management, engineering, and transportation. Recently, it was realized that the practical experience gained in stochastic programming can be expanded to a much larger spectrum of applications including financial modeling, asset-liability management, bond portfolio management, currency modeling, risk control, and probabilistic risk analysis. This conference will focus on recent advances in theory and implementation issues of stochastic programming algorithms, software, and applications.

Topics: The conference will feature approximately 30-40 invited speakers during a three-day period. Major topics to be covered in the conference include: (1) advances in theory and implementation of stochastic programming algorithms; (2) sensitivity analysis of stochastic systems; and (3) stochastic programming applications.

Information: For further information please contact: S. Uryasev, Center for Applied Optimization, Dept. of Industrial and Systems Engineering, Univ. of Florida, 474 Well Hall, Gainesville, FL 32611-6595; tel: 352-392-3091; fax: 352-392-3537; e-mail: Uryasev@ise.ufl.edu; URL: http://www.ise.ufl.edu/uryasev/

June 2000

* 3-7 1999-2000 ASL Annual Meeting, University of Illinois at Urbana-Champaign, Illinois.

Program Notes: The program will reflect the accomplishments and future prospects of modern logic, in recognition of the new millennium.

Local Arrangements: L. van den Dries, C. W. Henson, C. G. Jockusich Jr., and A. Pillay.

Information: Association for Symbolic Logic, 1409 West Green Street, Urbana, IL 61801; tel: 217-244-7902; fax: 217-333-9576; e-mail: aslm@math.uiuc.edu; WWW: http://www.math.uiuc.edu/~asl/

July 2000


Sponsors: Technical Univ. of Valencia (UPV) and Univ. of Valencia (UV).

Program: There will be about 15 invited lectures on various topics of functional analysis. Participants will have the opportunity to submit abstracts for lectures of 25 minutes in parallel sessions; details will be announced. The Proceedings will be published in the series North-Holland Math. Studies.

Invited Speakers: G. Dalas (Leeds, England), T. W. Gamelin (UCLA), G. Godefroy (Paris VI, France), J. Lindenstrauss (Hebrew Univ., Jerusalem), N. Kalton (Columbia, MO), R. Meise (Dusseldorf, Germany), A. Peckzowski (Polish Acad. of Sciences, Warsaw), G. Pisier (Paris VI, France and Texas A&M), D. Vogt (Wuppertal, Germany), P. Wojtaszczyk (Univ. of Warsaw, Poland).


Preregistration: e-mail: VLC2000@uni-paderborn.de, or by regular mail to: K. D. Bierstedt, Univ. Paderborn, FB 17, Math., D-33095 Paderborn, Germany; or J. Bonet, Universidad Politecnica de Valencia, Departamento de Matemática Aplicada, E-46071 Valencia, Spain.

Information: The homepage of the meeting can be found at the Web sites: http://math-www.uni-paderborn.de/VLC2000/ and http://www.upv.es/VLC2000/.
New Publications Offered by the AMS

Algebra and Algebraic Geometry

Mirror Symmetry and Algebraic Geometry
David A. Cox, Amherst College, MA, and Sheldon Katz, Oklahoma State University, Stillwater

Mirror symmetry began when theoretical physicists made some astonishing predictions about rational curves on quintic hypersurfaces in four-dimensional projective space. Understanding the mathematics behind these predictions has been a substantial challenge. This book is the first completely comprehensive monograph on mirror symmetry, covering the original observations by the physicists through the most recent progress made to date. Subjects discussed include toric varieties, Hodge theory, Kahler geometry, moduli of stable maps, Calabi-Yau manifolds, quantum cohomology, Gromov-Witten invariants, and the mirror theorem.

Features:
- Numerous examples worked out in detail
- An appendix on mathematical physics
- An exposition of the algebraic theory of Gromov-Witten invariants and quantum cohomology
- A proof of the mirror theorem

This item will also be of interest to those working in mathematical physics.

Contents (Preliminary): Introduction; The quintic threefold; Toric geometry; Mirror symmetry constructions; Hodge theory and Yukawa couplings; Moduli spaces; Gromov-Witten invariants; Quantum cohomology; Localization; Quantum differential equations; The mirror theorem; Conclusion; Appendices; Bibliography.

Mathematical Surveys and Monographs

Matching of Orbital Integrals on GL(4) and GSp(2)
Yuval Z. Flicker, Ohio State University, Columbus

The trace formula is the most powerful tool currently available to establish liftings of automorphic forms, as predicted by Langlands principle of functionality. The geometric part of the trace formula consists of orbital integrals, and the lifting is based on the fundamental lemma. The latter is an identity of the relevant orbital integrals for the unit elements of the Hecke algebras.

This volume concerns a proof of the fundamental lemma in the classically most interesting case of Siegel modular forms, namely the symplectic group Sp(2). These orbital integrals are compared with those on GL(4), twisted by the transpose inverse involution. The technique of proof is elementary. Compact elements are decomposed into their absolutely simple and topologically unipotent parts also in the twisted case; a double coset decomposition of the form H \( G \setminus K \) — where \( H \) is a subgroup containing the centralizer — plays a key role.

Contents: Part I. Preparations: Statement of Theorem; Stable conjugacy; Explicit representatives; Stable \( \theta \) -conjugacy; Useful facts; Endoscopic groups; Instability; Kazhdan's decomposition; Decompositions for \( GL(2) \); Decomposition for \( Sp(2) \); Part II. Main comparison: Strategy; Twisted orbital integrals of type (I); Orbital integrals of type (I); Comparison in stable case (I), \( E/F \) unramified; Comparison in stable case (I), \( E/F \) ramified; Endoscopy for \( H = GSp(2) \) type (I); Unstable twisted case. Twisted endoscopic group of type I.F.2; Twisted endoscopic group of type I.F.3, \( E/F \) unramified; Twisted orbital integrals of type (II); Orbital integrals of type (II); Stable twisted case. Comparison in case (II), \( E/F \) ramified (\( e = 2 \)); Unstable twisted case. Twisted endoscopic group of type I.F.2; Comparison in case (III), \( E/F \) ramified (\( e = 2 \)); Unstable twisted case. Twisted endoscopic group of type I.F.2; Comparison in case (IV), \( E/F \) ramified (\( e = 1 \)); Unstable twisted case. Twisted endoscopic group of type I.F.2; Comparison in case (IV), \( E/F \) unramified (\( e = 1 \)); Unstable twisted case. Twisted endoscopic group of type I.F.2; Endoscopy for \( GSp(2) \), type (II); Comparison in case (III); Unstable twisted case. Twisted endoscopic group of type I.F.2; Comparison in case (IV); Unstable twisted case. Twisted endoscopic group of type I.F.2; Part III. Semi simple reduction: Review; Case of torus of type (I); Case of torus of type (II); Case of torus of type (III); Case of torus of type (IV); References.

Memoirs of the American Mathematical Society, Volume 137, Number 655
Continued
Annihilating Fields of Standard Modules of \( \mathfrak{sl}(2, \mathbb{C})^\sim \) and Combinatorial Identities

Arne Meurman, University of Lund, Sweden, and Mirko Primc, University of Zagreb, Croatia

In this volume, the authors show that a set of local admissible fields generates a vertex algebra. For an affine Lie algebra \( \mathfrak{g} \), they construct the corresponding level \( k \) vertex operator algebra and show that level \( k \) highest weight \( \mathfrak{g} \)-modules are modules for this vertex operator algebra. They determine the set of annihilating fields of level \( k \) standard modules and study the corresponding loop \( \mathfrak{g} \)-module—the set of relations that defines standard modules. In the case when \( \mathfrak{g} \) is of type \( A_1^{(1)} \), they construct bases of standard modules parameterized by colored partitions, and as a consequence, obtain a series of Rogers-Ramanujan type combinatorial identities.

Contents: Abstract; Introduction; Formal Laurent series and rational functions; Generating fields; The vertex operator algebra \( N(kA_0) \); Modules over \( N(kA_0) \); Relations on standard modules; Colored partitions, leading terms and the main results; Colored partitions allowing at least two embeddings; Relations among relations; Relations among relations for two embeddings; Linear independence of bases of standard modules; Some combinatorial identities of Rogers-Ramanujan type; Bibliography.

Memoirs of the American Mathematical Society, Volume 137, Number 652


Analysis

Algebraic and Strong Splittings of Extensions of Banach Algebras

W. G. Bade, University of California, Berkeley, H. G. Dales, University of Leeds, UK, and Z. A. Lykova, University of Newcastle, Newcastle Upon Tyne, UK

In this volume, the authors address the following:

Let \( A \) be a Banach algebra, and let \( \Sigma : 0 \to I \to A \to 0 \) be an extension of \( A \), where \( I \) is a Banach algebra and \( I \) is a closed ideal in \( A \). The extension splits algebraically (respectively, splits strongly) if there is a homomorphism (respectively, continuous homomorphism) \( \theta : A \to I \) such that \( \theta \) is the identity on \( I \).

Consider first for which Banach algebras \( A \) it is true that every extension of \( A \) in a particular class of extensions splits, either algebraically or strongly, and second for which Banach algebras it is true that every extension of \( A \) in a particular class which splits algebraically also splits strongly.

These questions are closely related to the question when the algebra \( I \) has a (strong) Wedderburn decomposition. The main technique for resolving these questions involves the Banach cohomology group \( H^2(A,E) \) for a Banach \( A \)-bimodule \( E \) and related cohomology groups.

Later chapters are particularly concerned with the case where the ideal \( I \) is finite-dimensional. Results are obtained for many of the standard Banach algebras \( A \).

Contents: Introduction; The role of second cohomology groups; From algebraic splittings to strong splittings; Finite-dimensional extensions; Algebraic and strong splittings of finite-dimensional extensions; Summary; References.

Memoirs of the American Mathematical Society, Volume 137, Number 656

Applications

Topological and Market Applications

Graciela Chichilnisky, Columbia University, New York, NY, Editor

This volume presents the proceedings of a workshop on geometry, topology, and markets held at The Fields Institute. The workshop was attended by eminent mathematicians and financial and economic theorists. Using a topological approach, the volume discusses new mathematics and its applications to social sciences and financial markets.

Topics addressed at the workshop included new topological invariants for existence, characterization and computation of market equilibria and their relation to social choice and to other forms of resource allocation, competitive and cooperative systems, algebraic geometry and markets with increasing returns, computational complexity, and stochastic processes and financial markets.

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

Contents: M. W. Hirsch, Applications of dynamical systems to deterministic and stochastic economic models; G. Chichilnisky, A unified perspective on resource allocation: Limited arbitrage is necessary and sufficient for the existence of a competitive equilibrium, the core and social choice; M. Broadie and J. Detemple, American options on dividend-paying assets; V. Baryshnikov and G. Chichilnisky, Intergenerational choice: A paradox and a solution.

Fields Institute Communications, Volume 22

Mathematical Support for Molecular Biology

Martin Farach-Colton,
Lucent Technologies Bell Laboratories, Murray Hill, NJ, Fred S. Roberts, Rutgers University, New Brunswick, NJ, Martin Vingron, Heidelberg, Germany, and Michael Waterman, University of Southern California, Los Angeles, Editors

This volume features highlights from the DIMACS Special Year on "Mathematical Support for Molecular Biology". Top researchers presented both new research results and comprehensive overviews on the use of mathematics (especially discrete mathematics) and theoretical computer science in molecular biology. The book provides a unique "snapshot" of this growing area of study. It will be of interest to both experts and novices seeking information on the state of the research.

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


DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 47

Networks in Distributed Computing

Marios Mavronicolas, University of Cyprus, Nicosia, Michael Merritt, AT&T Bell Labs, Murray Hill, NJ, and Nir Shavit, Weizmann Institute, Rehovot, Israel, Editors

This volume presents the proceedings from the DIMACS Workshop in Distributed Computing held at Rutgers University. It provides a broad survey of major topics concerning modern applications of networks in the context of distributed computing. Articles included touch upon fundamental problems and challenges related to recent technological advances in networking industry which are directly relevant and interesting to research on the mathematical principles of distributed computing.

Included are issues on diverse areas of networking such as ATM networking technology, issues on routing and flow control in communications networks, security, optical networking and mobile computing. This volume provides state-of-the-art research in these significant areas. The material should acquaint the theoretical community of distributed computing with related issues and problems.

Continued
New Publications Offered by the AMS

Treatment is applied and tailored to industrial advances in networking, however the underlying material presents a rich variety of theoretical problems in distributed computing that carry significant interest and challenge for the modern mathematician.

Contents: Y. Afek, Y. Mansour, and Z. Ostfeld, Virtual-credit: Efficient end-to-end credit based flow control; T. Anker, G. V. Chockler, D. Dolev, and I. Kedem, Scalable group membership services for novel applications; O. M. Cheiner and A. A. Shvartsman, Implementing an eventually-serializable data service as a distributed system building block; D. Fotakis, G. Pantziou, G. Pentaris, and P. Spirakis, Frequency assignment in mobile and radio networks; O. Gerstel, On limited wavelength conversion in optical ring networks;

G. Hjálmýsson and K. K. Ramakrishnan, UNITE-An architecture for lightweight signaling in ATM networks;

M. Mavronicolas, Timing-based connection management;


DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 45

LC 98-37246, 1991 Mathematics Subject Classification: 05C05, 05C10, 05C38, 05C85, 05C90, 68M07, 68M10, 68M20, 68Q05, 68Q10, 68Q22, 68Q25; Individual member $23, List $39, Institutional member $31, Order code DIMACS/45N

Multichannel Optical Networks: Theory and Practice

Peng-Jun Wan, Illinois Institute of Technology, Chicago,
Ding-Zhu Du, University of Minnesota, Minneapolis, and
Panos M. Pardalos, University of Florida, Gainesville, Editors

Time division multiplexing (TDM) has been the fundamental basis for adding capacity to digital telecommunications networks for decades. However, within the past two years, wavelength division multiplexing (WDM) has been emerging as an important and widely deployed complement to TDM. Sales of systems based on the new technology have risen at breathtaking speed. The driving force behind this sales explosion was the unexpected rapid exhaustion of long distance fiber network capacity. This fiber exhaust, combined with favorable economics for WDM, led to the use of this technology over other alternatives.

The WDM deployment raises fundamental and challenging problems that require novel and innovative solutions. This volume presents papers from an interdisciplinary workshop held at DIMACS on multichannel optical networks. Leading computer science theorists and practitioners discussed admission control, routing and channel assignment, multicasting and protection, and fault-tolerance. The book features application of theoretical and/or algorithmical results to practical problems and addresses the influence of practical problems to theoretical/algorithicm studies. The volume can serve as a text for an advanced course in computer science, networking, and operations research.

Differential Equations

Differential Operators and Spectral Theory

M. Sh. Birman's 70th Anniversary Collection

V. Buslaev, St. Petersburg State University, Russia,
M. Solomyak, Weizmann Institute of Science, Rehovot, Israel, and D. Yafaev, Rennes University, France, Editors

This volume contains a collection of original papers in mathematical physics, spectral theory, and differential equations. The papers are dedicated to the outstanding mathematician, Professor M. Sh. Birman, on the occasion of his 70th birthday. Contributing authors are leading specialists and close professional colleagues of Birman.

The main topics discussed are spectral and scattering theory of differential operators, trace formulas, and boundary value
problems for PDEs. Several papers are devoted to the magnetic Schrödinger operator, which is within Birman's current scope of interests and recently has been studied extensively. Included is a detailed survey of his mathematical work and an updated list of his publications.

This book is aimed at graduate students and specialists in the above-mentioned branches of mathematics and theoretical physics. The biographical section will be of interest to readers concerned with the scientific activities of Birman and the history of those branches of analysis and spectral theory where his contributions were important and often decisive.

Features:
- The first detailed survey of Birman’s mathematical work; includes an updated bibliography.
- New material on the history of some branches of analysis.
- Prominent authors: Lieb, Agmon, Deift, Simon, Ladyzhenskaya, and others.
- All original works, containing new results in fields of great current interest.

This item will also be of interest to those working in analysis.

Contents: V. Buslaev, M. Solomyak, and D. Yafaev, On the scientific work of Mikhail Shlemovich Birman; List of publications of M. Sh. Birman; S. Agmon, Representation theorems for solutions of the Helmholtz equation on $\mathbb{R}^n$; V. S. Buslaev, Kronig-Penney electron in a homogeneous electric field; E. A. Carlen and E. H. Lieb, A Minkowski type trace inequality and strong subadditivity of quantum entropy; P. Deift, Integrable operators; F. Gesztesy and B. Simon, Oscillatory eigenvalue problems with relaxed conditions; A. Ladyzhenskaya and G. A. Seregin, The discrete spectrum of the two-dimensional magnetic Schrödinger operator; M. A. Shubin, Elliptic boundary value problems with relaxed conditions; A. V. Sobolev, On the spectrum of the periodic magnetic Hamiltonian; T. Weidl, Another look at Cwikel's inequality; D. Yafaev, The discrete spectrum in the singular Friedrichs model; G. Zhislin, Spectrum of the relative motion of many-particle systems in a homogeneous magnetic field: What do we know about it?

American Mathematical Society Translations—Series 2
(Advances in the Mathematical Sciences), Volume 189
LC 91-640741, 1991 Mathematics Subject Classification: 35Pxx,
35Qxx, Individual member $59, List $99, Institutional member $79, Order code TRANS2/189N

Monge Ampère Equation:
Applications to Geometry and Optimization
Luis A. Caffarelli, New York University, Courant Institute, and Mario Milman, Florida Atlantic University, Boca Raton, Editors

In recent years, the Monge Ampère Equation has received attention for its role in several new areas of applied mathematics:
- As a new method of discretization for evolution equations of classical mechanics, such as the Euler equation, flow in porous media, Hele-Shaw flow, etc.,
- As a simple model for optimal transportation and a div-curl decomposition with affine invariance and
- As a model for front formation in meteorology and optimal antenna design.

These applications were addressed and important theoretical advances presented at a NSF-CBMS conference held at Florida Atlantic University (Boca Raton). L. Caffarelli and other distinguished specialists contributed high-quality research results and up-to-date developments in the field. This is a comprehensive volume outlining current directions in nonlinear analysis and its applications.


Contemporary Mathematics, Volume 226
LC 98-38822, 1991 Mathematics Subject Classification: 35J60,
35B55, 35A30, 46N10, 49Q20, 58E12, Individual member $23,
List $39, Institutional member $31, Order code CONM/226N
Differential Equations Methods for the Monge-Kantorovich Mass Transfer Problem

L. C. Evans, University of California, Berkeley, and W. Gangbo, Georgia Institute of Technology, Atlanta

In this volume, the authors demonstrate under some assumptions on $f^+$, $f^-$ that a solution to the classical Monge-Kantorovich problem of optimally rearranging the measure $\mu^+ = f^+dx$ onto $\mu^- = f^-dy$ can be constructed by studying the $p$-Laplacian equation $-\text{div}(\text{Du}_{p})^{p-2} \text{Du}_{p} = f^+ - f^-$ in the limit as $p \to \infty$. The idea is to show $u_p \to u$, where $u$ satisfies $|Du| \leq 1$, $-\text{div}(aDu) = f^+ - f^-$ for some density $a \geq 0$, and then to build a flow by solving a nonautonomous ODE involving $a, Du, f^+, f^-$. Contents: Introduction; Uniform estimates on the $p$-Laplacian, limits as $p \to \infty$; The transport set and transport rays; Differentiability and smoothness properties of the potential; Generic properties of transport rays; Behavior of the transport density along rays; Vanishing of the transport density at the ends of rays; Approximate mass transfer plans; Passage to limits a.e.; Optimality; Appendix: Approximating semiconcave and semiconvex functions by $C^2$ functions; Bibliography.

Memoirs of the American Mathematical Society, Volume 137, Number 653


Geometry and Topology

Selections from MSRI's Video Archive, Volume 2
The Chern Symposium, March 5-7, 1998

A publication of MSRI.

Featured speakers: Raoul Bott, Harvard University, Cambridge, MA; Robert Bryant, Duke University, Durham, NC; Xiuxiong Chen, Stanford University, CA; S. S. Chern, MSRI and University of CA, Berkeley; Phillip Griffiths, Institute for Advanced Study, Princeton, NJ; Friedrich Hirzebruch, Max-Planck Institute for Mathematics; Blaine Lawson, State University of New York, Stony Brook; Kefeng Liu, Stanford University, CA; Eckhard Meinrenken, University of Toronto, ON, Canada; James Simons, Renaissance Technologies, New York; Chuu-Lian Terng, Northeastern University, Boston, MA; Alan Weinstein, University of California, Berkeley.

This CD-ROM features video presentations from the Chern symposium in geometry sponsored jointly by the University of CA (Berkeley) and MSRI. The symposium presented developments in differential geometry over the past few decades. Recent progress and new directions in the field were also covered.

The CD requires RealVideo Player, which can be downloaded free from the RealNetworks Internet home page. RealVideo Player is available for Windows 95/Windows NT, Windows 3.1, Mac, IRIX 6.2/6.3, Solaris 2.5 and Linux 2.0.

Distributed worldwide by the American Mathematical Society.

*RealVideo is a registered trademark and RealNetworks is a trademark of RealNetworks, Inc.

Contents: J. Simons, Introductory remarks; R. Bott, Configuration space invariants of knots and 3-manifolds; R. Bryant, Finsler manifolds of constant flag curvature; Xiuxiong Chen, Extrinsic metrics in Riemann surfaces and the uniformization theorem; S. S. Chern, Projective geometry; F. Hirzebruch, Why do I like Chern classes?; B. Lawson, Algebraic cycles and the classical groups; K. Liu, Mirror principle; E. Meinrenken, Duistermaat-Heckman formulas for group valued moment maps; C.-L. Terng, Backlund transformations and loop ground actions; A. Weinstein, From Riemann geometry to Poisson geometry and back again.

Mirror Symmetry III
Duong H. Phong, Columbia University, New York, NY, Luc Vinet, University of Montreal, PQ, Canada, and Shing-Tung Yau, Harvard University, Cambridge, MA, Editors

This book presents surveys from a workshop held during the theme year in geometry and topology at the Centre de recherches mathematiques (CRM, University of Montréal). The volume is in some sense a sequel to Mirror Symmetry I (1998) and Mirror Symmetry II (1996), co-published by the AMS and International Press.

Included are recent developments in the theory of mirror manifolds and the related areas of complex and symplectic geometry. The long introductory articles explain the key physical ideas and motivation, namely conformal field theory, supersymmetry, and string theory. Open problems are emphasized. Thus the book provides an efficient way for a very broad audience of mathematicians and physicists to reach the frontier of research in this fast expanding area.

Features:
- Crucial research pertaining to future developments in algebraic and symplectic geometry and to the physics of unified string theories
- Well-known authors who are leaders in the field
- Introductory article by Greene and Yau
- A solid and even blend of ideas and techniques from both mathematics and physics

This item will also be of interest to those working in mathematical physics.

This book is co-published by the AMS, International Press, and Centre de Recherches Mathematiques.

Contents:
B. R. Greene, Aspects of quantum geometry;
S.-T. Yau, Introduction to enumerative invariants; T. H. Parker, Compactified moduli spaces of pseudo-holomorphic curves;
M. Verbitsky, Mirror symmetry for hyper-Kähler manifolds;
M. Gross, Connecting the web: A prognosis; A. Klemm and P. Mayr, Strong coupling singularities and non-abelian gauge symmetries in N = 2 string theory; S. Kachru, Remarks on (0,2) Calabi-Yau models; K. Liu, Relations among fixed point; J. Jorgenson and A. Todorov, An analytic discriminant for polarized algebraic K3 surfaces; D. R. Morrison, Through the looking glass; B. Siebert, An update on (small) quantum cohomology.

AMS/IP Studies in Advanced Mathematics, Volume 10

Mathematical Physics

Geometry of q-Hypergeometric Functions, Quantum Affine Algebras and Elliptic Quantum Groups
V. Tarasov, Steklov Mathematical Institute, St. Petersburg, Russia, and A. Varchenko, University of North Carolina, Chapel Hill

A publication of Societe Mathematique de France.
The trigonometric quantized Knizhnik-Zamolodchikov (qKZ) equation associated with the quantum group Uq(sl2) is a system of linear difference equations with values in a tensor product of Uq(sl2) Verma modules. The authors solve the equation in terms of multidimensional q-hypergeometric functions and define a natural isomorphism of the space of solutions and the tensor product of the corresponding evaluation Verma modules over the elliptic quantum group E_{\rho,\gamma}(sl2) where the parameters \rho and \gamma are related to the parameter \rho of the quantum group Uq(sl2) and the step p of the qKZ equation via \rho = e^{\pi i/p} and \gamma = e^{2\pi i/p}.

The authors construct asymptotic solutions associated with suitable asymptotic zones and compute the transition functions between the asymptotic solution in terms of the dynamical elliptic R-matrices. This description of the transition functions gives a connection between representation theories of the quantum loop algebra Uq(sl2) and the elliptic quantum group E_{\rho,\gamma}(sl2) and is analogous to the Kohno-Drinfeld theorem on the monodromy group of the differential Knizhnik-Zamolodchikov equation.

In order to establish these results, the authors construct a discrete Gauss-Manin connection, in particular, a suitable discrete local system, discrete homology and cohomology groups with coefficients in this local system, and they identify an associated difference equation with the qKZ equations.

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

Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, 8 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Discrete flat connections and local systems; R-matrices and qKZ connection; Tensor coordinates on the hypergeometric spaces; The hypergeometric pairing and the hypergeometric solutions of the qKZ equation; Asymptotic solutions of the qKZ equation; Proofs; Appendices; References.

Astérisque, Number 246
October 1998, 135 pages, Softcover, 1991 Mathematics Subject Classification: 17B37, 17B65, 33D60, 33D70, 33D80, 81R10, 81R50, Individual member $23, List $25, Order code AST/246N
A long open problem in probability theory has been the following: Can the graph of planar Brownian motion be split by a straight line?

Let $Z_t$ be two-dimensional Brownian motion. Say that a straight line $L$ is a cut line if there exists a time $t \in (0, 1)$ such that the trace of $\{Z_s: 0 \leq s < t\}$ lies on one side of $L$ and the trace of $\{Z_s: t < s \leq 1\}$ lies on the other side of $L$. In this volume, the authors provide a solution, discuss related works, and present a number of open problems.

Contents: Introduction; Preliminaries; Decomposition of Bessel processes; Random walk estimates; Estimates for approximate points of increase; Two and three angle estimates; The main estimate; Estimates for wedges; Filling in the gaps; Further results and problems; References.

Memoirs of the American Mathematical Society, Volume 137, Number 657


This lecture examines the notion of invariant measure from a fresh viewpoint. The most familiar examples of invariant measures are area and volume, which are invariant under the group of rigid motions. Master expositor Gian-Carlo Rota shows how, starting with a few simple axioms, one can concoct new invariant measures and explore their properties. One set of such measures, known as the intrinsic volumes, are quite new and still somewhat mysterious. However, they have intriguing probabilistic interpretations and in fact can be shown to form a basis for the space of all continuous invariant measures. Rota also discusses the remarkable connection between the intrinsic volumes and the Euler characteristic. Reaching deep ideas while remaining at an elementary level, this lecture would be accessible to undergraduate mathematics majors.

This item will also be of interest to those working in geometry and topology.
AMS Publications by 1999 Joint Mathematics Meetings' Speakers

These mathematicians will present topics of current interest in their fields at the Joint Mathematics Meetings in San Antonio: Naomi Fisher on Mathematics and Education Reform; Rodica Simion on Convex Polytopes and Partially Ordered Sets; Alan Schoenfield, panel moderator for the discussion on Principles and Standards for School Mathematics; and Jonathan M. Borwein on Experimental Mathematics: Insight from Computation. The publications below include work by these speakers. Also, be sure to visit the AMS booth during exhibit hours to browse these and other publications by speakers at the Joint Mathematics Meetings.

Formal Power Series and Algebraic Combinatorics
(Séries Formelles et Combinatoire Algébrique), 1994
Louis J. Billera, Cornell University, Ithaca, NY,
Curtis Greene, Haverford College, PA,
Rodica Simion, George Washington University, DC, and
Richard P. Stanley, Massachusetts Institute of Technology, Cambridge, Editors

Organic Mathematics
J. Borwein and P. Borwein, Simon Fraser University,
Burnaby, BC, Canada, L. Jorgenson, Center for Experimental and Constructive Mathematics, Simon Fraser University, Burnaby, BC, Canada, and R. Corless, University of Western Ontario, London, Canada, Editors
Members of the Canadian Mathematical Society may order at the AMS member price.

Changing the Culture:
Mathematics Education in the Research Community
Naomi D. Fisher, Harvey B. Keynes, and
Philip D. Wagreich, Editors
CBMS Issues in Mathematics Education*, Volume 5; 1995; ISBN 0-8218-0385-2; 214 pages; Softcover; All Individuals $35, List $59, Order Code CBMATH/5C91

Mathematicians and Education Reform 1990–1991
Naomi D. Fisher, University of Illinois at Chicago,
Harvey B. Keynes, University of Minnesota, Minneapolis, and
Philip D. Wagreich, University of Illinois at Chicago, Editors
CBMS Issues in Mathematics Education*, Volume 3; 1993; ISBN 0-8218-0383-4; 185 pages; Softcover; All Individuals $37, List $60, Order Code CBMATH/3C91

Research in Collegiate Mathematics Education. II
Jim Kaput, University of Massachusetts at Dartmouth,
Alan H. Schoenfield, University of California, Berkeley, and
Ed Dubinsky, Purdue University, West Lafayette, IN, Editors
CBMS Issues in Mathematics Education*, Volume 6; 1996; ISBN 0-8218-0382-6; 217 pages; Softcover; All Individuals $22, List $37, Order Code CBMATH/6C91

Research in Collegiate Mathematics Education. III
Alan H. Schoenfield, University of California, Berkeley,
Jim Kaput, University of Massachusetts, Dartmouth, and
Ed Dubinsky, Georgia State University, Atlanta, Editors
CBMS Issues in Mathematics Education*, Volume 7; 1998; ISBN 0-8218-0838-8; 316 pages; Softcover; All Individuals $24, List $40, Order Code CBMATH/7C91

*This series is published in cooperation with the Mathematical Association of America.
Visit the AMS Bookstore, our online catalog of books, videos, journals, software, and gift items at www.ams.org/bookstore.

Now includes over 2800 books!

A searchable catalog of over 2900 books, videos, journals, software, and gift items from the American Mathematical Society and participating publishers.

AMS Bookstore News
- New Title Email Notification.
- Special Sale Items.
- Chelsea Publishing Titles Now Available.
- Recommended Textbooks.
- AMS Publications on Display.
- What's New This Month.

SEARCH

Barry Cipra
This volume is fourth in the much-acclaimed AMS series What's Happening in the Mathematical Sciences. The lively style and in-depth coverage of some of the most important "happenings" in mathematics today make this publication a delightful and intriguing read accessible to a wide audience. High school students, professors, researchers, engineers, statisticians, computer scientists--anyone with an interest in mathematics--will find captivating material in this book. As the 20th century draws to a close, What's Happening presents the state of modern mathematics and its worldwide significance in a timely and enduring fashion.

URL www.ams.org/bookstore
Classified Advertisements

Positions available, items for sale, services available, and more

ALABAMA

UNIVERSITY OF ALABAMA IN HUNTSVILLE
Mathematical Sciences Department

The mathematical sciences department of the University of Alabama in Huntsville invites applications for two tenure-track faculty positions with the rank of assistant professor or associate professor beginning in August 1999. Applicants must possess a Ph.D. in mathematics or applied mathematics and demonstrate evidence of excellent teaching ability and outstanding research potential in an area of interest to current departmental faculty and students. These areas include applied probability/statistics, stochastic analysis, nonlinear functional analysis, differential equations/dynamical systems, numerical analysis, and discrete mathematics. Special consideration will be given to those applicants who specialize in computational fluid dynamics, spatial-temporal statistics or reliability theory. Send letter of application, vita with AMS Standard Cover Sheet, transcripts, and three letters of reference to the Chairman, Department of Mathematical Sciences, University of Alabama in Huntsville, Huntsville, AL 35899. Review of applications will begin January 15, 1999, and will continue until the position is filled. Women and minorities are particularly encouraged to apply. The University of Alabama in Huntsville is an Affirmative Action/Equal Opportunity Employer.

CALIFORNIA

CALIFORNIA STATE UNIVERSITY, LONG BEACH
Department of Mathematics

Tenure-track assistant professor in numerical analysis (applied mathematics) starting August 25, 1999. Must have Ph.D. in mathematics or applied mathematics with specialization in numerical analysis. Duties include teaching graduate and undergraduate courses in numerical analysis and applied mathematics, research in NA/AM leading to publication, committee service including possible curriculum development. Salary $38,756-$47,844/academic year. For more information, visit http://www.csulb.edu/math/. Review of applications begins January 19, 1999. To apply, send curriculum vitae, three letters of recommendation, transcript from Ph.D.-awarding university to Dr. Sam Counclllman, Chair, Mathematics Department, CSULB, 1250 Bellflower Blvd., Long Beach, CA 90840-1001. CSULB is an Equal Opportunity Employer committed to excellence through diversity. The Department of Mathematics has 33 full-time faculty members and-offers B.A., B.S., and M.S. degrees. Candidates should have a Ph.D. in the mathematical sciences, a strong commitment to excellence in teaching both at the undergraduate and graduate level, and potential for continuing research. Since the department has recently instituted a graduate option in applied mathematics, candidates with specialty in applied mathematics will be given particular consideration. Please send a vita, the AMS Standard Cover Sheet, and three letters of recommendation, one of which addresses the candidate’s teaching abilities, to the

U.S. laws prohibit discrimination in employment on the basis of color, race, sex, age, 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).

Submission: Promotions Department, AMS, P. O. Box 6248, Providence, Rhode Island 02940, or via fax, 401-331-3842, or send e-mail to classadsl@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.
Hiring Committee, Department of Mathematics, CSUN, Northridge, CA 91330-8313, by January 22, 1999. E-mail (inquiries only) math.hiring@csum.edu. California State University is an Equal Opportunity/Title IX/section 503/504 Employer.

**HARVEY MUDD COLLEGE**
Professor of Mathematics

Harvey Mudd College invites applications for a permanent position in mathematics at the full professor level. Demonstrated excellence in teaching is absolutely essential for all candidates, as is an established research program. Preference will be given to applicants in applied fields of mathematics; experience in the application of mathematics to industrial or technological problems is highly desired. The successful candidate will play a central role in the continued development and leadership of the Mathematics Clinic Program at HMC. An educational innovation of Harvey Mudd College, the Clinic program brings together teams of students to work for an academic year on research projects sponsored by business, industry, or government. Candidates should also be willing to supervise undergraduate research and work with others in the development of the undergraduate curriculum and other departmental initiatives.

Harvey Mudd College is a highly selective undergraduate institution of science, engineering and mathematics; the average SAT score of entering students is over 1450. More than one-third of the student body are National Merit Scholarship finalists. Each year there are over 50 graduates in mathematics, with approximately half going on to graduate school. Over 40% of mathematics alumni from HMC have obtained a Ph.D. The college enrolls about 650 students and is associated with four other undergraduate colleges, the Claremont Graduate University, and the Keck Graduate Institute of the Applied Life Sciences, forming together an academic community of about 5,000 students. There are over 50 mathematicians in Claremont.

Applicants should send a curriculum vitae, a description of their teaching philosophy and accomplishments, a description of their current research program, and names and addresses of at least three persons as references. Only references of finalists for the position will be contacted. Preference will be given to applications received before February 1, 1999. Harvey Mudd College is an Equal Opportunity Employer and is committed to the recruitment of candidates historically underrepresented on college faculties.

Address for applications:
Professor Robert Borrelli, Chairman
Mathematics Search Committee
Department of Mathematics
Harvey Mudd College
Claremont, CA 91711-5990

E-mail: borrelli@hmc.edu
URL: http://www.math.hmc.edu/

**MILLS COLLEGE**
Assistant Professor of Mathematics

Mills College invites applications for a tenure-track position as assistant professor of mathematics starting fall 1999. Required: Ph.D. in mathematics and a broad background in mathematics. Preference will be given to candidates with expertise in analysis. Applicants must submit evidence of superior teaching and research abilities. Teaching load: Five courses per year. 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.

Mills College is a small, well-known liberal arts college for women located in the San Francisco Bay Area. It offers 33 majors and 18 graduate programs, including a master's program in interdisciplinary computer science. The faculty/student ratio is 1:11.

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 January 22, 1999. Hard copies required; electronic copies optional. For more information see http://www.mills.edu/ADMIN_INFO/PROFEST/SEARCHES/.

Women and minorities are encouraged to apply. AA/EOE.

**SAINT MARY'S COLLEGE OF CALIFORNIA**
Tenure-Track Associate Professor

Assoc. prof., fall 1999, tenure-track (candidates at asst. prof. will be considered in exceptional cases). Teach and assist in development of interdisciplinary computer science major. Requires Ph.D. in computer science or math, expertise in computer science applications, demonstrated success in teaching interdisciplinary curriculum, active research program. Saint Mary’s College is a liberal arts, Catholic, co-educational college operated by the Christian Brothers. Send letter of application and CV to: J. R. Sangwine-Yager, Saint Mary’s College, P.O. Box 3517, Moraga, CA 94575-3517. Send three letters of recommendation, two of which address your match to these qualifications. Deadline is January 15, 1999; position open until filled. EOE.

**UNIVERSITY OF CALIFORNIA, BERKELEY**
Department of Statistics

We invite applications for a faculty position at any tenured or tenure-track rank, to begin July 1, 1999. We will consider strong candidates in any area of theoretical and applied statistics, probability and applied probability theory.

The department is particularly interested in hearing from suitably qualified women or members of minorities currently underrepresented in faculty positions. Send applications or inquiries (including résumé and three names of references) by January 19, 1999, to: Chair, University of California, Berkeley, Department of Statistics, 367 Evans Hall #3860, Berkeley, CA 94720-3860; fax 510-642-7882; e-mail: recruit@stat.berkeley.edu. The University of California is an Equal Opportunity/Affirmative Action Employer.

**COLORADO**

**THE COLORADO COLLEGE**
Department of Mathematics
14 E. Cache La Poudre
Colorado Springs, CO 80903

e-mail: msiddoway@coloradoc College.edu

The Department of Mathematics invites applications for one or more one-year non-tenure-track positions to begin in September 1999. The department will hire one person in applied mathematics. Applications from all fields are encouraged for any additional positions. Ph.D. in applied mathematics or mathematics required for all positions. In keeping with departmental tradition, all applicants are expected to be able to teach courses across the mathematics curriculum. The application deadline for all positions is February 12, 1999. Review of completed applicant files will begin on February 12 and will continue until all positions are filled. We encourage applications from all ranks for the position in applied mathematics and at the assistant professor level for any additional positions.

Colorado College, a leading national liberal arts college, is dedicated to greater diversity among its faculty and in its curriculum. The College welcomes members of all minority groups and reaffirms its commitment not to discriminate on the basis of race, color, age, religion, sex, national origin, sexual orientation, or disability in its educational programs, activities, and employment practices.

The Department of Mathematics values both excellence in teaching and vigorous mathematical scholarship. Candidates should send a letter of application describing both their commitment to teaching and mathematical interests, a curriculum vitae, and three letters of recommendation (at least one of which should address abilities
as a teacher) to Mike Siddoway at the address above. Please indicate whether you will be available to meet with representatives of the College at the joint MAA/AMS meetings in San Antonio in January 1999. Equal Opportunity Employer.

COLORADO STATE UNIVERSITY
Department of Mathematics
Faculty, Postdoctoral, and Visiting Positions

The Department of Mathematics at Colorado State University invites applications for three regular tenure-track faculty positions and one postdoctoral position beginning fall of 1999. The appointment level for the faculty positions is open, but preference will be given to candidates at the assistant professor level. The individuals appointed must hold a Ph.D. at the time of appointment and be capable of fulfilling the highest expectations in research and in teaching. The department currently has areas of strength in both applied/computational and pure mathematics, including dynamical systems, numerical analysis, optimization, partial differential equations, pattern analysis, algebra, algebraic geometry/topology, combinatorics, and analysis. While our primary needs are in algebraic geometry, numerical partial differential equations, and optimization, exceptional candidates in other areas of interest may also be considered.

A one-semester visiting professorship is also being offered for 1999-2000.

Applicants should submit a complete curriculum vitae and a summary of future research plans; evidence of strong teaching credentials is also desired. Applicants should also arrange for at least three letters of recommendation to be sent on their behalf to:

Faculty Hiring Committee
Department of Mathematics
Colorado State University
Fort Collins, CO 80523-1874

Applications received by January 15, 1999, will receive full consideration, but screening will continue until the positions are filled. A job description can be found at http://www.math.colostate.edu/jobs.html. Colorado State University is an EEO/AA Employer.

UNIVERSITY OF COLORADO AT COLORADO SPRINGS

The Department of Mathematics at the University of Colorado at Colorado Springs invites applications for a tenure-track position to start Aug 1999-2000. Applicants should document strength in both teaching and research. The department is looking for a candidate whose teaching interests are closely related to a departmental specialty: ring and module theory, probability, differential equations, harmonic analysis and wavelets, and applied mathematics. The normal teaching load is five semester courses per year. To apply, please submit in a single package a letter of application, the AMS Standard Cover Sheet, and a curriculum vitae. Candidates should arrange for three letters of recommendation to be sent. Mail all materials to: Search Committee, Department of Mathematics, University of Colorado, Colorado Springs, CO 80933-7150. Selection of candidates will begin on February 1, 1999. Women and minorities are especially encouraged to apply. The University of Colorado is an Equal Opportunity/Affirmative Action Employer.

UNIVERSITY OF DENVER

The Department of Mathematics and Computer Science invites applications for a tenure-track faculty position in mathematics at the assistant professor level to begin fall 1999. Candidates must have a Ph.D. in mathematics by September 1999. All research areas will be considered, but we are especially interested in a candidate who can interact with current faculty and who has demonstrated interest in innovative ways to teach mathematics. Active areas of mathematics research include operator algebras, functional analysis, mathematical physics, quantum computation, and dynamics. Our Web site at http://www.du.edu/ contains more information about research and other aspects of the department.

The University of Denver is a medium-sized (8,000 students) private university with a strong emphasis on teaching and research. Class sizes are small, the teaching load is moderate, and the salary is competitive. The department offers bachelor's and master's degrees in mathematics and computer science and a combined Ph.D. in mathematics and computer science. The University of Denver is committed to enhancing the diversity of its faculty and staff and encourages applications from women, persons of color, persons with disabilities, and veterans.

Screening of applications will begin immediately and will continue until the position is filled. We strongly encourage applicants to contact the Web site http://www.dupacs.org/ in order to submit an electronic AMS Cover Sheet. Applicants should also submit hard copies of curriculum vitae, a statement of teaching and research interests, and at least three reference letters, at least one of which must address teaching, to: Chair, Mathematics Search Committee, Mathematics and Computer Science Dept., University of Denver, Denver, CO 80208-2453.

DELAWARE

UNIVERSITY OF DELAWARE

The Department of Mathematical Sciences invites applications for a tenure/tenure-track position to begin September 1, 1999. The position is in applied mathematics with level open. Strong preference will be given to candidates at the associate or entry full professor level. Evidence of a strong publication record and fundable research is required. Experience and interest in establishing or mentoring links with industry and other academic disciplines will weigh heavily in the candidate's favor. Expertise in one or more of the areas of wave propagation, fluid dynamics, material science, scientific computation, and inverse problems will also weigh heavily in the candidate's favor. Evidence of effective teaching at the graduate and undergraduate level is essential. Applications should send CV (including funding history), reprints and/or preprints, and three letters of recommendation to: Applied Math Search Committee, Department of Mathematical Sciences, University of Delaware, Newark, DE 19716. Applications must be received by January 15, 1999, to receive full consideration.

The University of Delaware is an Equal Opportunity Employer which encourages applications from qualified minority group members and women.

FLORIDA

FLORIDA ATLANTIC UNIVERSITY

Applications are invited for two tenure-track faculty positions, beginning fall of 1999, in the areas of statistics and cryptography. Applicants must have a Ph.D. in mathematics, statistics, or related discipline. Applicants should send curriculum vitae, including a list of publications, a statement of research and teaching interests, and three letters of recommendation to: Hiring Committee, Department of Mathematical Sciences, Florida Atlantic University, Boca Raton, FL 33431. Applications received before February 15, 1999, will receive full consideration. For more information visit http://www.math.fau.edu/. Women and minorities are strongly encouraged to apply. As an agency of the State of Florida, FAU will make application materials and selection procedures available for review, in accordance with the State Sunshine Law. Florida Atlantic University is an Equal Opportunity/Access/Affirmative Action Institution.

FLORIDA GULF COAST UNIVERSITY

Mathematics
College of Arts & Sciences

Florida Gulf Coast University invites applications for two faculty positions available August 1999. The College of Arts and Sciences offers an innovative degree program in liberal studies and is dedicated to quality undergraduate teaching in an inquiry-based, interdisciplinary setting. Candidates will possess a commitment to excellence in teaching, the ability to teach
broad range of undergraduate math courses, experience with computer algebra systems in teaching, experience or interest in developing distance learning courses, and the ability to interact positively with faculty and students at all levels of education and discipline and to contribute to interdisciplinary curriculum development. Appointments will be made on 9-mo., multi-yr. contract basis.

Assistant professor, Pos. #12302. Req'd: Ph.D. in math conferred by August 1999. Prefer: Prior faculty experience. Area of specialization open. Ability to direct undergraduate research projects is a plus. Continued scholarly activity is expected at a level commensurate with the mission of the university.

Instructor, Pos. #12304. Req'd: Master's degree in either math or closely allied discipline with substantial graduate credits in math. Prefer: Some graduate coursework in probability and/or statistics. Prior full-time teaching experience is desirable.

To apply, submit two packages for each position. Each package must include a cover letter, curriculum vitae, and a list of five references postmarked by the deadline date of February 1, 1999, to FGCU, HR Dept., Position #, 10501 FGCU Blvd. South, Ft. Myers, FL 33965-6565. For add'l information, visit our Web site at http://admin.fgcu.edu/hr/ index.html or call 941-590-1111. Under Florida's Public Records Law, applications submitted are available for public review upon request.

FGCU is an EO/EA/AI which has a commitment to cultural, racial, and ethnic communities, and encourages women and minorities to apply. It is expected that successful candidates share in this commitment.

FLORIDA INTERNATIONAL UNIVERSITY
Department of Mathematics

The Department of Mathematics invites applications for a tenure-track position, subject to administrative approval, effective August 1999. The position will probably be at the assistant professor level. Duties will include mathematical research, teaching, and service. Candidates must have a Ph.D. in mathematics. Applications from applied mathematicians are encouraged.

Florida International University is a member of the State University System of Florida, with over 30,000 students. The department offers bachelor’s and master’s degrees. Current research interests of the faculty include algebra, number theory, analysis/P.D.E., numerical analysis, logic, and differential geometry/topology.

To apply, send a letter of application, vita, and three letters of recommendation to:

Recruitment Committee
Department of Mathematics
Florida International University
Miami, FL 33199

http://www.fiu.edu/~math/

Florida International University is an Equal Opportunity/Equal Access Employer.

FLORIDA STATE UNIVERSITY
Fellowships in Mathematics and Molecular Biology

The Program in Mathematics and Molecular Biology (PMBB), with support from the National Science Foundation and the Burroughs Wellcome Fund Interfaces Program, offers graduate and postdoctoral fellowships for training and research at the interface between mathematics and molecular biology. Current fellowship research topics include geometry and topology of nucleic acids, mathematical analysis of protein structures and dynamics, radiation hybrid mapping of the human genome, metrics on phylogenetic trees, and color-bar codes for determining spatial configuration of chromosomes in nuclei. Applicants must propose a project with both a mathematical and a biological component in order to be considered. PMBB fellowships can be held at any university or college in the United States. Application deadline is February 1, 1999. Women and minorities are encouraged to apply. Funding can begin between July 1, 1999, and December 1, 1999. For information and application materials contact: Program in Mathematics and Molecular Biology, Department of Mathematics, Florida State University, Tallahassee, FL 32306-4510; tel: 850-644-8710; fax: 850-644-6612; email: pmb@math.fsu.edu; URL: http://www.math.fsu.edu/~pmb/

GEORGIA INSTITUTE OF TECHNOLOGY

EMORY UNIVERSITY
Atlanta, Georgia 30322
Mathematics and Computer Science Department

The Department of Mathematics and Computer Science, Emory University, invites applications for an anticipated tenure-track assistant professorship or a tenured appointment at the rank of associate professor or professor, effective 1999-2000. Applicants must have a Ph.D. in mathematics and a closely related field. The department offers several undergraduate programs within Emory College, a Ph.D. in mathematics and an M.S. in computer science. Applicants are expected to have strong records or promise as undergraduate and graduate teachers.

Emory University has embarked on an ambitious building program for the sciences and mathematics, and we expect substantial growth in departmental and interdisciplinary education and research programs. Key to our development is creation of a computational science research group. Successful applicants will combine strength in one of the fundamental areas of numerical analysis, applied mathematics or high-performance computing together with demonstrated expertise in application areas. Life science applications are of particular interest given Emory's emphasis on life and medical science research. We expect this appointment to be the first of several devoted to these research areas.

Applicants must have Ph.D.s, at least three recommenders' names, and recommendation letters sent to Professor Dwight Duffus, Emory University, Atlanta, GA 30322.

Applications will begin on January 15, 1999.

Emory University is an Affirmative Action/Equal Opportunity Employer.

GEORGIA INSTITUTE OF TECHNOLOGY

The School of Mathematics expects to have visiting and tenure-track positions at various levels in pure and applied mathematics and statistics beginning in fall 1999. The School intends to expand its areas of expertise and foresee the potential for 10-15 new appointments in the next five years. Candidates with strong research and teaching records or potential should arrange for a résumé, at least three letters of reference, and a summary of future research plans to be sent to the Hiring Committee, School of Mathematics, Georgia Institute of Technology, Atlanta, GA 30332-0160. Georgia Tech, an institution of the University System of Georgia, is an Equal Opportunity/Affirmative Action Employer.

GEORGIA STATE UNIVERSITY
Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science of Georgia State University
invites applications for anticipated tenure-track positions for assistant professor beginning August 1999. Earned Ph.D. in mathematics or a closely related discipline and an excellent record in publications in mathematics are required, with preference for extramural funding. Preference is for individual with specialty in abstract algebra, differential equations, mathematics education, number theory, or topology.

Applicants should send a letter of application, vita, and three letters of recommendation to: Chair, Department of Mathematics and Computer Science, Georgia State University, University Plaza, Atlanta, GA 30303-3083 (or e-mail to: smfraser@gsu.edu). Applications must be postmarked no later than 2/21/99. Georgia State University is an EEO/AA Institution.

**ILLINOIS**

**ILLINOIS INSTITUTE OF TECHNOLOGY**

Department of Computer Science and Applied Mathematics

Applications are invited for two tenure-track positions in mathematics (one possibly at senior level) beginning in August 1999. Applicants must have a doctorate in applied mathematics or related fields. The department is particularly interested in the areas of numerical/computational mathematics and probability/statistics.

To ensure complete consideration, applicants should submit a detailed curriculum vitae, a statement of research and teaching interests, and the names and e-mail addresses of at least three references by January 15, 1999, to:

Prof. P. Deliyanis
Department of Computer Science and Applied Mathematics
Illinois Institute of Technology
Chicago, IL 60616

The Illinois Institute of Technology is an Equal Opportunity/Affirmative Action Employer.

**ILLINOIS WESLEYAN UNIVERSITY**

The Department of Mathematics and Computer Science at Illinois Wesleyan University invites applications for a full-time, tenure-track position jointly in both mathematics and computer science to begin August 1999. Candidates must have a Ph.D. in computer science or mathematics and possess considerable expertise in both areas. The position is open to all areas of specialization in mathematics and CS.

Illinois Wesleyan is a highly selective undergraduate liberal arts university of 1,900 students located in Bloomington, Illinois, a community of about 100,000. The Department of Mathematics and Computer Science is located in the new Center for Natural Science Learning and Research. This $25 million facility is equipped with over ninety Sun SPARC stations for student and faculty use. For additional information on the computer science curriculum and facilities, see http://www.iwu.edu/~cs. Send letter of application, AMS Cover Sheet, and resume, plus three letters of reference under separate cover, to: Dr. Melvyn Jeter, Chair, Department of Mathematics and Computer Science, Illinois Wesleyan University, P.O. Box 2900, Bloomington, IL 61702-2900.

Illinois Wesleyan University is an Equal Opportunity Employer. Applications will be reviewed beginning January 31, 1999. Preference may be given to those completed by this date. Preliminary interviews for this position will be held at the Joint Mathematics Meetings in San Antonio, Texas (January 1999). Review of applications will continue until the position is filled.

**IOWA**

**IOWA STATE UNIVERSITY**

Department of Mathematics

The department seeks applicants, pending funding, for two tenure-track positions to begin in the fall of 1999. The positions are expected to be at the assistant professor level, but exceptional applicants for a higher rank may be considered. An excellent record in research and teaching is required, and experience beyond the Ph.D. is desirable.

One position is targeted at control theory and practice. We are interested in a mathematician who can interact with current faculty in the department as well as with the numerous faculty in other departments interested in control problems.

The second position is targeted at areas of applied mathematics that are complementary to the existing strengths in the department. These include partial differential equations, numerical analysis, control theory, computational and mathematical biology, stochastic analysis, and discrete mathematics applied to computer science and other problems.

An applicant must indicate which position(s) they are applying for and submit a vita and a brief statement describing their research accomplishments and plans. They must also arrange for the submission of their graduate transcripts and four letters of recommendation, one of which must address the applicant’s teaching ability and experience. All application materials should be sent to: Max Gunzburger, Department of Mathematics, Iowa State University, Ames IA 50011-2064. Applicants whose completed applications are received by February 15, 1999 are assured of receiving full consideration.

Iowa State University strongly encourages women and members of underrepresented groups to apply.

**THE UNIVERSITY OF IOWA**

The Department of Mathematics at The University of Iowa invites applications for the following position:

Pending availability of funds, one or more visiting positions for all or part of the 1999-00 academic year. Selection will be based on research expertise and teaching ability. Preference will be given to applicants whose scholarly activity is of particular interest to members of the current faculty.

Women and minority candidates are especially urged to apply for the above positions.

To apply, send a complete vita and have three letters of recommendation sent to: Professor Bor-Luh Lin, Chair Department of Mathematics The University of Iowa Iowa City, Iowa 52242

The University of Iowa is an Equal Employment Opportunity and Affirmative Action Employer.

**KANSAS**

**UNIVERSITY OF KANSAS**

Department of Mathematics

Applications are invited for a tenure-track position and a temporary position at the assistant professor level beginning August 18, 1999, or as negotiated. (These positions are contingent on final budgetary approval.) For the tenure-track position preference will be given to candidates in nonlinear dynamical systems and chaos and otherwise to candidates in pure or applied mathematics or statistics whose specialties mesh well with those already represented in the department. For the temporary position, preference will be given to candidates in quantum groups and otherwise to candidates whose research interests mesh well with those of our faculty. Candidates must have a Ph.D. or its requirements completed by August 15, 1999. Postdoctoral experience for the tenure-track position is preferred.

Letter of application, detailed resume with description of research, completed AMS standardized application form, and three letters of recommendation should be sent to C. J. Himmelberg, Chairman, Department of Mathematics, 405 Snow Hall, University of Kansas, Lawrence, KS 66045-2142.

Deadlines: Review of applications will begin January 1, 1999, and will continue until the positions are filled.

EO/AA Employer.
LOUISIANA
CENTENARY COLLEGE
Allen Harvey Broyles
Professor of Mathematics

Applications and nominations for the endowed Broyles Chair of Mathematics are invited by Centenary College, the oldest college west of the Mississippi. Founded in 1825, Centenary is a member of the Associated Colleges of the South with Centre, Furman, Rhodes, Richmond, Sewanee, Trinity, Washington & Lee, and seven other selective institutions. The college enjoys an endowment of $88 million supporting 16 endowed chairs, and its math/science program was recently selected as one of America’s 200 best. The student/faculty ratio is 12:1, and a high percentage of graduates continue into advanced studies.

Ideal candidates will be in the earlier stages of their careers, with a strong interest in the application of computers to mathematics and preferably a history of using computers in their mathematical research. Evidence of strong teaching skills, a commitment to research, and a record of engaging students in undergraduate research are requisites. Endowed chair holders receive a reduced teaching load and a significant stipend to support their professional activities. Applicants please submit a vita, statement of teaching philosophy and research interests, and at least three letters of recommendation to:
Chair, Broyles Search Committee
Office of the Provost
Centenary College
Shreveport, LA 71134-1188

Applications will be accepted until the position is filled; those from women and minorities are especially welcome.

MASSACHUSETTS
BOSTON UNIVERSITY

The Department of Mathematics and Statistics at Boston University invites applications for one tenure-track position at the assistant professor level in the areas of geometry and topology. The position will begin in September 1999, subject to administrative approval. Review of applications will begin on January 15, 1999. Candidates should demonstrate a strong commitment to teaching and research. Please submit the AMS Application Cover Sheet with at least three letters of recommendation to: Dynamical Systems Search Committee, Department of Mathematics, Boston University, 111 Cambridge St., Boston, MA 02215. Application deadline: January 15, 1999. Boston University is an Affirmative Action/Equal Opportunity Employer.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Applied Mathematics

Applications are invited for a limited number of positions in applied mathematics starting fall 1999. Available positions include instructorships, lectureships, assistant professorships, and possibly higher levels. Applicants should demonstrate a strong commitment to teaching and research. Please submit the AMS Application Cover Sheet with at least three letters of recommendation to: Dynamical Systems Search Committee, Department of Mathematics, Boston University, 111 Cambridge St., Boston, MA 02215. Application deadline: January 15, 1999. Boston University is an Affirmative Action/Equal Opportunity Employer.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Mathematics

The Department of Mathematics and Statistics at Boston University invites applications for a two-year position at the visiting assistant professor level in the area of dynamical systems. The position will begin in September 1999, subject to administrative approval. Candidates should demonstrate a strong commitment to teaching and research. Please submit the AMS Application Cover Sheet with at least three letters of recommendation to: Dynamical Systems Search Committee, Department of Mathematics, Boston University, 111 Cambridge St., Boston, MA 02215. Application deadline: January 15, 1999. Boston University is an Affirmative Action/Equal Opportunity Employer.

BOSTON UNIVERSITY

The Department of Mathematics and Statistics at Boston University invites applications for a two-year position at the visiting assistant professor level in the area of dynamical systems. The position will begin in September 1999, subject to administrative approval. Candidates should demonstrate a strong commitment to teaching and research. Please submit the AMS Application Cover Sheet with at least three letters of recommendation to: Dynamical Systems Search Committee, Department of Mathematics, Boston University, 111 Cambridge St., Boston, MA 02215. Application deadline: January 15, 1999. Boston University is an Affirmative Action/Equal Opportunity Employer.

WILLIAMS COLLEGE
Williamstown, MA 01267
Department of Mathematics

Tenure-eligible position in statistics, beginning fall 1999, probably at the rank of assistant professor. In exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and statistics, including scholarship and consulting, is required. Applicants with emphasis in operations research will also be considered.

Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Evaluation of applications will begin November 15 and will continue until the position is filled. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

WORCESTER POLYTECHNIC INSTITUTE
Department of Mathematical Sciences

The Mathematical Sciences Department of Worcester Polytechnic Institute (WPI) invites applications for several tenure-track faculty positions in applied and computational mathematics to begin in the fall of 1999. Applicants will probably be at the assistant professor level, but exceptionally well qualified candidates may be considered for appointments at higher rank. An earned Ph.D. or equivalent degree is required. A successful candidate must be able to contribute strongly to both the department’s research activities and its innovative, project-based educational programs. Areas of research in the department include partial differential equations with applications in fluid and continuum mechanics, composite materials, computational modeling and simulation, numerical analysis, optimization, control theory, applied probability, discrete mathematics, and applied statistics.

Open to mathematicians with doctorates who show definite promise in research. Teaching loads are six hours per week during one semester and three hours per week during the other. Applications should be completed by January 1. Please arrange to have sent (a) a vita, (b) three letters of reference, (c) a description of the research in your thesis, and (d) the research which you plan for next year to: Pure Mathematics Committee, Massachusetts Institute of Technology, Room 2-263, Cambridge, MA 02139-4307. M.I.T. is an Equal Opportunity/Affirmative Action Employer.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
C.L.E. Moore Instructorships in Mathematics

Tenure-eligible position in statistics, beginning fall 1999, probably at the rank of assistant professor. In exceptional cases, however, more advanced appointments may be considered. Excellence in teaching and statistics, including scholarship and consulting, is required. Applicants with emphasis in operations research will also be considered.

Please have a vita and three letters of recommendation on teaching and research sent to Hiring Committee. Evaluation of applications will begin November 15 and will continue until the position is filled. As an EEO/AA Employer, Williams especially welcomes applications from women and minority candidates.

WORCESTER POLYTECHNIC INSTITUTE
Department of Mathematical Sciences

The Mathematical Sciences Department of Worcester Polytechnic Institute (WPI) invites applications for several tenure-track faculty positions in applied and computational mathematics to begin in the fall of 1999. Applicants will probably be at the assistant professor level, but exceptionally well qualified candidates may be considered for appointments at higher rank. An earned Ph.D. or equivalent degree is required. A successful candidate must be able to contribute strongly to both the department’s research activities and its innovative, project-based educational programs. Areas of research in the department include partial differential equations with applications in fluid and continuum mechanics, composite materials, computational modeling and simulation, numerical analysis, optimization, control theory, applied probability, discrete mathematics, and applied statistics.

Open to mathematicians with doctorates who show definite promise in research. Teaching loads are six hours per week during one semester and three hours per week during the other. Applications should be completed by January 1. Please arrange to have sent (a) a vita, (b) three letters of reference, (c) a description of the research in your thesis, and (d) the research which you plan for next year to: Pure Mathematics Committee, Massachusetts Institute of Technology, Room 2-263, Cambridge, MA 02139-4307. M.I.T. is an Equal Opportunity/Affirmative Action Employer.
WPI is a private and highly selective technological university with an enrollment of 2,700 undergraduates and about 1,000 full- and part-time graduate students. The campus is located in Worcester, MA, New England's second largest city, in close proximity to the city's many cultural attractions as well as nine other institutions of higher education in the urban area. Worcester, forty miles west of Boston, offers access to the diverse cultural and recreational resources of New England and provides opportunities for urban, suburban, or rural lifestyles. WPI offers a smoke-free environment.

The Mathematical Sciences Department has 24 full-time faculty and supports a Ph.D. program and M.S. programs in applied mathematics and applied statistics, as well as a full undergraduate program. For additional information about the Mathematical Sciences Department and WPI, see http://www.wpi.edu/Academics/Depts/Math/. Qualiﬁed applicants should send a detailed curriculum vitae, a one-page statement of their speciﬁc teaching and research objectives, and the names of four references with mail/email addresses and telephone/fax numbers to Search Committee, Mathematical Sciences Department, WPI, 100 Institute Road, Worcester, MA 01609-2280.

Applications will be considered on a continuing basis beginning January 1, 1999, until the positions are ﬁlled.

To enrich education through diversity, WPI is an Afﬁrmative Action, Equal Opportunity Employer.

MISSISSIPPI

MISSISSIPPI STATE UNIVERSITY
Department of Mathematics and Statistics
Faculty Position

Applications are invited for a tenure-track position at the rank of assistant or associate professor for the 1999-2000 academic year. Requirements include a doctoral degree, demonstrated success or a strong potential for research, and a commitment to effective undergraduate and graduate teaching. Preference will be given to candidates with research interests in numerical analysis, statistics, applied analysis, or applicable analysis, but especially strong candidates in any area of research are encouraged to apply. Salary is competitive and commensurate with qualiﬁcations.

The department is strongly research oriented. The new department head, Dr. Shair Ahmad, will join it in January 1999. It is also anticipated that several permanent faculty positions will be ﬁlled within the next two years. The department is housed in the College of Arts and Sciences and offers a Ph.D. program in mathematical sciences. Opportunities exist for applicants with an interest in interdisciplinary research or consulting. Applicants should submit a résumé with a completed AMS Application Cover Sheet and three letters of recommendation to:

Jianping Zhu, Chair
Screening Committee
Department of Mathematics and Statistics
Mississippi State University
P. O. Box MA
Mississippi State, MS 39762

The screening process will begin on February 1, 1999, and will continue until the position is ﬁlled. The department especially welcomes applications from women and minority candidates. Mississippi State University is an AA/EOE.

NEW JERSEY

PRINCETON UNIVERSITY
Department of Molecular Biology
Lewis Thomas Fellows Program in Computational and Physical Biology

A fellowship program has been established for outstanding young scientists to work in the Department of Molecular Biology. The program provides opportunities for exceptional individuals holding Ph.D. degrees (or the equivalent) in the areas of physics, chemistry, computer science, or computational approaches to biology who wish to gain expertise in molecular biology. Research will be carried out in collaboration with members of the Department of Molecular Biology. Fellows will be appointed for two years, with the potential for one additional year of support. The application deadline is December 15, 1998, for a nominal start date of September 1, 1999. For more information about the program and the Department of Molecular Biology, visit our Web site, http://www.molbio.princeton.edu/.

Applications must include a curriculum vitae, list of publications, brief statement (3 pages) of research interests and goals, and the names of three referees who have been asked to send references. Address applications to: Lewis Thomas Fellowship Committee, Department of Molecular Biology, Princeton University, Princeton, NJ 08544-1014.

Princeton University is an Affirmative Action/Equal Opportunity Employer and welcomes applications from women and members of minority groups.

PRINCETON UNIVERSITY
The Program in Applied and Computational Mathematics at Princeton University is seeking postdoctoral fellows to join in a multidisciplinary research effort involving academic and industrial scientists. Their research will be directed at fundamental understanding of scaling issues in several settings, such as data network trafﬁc, dynamical systems, and efﬁcient representation of massive data sets exhibiting multiple scales. Appointments are for one year in duration, but may be renewed annually for up to three years. Applicants should have a recent Ph.D. on the equivalent in the mathematical sciences. Priority will be given to applications received by January 15, 1999; applications will be accepted until the positions are ﬁlled. Please send a letter of application, current vita, description of research, and three letters of recommendation to:

Professor Ingrid Daubechies
Princeton University
Program in Applied and Computational Mathematics
Fine Hall, Washington Road
Princeton, NJ 08544

Princeton University is an Equal Opportunity/Affirmative Action Employer.

NEW YORK

CLARKSON UNIVERSITY
Department of Mathematics and Computer Science

The Department of Mathematics and Computer Science at Clarkson University invites applications for a tenure-track assistant professor of mathematics. Minimum requirements: a Ph.D. in statistics, demonstrated excellence in both teaching and research, ability to communicate readily in English. The candidate's research interests should mesh well with those of the faculty in engineering, science, or management. Background in regression graphics, modelling, applications, data analysis, or computation is preferred. Applications including AMS Application Cover Sheet, CV, and three reference letters must be received by 2/15/99. Starting date is August 16, 1999.

Applicants should send their curriculum vitae (please, no e-mail) and letters of reference to D. M. Powers, Department of Mathematics and Computer Science, Clarkson University, Box 5815, Potsdam, NY 13699-5815. Completed applications will be reviewed starting February 15, 1999. Clarkson University is an AA/EOE. Women and minorities are encouraged to apply. POS#31-98.

COLUMBIA UNIVERSITY
Department of Computer Science

The Department of Computer Science anticipates a non-tenure-track opening for a lecturer. We invite applications from outstanding classroom instructors with strong
activity in research in computer science or in a computer-related mathematical discipline.

Our department of twenty tenure-track faculty and four lecturers emphasizes excellence in research and teaching and attracts excellent undergraduate and graduate students. The number of faculty is expected to increase.

Departmental facilities include numerous Sun-4 servers, Sun, IBM, and SGI workstations; Macs and PCs, plus state-of-the-art experimental equipment. The department is in the third year of an NSF CISE research infrastructure grant. We are within an hour's drive of the research laboratories of AT&T, Bellcore, IBM, Lucent, Matsushita, NEC, Nynex, Philips, Siemens, and other leading industrial companies.

Columbia University is one of the leading research universities in the United States, and one of the few is one of the cultural, financial, and communications capitals of the world. Columbia's enclosed campus of tree-lined walks is located in Morningside Heights on the Upper West Side. The department has its own building plus additional space and facilities in the new interdisciplinary Schapiro Center for Engineering and Physical Science Research. University-subsidized housing and parking are available.

Please submit a summary of research interests, CV, e-mail address, and the names of at least three references to:

Lecturer Search
C/o Prof. Jonathan Gross
Department of Computer Science
450 Computer Science Building
Columbia University
New York, NY 10027
E-mail: research@cs.columbia.edu

Columbia University is an Equal Opportunity/Affirmative Action Employer. We encourage applications from women and minorities.

LEHMAN COLLEGE (CUNY)
Department of Mathematics and Computer Science

Positions are available starting September 1, 1999, for an assistant/associate/full professor in mathematics and an instructor/assistant/associate/full professor in computer science. Positional requirements include an earned doctorate, outstanding research record or potential, and commitment to excellence in teaching and departmental and collegewide service. Instructor position requires a masters' degree and a commitment to excellence in teaching and departmental and collegewide service. Appointment rank and salary commensurate with qualifications and experience. Application deadline is February 5, 1999. Application procedure: Send curriculum vitae with a cover letter (indicate position you are applying for) and at least three letters of recommendation to: Professor Robert Feineman, Chair, Department of Mathematics and Computer Science, Lehman College, Bronx, NY 10468. Use of the AMS Cover Sheet for Academic Employment is encouraged. Additional information at http://www.lehman.cuny.edu/AA/EEO/ADA Employer.

QUEENS COLLEGE, CUNY
Visiting Professor/Associate Professor

Applications are invited for the two Gorenstein Visiting Professorships at Queens College, City University of New York, for the 1999-2000 academic year. Applications may be made for either one semester or two. Applicants should offer a strong research record as well as demonstrated excellence in undergraduate teaching. Applicants should have at least ten years' experience beyond the Ph.D. in university or industrial positions. Appointment is to visiting associate/full professor. Recognized are fields in mathematics and statistics.

Queens College is a liberal arts institution with undergraduate and master's level programs in mathematics and mathematics education. Advanced courses are often taught in conjunction with our Mathematics Laboratory. Queens College is located in Flushing, New York, and is easily accessible from Manhattan by public transportation.

Applicants should send a letter of intent indicating semester(s) of interest, a current vita, a brief description of research interests, and three letters of reference indicating semester(s) of interest, a curriculum vitae, and three letters of recommendation to: Professor Robert Feineman, Chair, Department of Mathematics and Computer Science, Lehman College, Bronx, NY 10468. Use of the AMS Cover Sheet for Academic Employment is encouraged. Additional information at http://www.lehman.cuny.edu/AA/EEO/ADA Employer.

SUNY, BINGHAMTON
Department of Mathematical Sciences

State University of New York at Binghamton invites applications for a position at the assistant professor level (tenure-track) effective September 1, 1999. The position is one of the four Ph.D.-granting centers of the SUNY system. Qualifications: Ph.D., evidence of teaching ability, and outstanding research or research potential. (Research areas near those of the current faculty will have priority.) Screening begins on January 15, 1999. Binghamton University is an Equal Opportunity/Affirmative Action Employer. Applications must include a letter of interest, a statement of the candidate's philosophy of teaching, a resume, three letters of recommendation describing teaching, research, and ability to be a strong candidate for tenure. Applications must be received by January 20, 1999. State University of New York at Potsdam is an Equal Opportunity/Affirmative Action Employer committed to excellence through diversity.

STATE UNIVERSITY OF NEW YORK, POTSDAM
Assistant Professor of Mathematics

The State University of New York at Potsdam invites applications for a full-time tenure-track position effective September 1, 1999, at the rank of assistant professor. Responsibilities of the position are to teach twelve hours per semester of undergraduate and first-year graduate courses. Applicants must include a letter of interest, a statement of the applicant's philosophy of teaching, a resume, three letters of recommendation describing teaching experience and abilities, and a transcript (a copy is acceptable). Send to: Dr. Kerr Chapman, Staffing Committee Chair, Mathematics Department, SUNY Potsdam, Potsdam, NY 13676 (chaptmsen@potsdam.edu). To ensure full consideration, applications must be received by January 20, 1999. State University of New York at Potsdam is an Equal Opportunity/Affirmative Action Employer committed to excellence through diversity.

NORTH CAROLINA

WAKE FOREST UNIVERSITY
Department of Mathematics and Computer Science

Applications are invited for a tenure-track position at the assistant professor level beginning August 1999. Duties include teaching statistics, operations research, and modeling at the undergraduate level, teaching in one of these areas at the graduate level, and continuing research. A Ph.D. in statistics, mathematics, or operations...
research is required. Leadership and participation in the departmental major in mathematical business is required; this is a joint major with the School of Business and Accountancy. Research areas of interest include optimization, mathematical statistics, regression and time series analysis, categorical data analysis, game theory, modeling, and other areas of operations research, statistics, or applicable mathematics. Women and minorities are encouraged to apply. The department has 25 members and offers a B.S. and M.A. in mathematics, a B.S. and M.S. in computer science, and a B.S. in each of mathematical business and mathematical economics. Send a letter of application and resume to: Richard D. Carmichael, Chair, Department of Mathematics and Computer Science, Wake Forest University, Box 7388, Winston-Salem, NC 27109-7388. AA/EO Employer.

OHIO

OHIO UNIVERSITY
Department of Mathematics

Applications are invited for four tenure-track assistant professor positions. All applicants must show exceptional promise in research and teaching. The first position is for a statistician or mathematician interested in directing the actuarial science option of our undergraduate mathematics major. The person filling this position will also be expected to be open to interaction on statistical issues with other departments within the university. The second position is for a numerical analyst. We expect the successful applicant for this position to be interested in pursuing collaborative research with our faculty members in differential equations. We are also looking for a candidate who is interested in computation and computer-related issues and is willing to become active in the advising of graduate students enrolled in the computer science option of our master's degree program in mathematics. Applications for the remaining two positions will be considered in the areas of computational and applied mathematics, general topology, set theory, and algebra. All positions will be effective September 1, 1999; a Ph.D. in mathematics or an equivalent degree is required for each one of them. The salary is competitive and there is an excellent fringe benefit package. A review of applications will begin January 31, 1999. Send a letter of application, resume, and three letters of recommendation to: Chair, Search Committee, Department of Mathematics, 321 Morton Hall, Athens, Ohio 45701. Ohio University is an Equal Opportunity/Affirmative Action Employer.

SOUTH CAROLINA

COLLEGE OF CHARLESTON
Department of Mathematics

Applications are invited for at least three tenure-track positions in mathematics at the assistant professor level starting in August 1999. The mathematics department at the College of Charleston has 29 full-time faculty and offers the B.S. and M.S. degrees in mathematics. Candidates must have a Ph.D. in one of the mathematical sciences, a commitment to undergraduate and graduate teaching, and potential for continuing research. Preference for one position will be given to applicants experienced in mathematics education who demonstrate the potential for securing external grants. The normal teaching load is 9 hours per week for those engaged in research. The salary is competitive. Faculty from the College of Charleston are also available to meet with applicants at the AMS/MAA Annual Meetings in San Antonio. Applicants should send a vita and three letters of recommendation to Deanna Caveny, Chair, Department of Mathematics, College of Charleston, Charleston, SC 29424-0001. Additional information is available by visiting http://math.cofc.edu/ or e-mailing caveny@cofc.edu. The process of evaluating applications will begin on January 18, 1999, but applications will be considered until the positions are filled. The College of Charleston is an Equal Opportunity/Affirmative Action Employer and encourages applications from minority and women candidates.

OKLAHOMA

THE UNIVERSITY OF OKLAHOMA
Department of Mathematics

Applications are invited for one full-time, tenure-track position beginning August 16, 1999. The position is initially budgeted at the assistant professor level, but an appointment at the associate professor level may be possible for an exceptional candidate with qualifications and experience appropriate to that rank. Normal duties consist of teaching two courses per semester, conducting research, and rendering service to the department, university, and profession at a level appropriate to the faculty member's experience. The position requires an earned doctorate and research interests that are compatible with those of the existing faculty; preference will be given to applicants with potential or demonstrated excellence in research and prior successful undergraduate teaching experience. Salary and benefits are competitive. For full consideration, applicants should send a completed AMS Cover Sheet, curriculum vitae, a description of current and planned research, and three letters of recommendation (at least one of which must address the applicant's teaching experience and proficiency) to: Search Committee, Department of Mathematics, University of Oklahoma, 601 Elm, Phsc 423, Norman, OK 73019. Tel: 405-325-6711 Fax: 405-325-7484 E-mail: search@math.ou.edu Screening of applications will begin on December 15, 1998, and will continue until the position is filled. The University of Oklahoma is an Equal Opportunity/Affirmative Action Employer. Women and minorities are encouraged to apply. OU has a policy of being responsive to the needs of dual-career couples.

TENNESSEE

UNIVERSITY OF TENNESSEE - KNOXVILLE

The mathematics department of the University of Tennessee seeks to fill two tenure-track assistant professorships: (1) in probability and stochastic processes, with preference shown to those candidates working in such areas of applied probability as communication networks, mathematical biology and genetics, and mathematical finance; and (2) in computational mathematics, with preference shown to those candidates pursuing new and innovative research in applications of computational mathematics to material sciences, biology, or finance. A Ph.D. is required. Some postdoctoral experience is preferred but not required. Substantial research promise as well as dedication to teaching are paramount. Employment begins August 1, 1999. Interested applicants should arrange to have a vita, three reference letters, a research statement (including abstracts), and evidence of quality teaching sent to Professor John B. Conway, Probability Search or Computational Math Search, (whichever applies), Mathematics Department, University of Tennessee, Knoxville, TN 37996-1300. Electronic applications are not acceptable. Use of the recent AMS Application Form is appreciated. Review of applications will begin December 1 and will continue until the position is filled. Information about the Department can be found at http://www.math.utk.edu/. The University of Tennessee is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA Employer.

TEXAS

UNIVERSITY OF HOUSTON - CLEAR LAKE
Department of Mathematical Science

Applications are being invited for a tenure-track opening for an assistant professor...
THE UNIVERSITY OF TEXAS AT AUSTIN
Austin, TX 78712
Department of Mathematics

Openings for fall 1999 include: (a) instructorships, some of which have R. H. Bing Faculty Fellowships attached to them, and (b) two or more positions at the tenure-track/tenure level.

(a) Instructorships at The University of Texas at Austin are postdoctoral appointments, renewable for two additional years. It is assumed that applicants for instructorships will have completed all Ph.D. requirements by August 31, 1999. Other factors being equal, preference will be given to those whose doctorates were conferred in 1998 or 1999. Candidates should show superior research ability and have a strong commitment to teaching. Consideration will be given only to persons whose research interests have some overlap with those of the permanent faculty. Duties consist of teaching undergraduate or graduate courses and conducting independent research. The projected salary is $38,500, plus fringe benefits, for the nine-month academic year. Each R. H. Bing Fellow holds an instructorship in the Mathematics Department, with a teaching load of two courses in one semester and one course in the other. The combined instructorship-fellowship stipend for nine months is $38,500, which is supplemented by a travel allowance of $1,000. Pending satisfactory performance of teaching duties, the fellowship can be renewed for two additional years. Applicants must show outstanding promise in research. Bing Fellowship applicants will automatically be considered for other departmental openings at the postdoctoral level, so a separate application for such a position is unnecessary.

Those wishing to apply for instructorship positions are asked to send a vita and a brief research summary to the above address c/o Recruiting Committee. Transmission of the preceding items via e-mail (address: instructor@math.utexas.edu) is encouraged.

(b) An applicant for a tenure-track or tenured position must present a record of exceptional achievement in her or his research area and must demonstrate a proficiency at teaching. In addition to the duties indicated above for instructors, such an appointment will typically entail the supervision of M.A. or Ph.D. students. The salary will be commensurate with the level at which the position is filled and the qualifications of the person who fills it.

Those wishing to apply for tenure-track/tenured positions are asked to send a vita and a brief research summary to the above address c/o Recruiting Committee. Transmission of the preceding items via e-mail (address: instructor@math.utexas.edu) is encouraged.

All applications must be supported by at least three letters of recommendation, at least one of which speaks to the applicant's teaching credentials. The screening of applications will begin on December 1, 1998.

The University of Texas at Austin is an Equal Opportunity Employer.
• Statistician/Modeler
• SAS Programmer

Obviously, to join the best, you'll need to be one of the best. A bachelor's degree in a mathematics-related field plus a master's degree in statistics or similar discipline are required. Also, a working knowledge of SAS, SPSS and/or S+, backed by outstanding communication skills are desirable. UNIX experience is a plus.

So, if your career is ready for a challenge, talk it over with Capital One. Because if you can forecast results, your future will be set. For more information, please fax or mail your résumé to:

Michele Bitsis
Attn: 12061-0335
Capital One Financial
11013 West Broad Street
Richmond, VA 23060
Fax: 804-967-1182
E-mail: michele.bitsis@capitalone.com

Capital One is an Equal Opportunity Employer committed to diversity in the workplace. We promote a drug-free work environment.

WYOMING

UNIVERSITY OF WYOMING
Department of Mathematics
Tenure-Track Position in Algebra/Combinatorics

The University of Wyoming mathematics department (Web site http://www.math.uwyo.edu/) invites applications for a tenure-track assistant professorship in algebra/combinatorics to start August 1999. Applicants must demonstrate strong ability in research, breadth of mathematical knowledge, strong commitment to undergraduate and graduate teaching, undergraduate advising, and willingness to supervise master's and doctoral students. Candidates in all areas of algebra and/or combinatorics will be considered.

All application materials should be mailed to Dr. Beno Chen, Head, Department of Mathematics, University of Wyoming, Laramie, WY 82071-3036. Candidates will send curriculum vitae including publication list, a summary of research interests, and a statement of teaching qualifications. Applicants should also arrange for three letters of recommendation to be mailed directly to Dr. Chen. Applications received by January 30, 1999, will receive first consideration. Department seeks candidates with an earned doctorate by appointment date of August 30, 1999. The University of Wyoming is an Affirmative Action/EQUAL Opportunity Employer, and we encourage women and underrepresented minorities to apply.

CANADA

SIMON FRASER UNIVERSITY
VANCOUVER, BRITISH COLUMBIA
Department of Mathematics and Statistics
Faculty Appointment in Pure Mathematics

The Department of Mathematics and Statistics of Simon Fraser University invites applications for a tenure-track position in pure mathematics at the assistant professor level starting September 1, 1999, or September 1, 2000. Applicants will be expected to have completed a Ph.D. degree at the time of appointment and to have demonstrated a strong teaching and research potential. The department is particularly interested in broadly based, computer-literate applicants with strength in algebra, but also welcomes applicants with strengths in such other areas as algebraic geometry, discrete mathematics, nonlinear analysis, or number theory.

Applications, including a curriculum vitae and descriptive statements on research plans and teaching activities, should be sent by January 31, 1999, to:

Dr. J. L. Berggren, Chair
Department of Mathematics and Statistics
Simon Fraser University
Burnaby, BC V5A 1S6 Canada

Please arrange for three letters of reference to be sent, in confidence, from the referees.

Further information on the department and the University can be found on the WWW site, http://www.math.sfu.ca/.

The position is subject to final budgetary approval.

UNIVERSITY OF OTTAWA

The Department of Mathematics and Statistics of the University of Ottawa invites applications from recent Ph.D.s for one tenure-track position at the assistant professor level beginning July 1, 1999. Applications in all areas of mathematics and statistics are invited. The department's priorities are modern applied mathematics, computational mathematics, and theoretical computer science. All qualified applicants are invited to apply.

Applications should be sent to:

Professor J. L. Berggren, Chair
Department of Mathematics and Statistics
Simon Fraser University
Burnaby, BC V5A 1S6 Canada

Deadline: January 31, 1999

The position is subject to final budgetary approval.
ITALY

INTERNATIONAL SCHOOL FOR ADVANCED STUDIES
Post-Doctoral Positions

The International School for Advanced Studies (SISSA/IASI) in Trieste expects to offer post-doctoral position in the following fields:
Differential Equations and Calculus of Variations
Control Theory
Mathematical Physics

These positions will be available from Autumn 1999 for one year and renewable for a second year. Candidates, who must not be over 36 years of age, should send their applications to arrive by January 15, 1999, with their curriculum vitae, list of published works and their research program. They should arrange for two letters of reference to be sent by the same date.

Applications and correspondence should be sent to:
Postdoc Program
International School
for Advanced Studies
Via Beirut, 2-4
34014 Trieste, Italy
e-mail: postdoc@siassa.it

PORTUGAL

CENTER FOR MATHEMATICAL ANALYSIS
GEOMETRY AND DYNAMICAL SYSTEMS
Departamento de Matemática
Instituto Superior Técnico
Av. Rovisco Pais
1096 Lisboa Codex, Portugal

Postdoctoral Positions

The Center for Mathematical Analysis, Geometry and Dynamical Systems of the Department of Mathematics of Instituto Superior Técnico, Lisbon, Portugal invites applications for postdoctoral positions for research in mathematics. Positions are for one year, with the possibility of extension for a second year upon mutual agreement. Selected candidates will be able to take up their position beginning September 1, 1999, and January 1, 2000.

Applicants should have a Ph.D. in mathematics obtained after December 31, 1996. They must show evidence of research promise in one of the areas in which the mathematics faculty of the Center is currently active. There are no teaching duties associated with these positions.

Applicants should send a curriculum vitae, reprints, preprints and/or dissertation abstract; description of research project (of no more than 1,000 words); and three letters of reference directly to the director at the above address.

To insure full consideration, complete application packages should be received by March 15, 1999. Additional information about the Center and the positions is available at http://www.math.ist.utl.pt/cam/.

PUERTO RICO

UNIVERSIDAD METROPOLITANA
Assistant Professorship in Mathematics

We invite applications for a position in mathematics at the rank of assistant professor beginning August 1, 1999. Duties include 6 to 9 credit hours of teaching per semester, with release time available for research. Minimal qualifications include a Ph.D. in mathematics, a commitment to teaching and research, and knowledge of Spanish (or a commitment to learning Spanish). UMET, a liberal arts institution in San Juan, Puerto Rico, with approximately 4,500 students, has received funding from the National Science Foundation’s Model Institutions for Excellence Program (MIE) for the purpose of improving its science and mathematics programs and to develop a model for excellence in education in these areas. We are seeking a candidate whose interests are in applied mathematics (interpreted in its broadest sense), but strong candidates in any area are encouraged to apply. Candidates should send a curriculum vitae, selected reprints/preprints/abstract of dissertation, evidence of teaching excellence, and three letters of recommendation to: Dr. Javier Avalos, Chair, Department of Science and Technology, UMET/MIE, P.O. Box 21150, San Juan, PR 00928-1150; e-mail: un_javalos@suagm2.suagm.edu; Web site: http://umet.mie.suagm.edu/.

TAIWAN

TSING HUA UNIVERSITY
Mathematics Division
National Center for Theoretical Sciences
Postdoctoral/Visiting Positions

The National Center for Theoretical Sciences (NCTS) is a new center in Taiwan intended to promote research in major areas of mathematics and theoretical physics. It is supported by a special grant from the National Science Council of the Republic of China. Various activities—workshops, advanced schools, and topical programs—are taking place at this center, sited at Tsing Hua University. Special topics chosen for the year 1998/99 are Dynamical Systems, Geometric Analysis, Number Theory and Discrete Mathematics.

The members of the Center consist of center scientists, visiting scientists, and postdocs. We are expecting to offer several postdoctoral positions starting in fall 1999. These can be either one-year or two-year appointments. Junior mathematicians who are interested in applying for our postdoctoral positions should send curriculum vitae, three letters of reference, research plans, and reprints/preprints, or their enquiries to National Center for Theoretical Sciences, Tsing Hua University, Hsinchu, Taiwan 30044; e-mail: cts@math.nthu.edu.tw; home page: http://www.math.nthu.edu.tw/~cts/.

The deadline for applications is March 1, 1999.

SERVICES AVAILABLE

DocuTxing

DocuTxing is a high-quality LaTeX typesetting facility for mathematical journals and monographs. Our services also include HTML coding, reference validation, and illustrations. We can see an electronic journal through from start to finish. For more information, samples, and references, please e-mail mainoffice@DocuTxing.com or visit http://www.DocuTxing.com/.

Translation and/or Typesetting

French, German, Russian, Spanish books/manuscripts translated into English by professional translator. Also LaTeX typesetting. Contact: Stephen S. Wilson, First Floor, 19 St. Georges Road, Cheltenham GL50 3DT, UK. Call/fax: 01242-224306 (UK), or e-mail: techtrans@clara.net.

PUBLICATIONS WANTED

MATHWATICS BOOKS PURCHASED

Pure & appl. adv. & research level, any age, usable cond. Reprints OK. One box to whole libraries sought. Contact: Collier Brown or Kirsten Berg @ Powell’s Technical Bks., Portland, OR. Call 800-225-6911, fax 503-228-0505, or e-mail: kirsten@technical.powells.com.
Volume 4, 1998 (year to date)

Juan Carlos Alvarez Paiva and Emmanuel Fernandes, Crofton formulas in projective Finsler spaces

S. V. Ivanov, On aspherical presentations of groups

Naoki Chigira, Nobuo Iyori, and Hiroyoshi Yamaki, Non abelian Sylow subgroups of finite groups of even order

O. Kharlampovich and A. Myasnikov, Tarski’s problem about the elementary theory of free groups has a positive solution

K. C. H. Mackenzie, Drinfel’d doubles and Ehresmann doubles for Lie algebroids and Lie bialgebroids

János Kollár, The Nash conjecture for threefolds

Tzong-Yow Lee, Asymptotic results for super-Brownian motions and semilinear differential equations

Takashi Hara and Gordon Slade, The incipient infinite cluster in high-dimensional percolation

Pavel Etingof and Alexander Kirillov, Jr., On Cherednik-Macdonald-Mehta identities

Palle E. T. Jorgensen and Steen Pedersen, Orthogonal harmonic analysis of fractal measures

Kevin Ford, The distribution of totients

Navin Keswani, Homotopy invariance of relative eta-invariants and C*-algebra K-theory

Bruce Geist and Joyce R. McLaughlin, Eigenvalue formulas for the uniform Timoshenko beam: the free-free problem

George Kamberov, Prescribing mean curvature: existence and uniqueness problem

M. F. Newman and Michael Vaughan-Lee, Some Lie rings associated with Burnside groups


ERA-AMS publishes high-quality research announcements of significant advances in all branches of mathematics. Authors may submit manuscripts to any editor. All papers are reviewed, and the entire Editorial Board must approve the acceptance of any paper. Papers are posted as soon as they are accepted and processed by the AMS.

ERA-AMS offers you...
- decreased turn-around time from submission to print
- fast access to your specific area of interest
- up-to-the-minute research information

To obtain submission information and the template, send email to: era-info@ams.org with the word “help” in the subject line.

For more information, contact: cust-serv@ams.org
1-800-321-4267, 1-401-455-4000, fax 1-401-455-4046

www.ams.org/era/
Asymptotic Statistics

A.W. van der Vaart

In addition to most of the standard topics of an asymptotics course, including likelihood inference, M-estimation, the theory of asymptotic efficiency, U-statistics, and rank procedures, the book also presents recent research topics such as semiparametric models, the bootstrap, and empirical processes and their applications. The topics are organized from the central idea of approximation by limit experiments, which gives the book one of its unifying themes. This entails mainly the local approximation of the classical i.i.d. set up with smooth parameters by location experiments involving a single, normally distributed observation. Thus, even the standard subjects of asymptotic statistics are presented in a novel way.

Cambridge Series in Statistical and Probabilistic Mathematics 3
1998 460 pp. 0-521-49603-9 Hardback $64.95

Orthogonal Rational Functions

Adhemar Bultheel, Pablo González-Vera, Erik Hendriksen, and Olav Njåstad

This book generalizes the classical theory of orthogonal polynomials on the complex unit circle or on the real line to orthogonal rational functions whose poles are among a prescribed set of complex numbers. The first part treats the case where these poles are all outside the unit disk or in the lower half plane. Classical topics such as recurrence relations, numerical quadrature, interpolation properties, Favard theorems, convergence, asymptotics, and moment problems are generalized and treated in detail. In the last chapter, several applications are mentioned including linear prediction, Pisarenko modeling, lossless inverse scattering, and network synthesis.

Cambridge Monographs on Applied and Computational Mathematics 5
1999 384 pp. 0-521-65006-2 Hardback $59.95

Games of No Chance

R. Nowakowski, Editor

"Some books make mathematics look like so much fun! This collection of 35 articles and a comprehensive bibliography is a marvelous and alluring account of a 1994 MSRI two week workshop on combinatorial game theory. This could be a menace to the rest of mathematics; those folks seem to be having such a good time playing games that the rest of us might abandon 'serious' mathematics and join the party... Even the technical terms are laced with humor."

—Ed Sandifer, MAA Online

Cambridge Monographs on Applied and Computational Mathematics 2
1998 549 pp. 0-521-64652-9 Paperback $29.95

Dynamical Systems and Numerical Analysis

A.M. Stuart and A.R. Humphries

This book unifies the study of dynamical systems and numerical solution of differential equations. Topics studied include the stability of numerical methods for contractive, dissipative, gradient and Hamiltonian systems together with the convergence properties of equilibria, periodic solutions and strange attractors under numerical approximation.

Cambridge Monographs on Applied and Computational Mathematics 2
1998 707 pp. 0-521-64563-8 Paperback $39.95

Enumerative Combinatorics

Volume 2

Richard P. Stanley

"...sure to become a standard as an introductory graduate text in combinatorics."

—George E. Andrews, Bulletin of the AMS

This second volume of a two-volume basic introduction to enumerative combinatorics covers the composition of generating functions, trees, algebraic generating functions, D-finite generating functions, noncommutative generating functions, and symmetric functions. The chapter on symmetric functions provides the only available treatment of this subject suitable for an introductory graduate course on combinatorics, and includes the important Robinson-Schensted-Knuth algorithm. Also covered are connections between symmetric functions and representation theory.

Cambridge Studies in Advanced Mathematics 62
1998 c.425 pp. 0-521-56069-1 Hardback $69.95

Calculus of Variations

Jürgen Jost and Xianguang Li-Jost

This textbook on the calculus of variations leads the reader from the basics to modern aspects of the theory. One-dimensional problems and the classical issues such as Euler-Lagrange equations are treated, as are Noether's theorem, Hamilton-Jacobi theory, and in particular geodesic lines, thereby developing some important geometric and topological aspects. The basic ideas of optimal control theory are also given. The second part of the book deals with multiple integrals. After a review of Lebesgue integration, Banach and Hilbert space theory and Sobolev spaces (with complete and detailed proofs), there is a treatment of the direct methods and the fundamental lower semi-continuity theorems. Subsequent chapters introduce the basic concepts of the modern calculus of variations, namely relaxation, Gamma convergence, bifurcation theory and minimax methods based on the Palais-Smale condition.

Cambridge Studies in Advanced Mathematics 64
1998 c.340 pp. 0-521-64203-5 Hardback $59.95

Available in bookstores or from Cambridge University Press

40 West 20th Street, New York, NY 10011-4211
Call toll-free 800-872-7423 Web site: http://www.cup.org
MasterCard/VISA accepted. Prices subject to change.
The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, a UNESCO-IAEA organisation, located in the Adriatico Riviera in the middle of a larger research complex with 74 resident physicists and 13 resident mathematicians, is seeking to reinforce its activities in mathematics, particularly, though not exclusively, in the following subjects: geometry (algebraic/differential), mathematics of economics (including game theory, decision theory, stochastic calculus, etc.), mathematics of informatics (including combinatorial optimisation, graph theory, etc.).

We are seeking simultaneously a senior scientist capable and willing to become the head of our Mathematics Group, as well as a younger candidate. Both should be outstanding scientists in their fields, active in research, with a significant and continuous research output of the highest quality. They should be internationally recognised as scientific leaders and a source of inspiration for younger collaborators. The Abdus Salam ICTP has as its mission "promotion of research in developing countries", and we expect a consubstantiation with these ideals. Candidates from developing countries and women candidates are particularly welcome to apply.

The positions will be P5 for the more senior candidate, with a salary range equivalent to U.S. $73,000–U.S. $88,000 per annum, and P3/P4, with a salary range equivalent to U.S. $52,000–U.S. $75,000 per annum for the other candidate. Most countries recognise our salaries as tax exempt. In both cases, there are special benefits connected with travel to the home country, children's education, and other grants.

For the P3/P4 position, there may be a one-year probationary period covered by a special contract which matches, at least partially, the conditions of the post.

Full curriculum vitae should be provided on Form No. 250, which may be obtained from the Abdus Salam International Centre for Theoretical Physics, Personnel Office, Box 586, I-34100 Trieste, Italy; Fax: +39 040 2240593; e-mail: sossi@ictp.trieste.it, or electronically from the Web (Website www.ictp.trieste.it).

The closing date for applications is 28 February 1999.

Anne Gatti
Director's Office
The Abdus Salam International Centre for Theoretical Physics
Strada Costiera 11
I-34100 Trieste
Italy
Tel: +39 040 2240251
FAX: +39 040 2240410
Visit us at Booths #400-402

One of *Choice*’s Outstanding Academic Books of 1995

**CONVERSATIONS ON MIND, MATTER, AND MATHEMATICS**
Jean-Pierre Changeux and Alain Connes
Edited and translated by M. B. DeBeroise
Paper $14.95

**LINEAR PROGRAMMING AND EXTENSIONS**
George B. Dantzig
*Princeton Landmarks in Mathematics and Physics*
Paper $29.95

**ABRAHAM ROBINSON**
The Creation of Nonstandard Analysis,
A Personal and Mathematical Odyssey
Joseph Warren Dauben
With a foreword by Benoit B. Mandelbrot
Paper $29.95

**REAL SUBMANIFOLDS IN COMPLEX SPACE AND THEIR MAPPINGS**
M. Salah Baouendi, Peter Ebenfelt, and Linda Preiss Rothschild
Cloth $69.50

**THE REAL FATOU CONJECTURE**
Jacek Graczyk and Grzegorz Świątek
*Annals of Mathematics Studies, 144*
With a foreword by Roger Penrose
Cloth $49.50

**QUATERNIONS AND ROTATION SEQUENCES**
J. B. Kuipers
Cloth $29.95

**CYCLES, TRANSFERS, AND MOTIVIC HOMOLOGY THEORIES**
Vladimir Voevodsky, Andrei Suslin, and Eric M. Friedlander
*Annals of Mathematics Studies, 143*
With a foreword by Israel Halperin
Paper $29.95 Cloth $59.50

Available at fine bookstores or directly from the publisher:
800-777-4726
http://pup.princeton.edu
Prepayment Methods and Mailing Addresses
All prices quoted in U.S. dollars.
Payment by check must be drawn on U.S. bank if paid in U.S. dollars.
Send checks, money orders, UNESCO coupons to American Mathematical Society, P.O. Box 5904, Boston, MA 02206-5904
To use credit cards, fill in information requested and mail to American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248 or call (401) 455-4000 or 1-800-321-4AMS.
For Foreign Bank Transfers: American Mathematical Society, State Street Bank and Trust Company, 225 Franklin St., ABA #011000028, Account #0128-262-3, Boston, MA 02110.
American Express □ Discover □ VISA □ MasterCard □

Date .......................... 19 ....................

Fields of Interest
If you wish to be on the mailing lists to receive information about publications in fields of mathematics in which you have an interest, please consult the list of major headings below. These categories will be added to your computer record so that you will be informed of new publications or special sales in the fields you have indicated.

EME Education/Mathematics Education
00 General
01 History and biography
02 Mathematical logic and foundations
04 Set theory
05 Combinatorics
06 Order, lattices, ordered algebraic structures
08 General algebraic systems
11 Number theory
12 Field theory and polynomials
13 Commutative rings and algebras
14 Algebraic geometry
15 Linear and multilinear algebra; matrix theory
16 Associative rings and algebras
17 Nonassociative rings and algebras
18 Category theory, homological algebra
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
39 Finite differences 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
67 Computer science
70 Mechanics of particles and systems
73 Mechanics of 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 Economics, operations research, programming, games
92 Biology and other natural sciences, behavioral sciences
93 Systems theory; control
94 Information and communication, circuits
Membership Categories

Please read the following to determine what membership category you are eligible for, and then indicate below the category for which you are applying.

Introductory ordinary member rate applies to the first five consecutive years of ordinary membership. Eligibility begins with the first year of membership in any category other than student and nominee. Dues are $50.

For ordinary members whose annual professional income is below $55,000, the dues are $99; for those whose annual professional income is $55,000 or more, the dues are $112.

The CMS cooperative rate applies to ordinary members of the AMS who are also members of the Canadian Mathematical Society and reside outside of the U.S. For members whose annual professional income is $55,000 or less, the dues are $84; for those whose annual professional income is above $55,000, the dues are $112.

For a joint family membership, one member pays ordinary dues, based on his or her income; the other pays ordinary dues based on his or her income, less $20. (Only the member paying full dues will receive the Notices and the Bulletin as a privilege of membership, but both members will be accorded all other privileges of membership.)

Minimum dues for contributing members are $198. The amount paid which exceeds the higher ordinary dues level and is purely voluntary may be treated as a charitable contribution.

For either students or unemployed individuals, dues are $33, and annual verification is required.

The annual dues for reciprocity members who reside outside the U.S. and Canada are $65. To be eligible for this classification, members must belong to one of those foreign societies with which the AMS has established a reciprocity agreement, and annual verification is required. Reciprocity members who reside in the U.S. or Canada must pay ordinary dues ($99 or $132).

The annual dues for category-S members, those who reside in developing countries, are $18. Members can choose only one privilege journal. Please indicate your choice below.

Members can purchase a multi-year membership by prepaying their current dues rate for either two, three, four or five years. This option is not available to category-S, unemployed, or student members.

1999 Dues Schedule (January through December)

Introductory ordinary member rate .............................................. $50

Ordinary member ................................................................. $99 $132

CMS cooperative rate ......................................................... $84 $112

Joint family member (full rate) .............................................. $99 $112

Joint family member (reduced rate) ................................. $79 $112

Contributing member (minimum $192) ............................... $33

Student member (please verify) ............................................. $33

Unemployed member (please verify) ..................................... $33

Reciprocity member (please verify) ........................................ $58 $99 $132

Category-S member ........................................................... $16

Multi-year membership ........................................................ $ for years

1 Student Verification (sign below)

I am a full-time student at ..................................................... currently working toward a degree.

2 Unemployed Verification (sign below) I am currently unemployed and actively seeking employment.

3 Reciprocity Membership Verification (sign below) I am currently a member of the society indicated on the right and am therefore eligible for reciprocity membership.

Signature

4 □ send NOTICES □ send BULLETIN
Members of the Society who move or change positions are urged to notify the Providence Office as soon as possible.

Journal mailing lists must be printed four to six weeks before the issue date. Therefore, in order to avoid disruption of service, members are requested to provide the required notice well in advance.

Besides mailing addresses for members, the Society's records contain information about members' positions and their employers (for publication in the Combined Membership List). In addition, the AMS maintains records of members' honors, awards, and information on Society service.

When changing their addresses, members are urged to cooperate by supplying the requested information. The Society's records are of value only to the extent that they are current and accurate.

If your address has changed or will change within the next two or three months, please fill out this form, supply any other information appropriate for the AMS records, and mail it to:

Customer Services
AMS
P.O. Box 6248
Providence, RI 02940

or send the information on the form by e-mail to:
amsmem@math.ams.org or cust-serv@math.ams.org

Name ______________________

Customer code ______________________

Change effective as of ______________________

Old mailing address ______________________

New mailing address ______________________

New position ______________________

If mailing address is not that of your employer, please supply the following informations:

New employer ______________________

Location of employer (city, state, zip code, country) ______________________

Telephone number ______________________

e-mail ______________________

Recent honors and awards ______________________
CMS Summer 1999 Meeting
Memorial University of Newfoundland, St. John’s, Newfoundland, May 29 – June 1, 1999

On behalf of Memorial University of Newfoundland and on the occasion of its 50th anniversary, the Department of Mathematics and Statistics extends a warm welcome to all participants in the 1999 Summer Meeting of the Canadian Mathematical Society. All scientific activities will take place at Memorial University of Newfoundland, St. John’s, Newfoundland, from Saturday, May 29 to Tuesday, June 1, 1999.

**Plenary Speakers:** Tom Korner (Cambridge), R. K. Brylinski (Pennsylvania State), Ed Barbeau (Toronto), Michael van den Bergh (Limburg/Belgium).

**Prize Lectures:** The Jeffery-Williams Lecture will be given by John Friedlander, University of Toronto. The Krieger-Nelson Prize will be given by Nicole Tomczak-Jaegermann, University of Alberta.

**Sessions**
- Combinatorics and its Applications (Org: Nabil Shalaby, Memorial University of Newfoundland and Doug Stinson, University of Waterloo); Frank Bennett (Halifax), Charles Colbourn (Maine), Kathryn Heinrich (SFU), Alexander Rosa (McMaster), Doug Stinson (Waterloo), Luc Vinet (Montreal).
- Education: What Mathematical Competitions Do for Mathematics (Org: Bruce Shawyer and Ed Williams, Memorial University of Newfoundland); Ed Barbeau (Toronto), Ron Dunkley (Waterloo), Rita Janes (Director of NCTM, co-founder of Newfoundland and Labrador Mathematics League), Tony Gardiner (Birmingham), Shannon Sullivan (MUN student).
- Graduate Student Seminar: A special session is being organized for graduate students. Anyone interested in participating in the organization of this program should contact Dr. Hermann Brunner, Meeting Director, at the following address: cms99@math.mun.ca.
- Joint CMS-CRM Session on Harmonic Analysis (Org: Kathryn Hare, University of Waterloo); J. Benedetto (Maryland), B. Forrest (Waterloo), Jean-Paul Gabardo (McMaster), E. Granirer (UBC), H. Hennig (McMaster), Z. Hu (Windsor), R. Kerman (Brock), Tom Körner (Cambridge), T. Lau (Alberta), D. Oberlin (Florida), J.-O. Ronning (Skode U.), G. Sinnamon (UWO), S. Wainger (Wisconsin).
- Nonlinear Analysis and its Applications (Org: Sankatha Singh and Bruce Watson, Memorial University of Newfoundland); G. Allasia (Torino), J. Borwein (SFU), P. Gauthier (Montreal), K. Goebel (Lublin), W. A. Kirk (Iowa), W. Light (Leicester), S. Park (Seoul), B. Rhoades (Indiana), W. Takahashi (Tokyo), E. Tarafdar (Australia), J. Whitfield (Lakehead).
- Perspectives in Ring Theory (Org: Eric Jespers, Vrije Universiteit Brussel and Edgar Goodaire, Memorial University of Newfoundland); Yuri Bahturin (Moscow), Michael van den Bergh (Limburg/Belgium), Jan Okniński (Warsaw), D. S. Passman (Wisconsin), Mohan Putcha (North Carolina State), Lex Renner (UWO), S. K. Sehgal (Edmonton).
- Joint CMS-Fields Institute Session on Representation Theory (Org: Abraham Broer, McGill University); Ranee K. Brylinski (Pennsylvania State), Jon Brundan (Oregon at Eugene), Clifton Cunningham (Massachusetts), Sam R. Evens (Arizona at Tucson), Loek Helminck (North Carolina State), Markus Hunziker (Brandeis), Alex S. Kleshchev (Oregon at Eugene), Friedrich Knop (Rutgers), V. Lakshmibai (Northeastern), W. Monty McGovern (Seattle), George McNinch (Notre Dame), Fiona Murphy (Toronto), Monica Nevins (Alberta), Mark Reeder (Boston College), Yasmine Sanderson (Rutgers), Gordon Savin (Utah), Eric Sommers (Harvard), Peter Trapa (Institute for Advanced Studies).
- Surveys in Mathematics (Org: Kumar Murty, Toronto); speakers to be announced.
- Contributed Papers: Contributed papers of 15 minutes duration are invited and graduate students are particularly urged to participate. Abstracts for CMS contributed papers should be prepared as specified below. For an abstract to be eligible, the abstract must be received before March 31, 1999. The abstract must be accompanied by its contributor’s registration form and appropriate fees.
- Workshop on Combinatorics: Participants might like to note that Memorial University is host for an AARMS-sponsored Workshop of Combinatorics from May 24-28, 1999. Details can be obtained from Dr. Nabil Shalaby, Department of Mathematics and Statistics, Memorial University of Newfoundland; nshalaby@math.mun.ca.
- Submission of Abstracts: The CMS publishes abstracts for all scheduled talks. Titles for Plenary Speakers, Prize Lecturers, and Invited Special Session Speakers for the scientific and education programme will appear in the April issue of the CMS Notes. Titles for Contributed Papers will appear in the May issue of the CMS Notes. All abstracts will be published in the meeting programme and will be available on the Canadian Mathematical Electronics Services (Camel) http://camel.math.ca/CMS/Events/summer99/ and on the CMS99 Summer Meeting Web Site: http://www.math.mun.ca/~cms99/.
Plenary Speakers, Prize Lecturers, and Invited Special Session Speakers for the scientific and education programme: These speakers are asked to submit their abstracts to the CMS as instructed by their organizers. Abstracts may be sent electronically, following instructions given below. Abstracts may also be prepared on the standard CMS form available from the session organizer or the CMS office in Ottawa. Abstracts should be sent to Dr. Richard Charron, Department of Mathematics and Statistics, Memorial University of Newfoundland, St. John’s, Newfoundland CANADA A1C 5S7, so as to arrive by the invited speaker deadline of February 26, 1999.

Contributed Papers: Those submitting contributed papers may submit their abstracts electronically, following instructions given below, or by using the standard CMS form available from the CMS office in Ottawa, in the February issue of the CMS Notes, or at the CMS Web site. Abstracts should be sent to Dr. Richard Charron, Department of Mathematics and Statistics, Memorial University of Newfoundland, St. John’s, Newfoundland CANADA A1C 5S7, so as to arrive by March 31, 1999.

Electronic submission of abstracts: Files should include the speaker’s name, affiliation, complete address, title of talk, and the abstract itself. Files may be submitted by e-mail to Dr. Richard Charron, at: abstracts@cms.math.ca. Please note the appropriate deadline given above for the submission of your abstract.

Social Events: Social events include a cash-bar reception on Friday evening during evening registration and a delegates’ luncheon (the cost of this luncheon is included in all registration categories). Tickets will be available for an evening of Dinner Theatre following the theme Newfoundland Kitchen Party.

Registration: Registration fee information and forms are available from the CMS Executive Office, 577 King Edward, Suite 109, PO Box 450, Station A, Ottawa, Ontario, CANADA KIN 6N5 Tel: 613-562-5702, FAX: 613-565-1539, e-mail: meetings@cms.math.ca, web: http://camel.math.ca/CMS/Events/summer99/ OR from CMS99, Department of Mathematics and Statistics, Memorial University of Newfoundland, St. John’s, Newfoundland, CANADA A1C 5S7, Tel: 709-737-8783, FAX: 709-737-3010, e-mail: cms99@math.mun.ca.

Speakers should contact their organizers for special speaker rates. Electronic pre-registration is available on our Camel site at http://camel.math.ca/CMS/Events/summer99/. This site also has the latest information on the meetings.

Accommodation: It is recommended that those attending the conference book early to avoid disappointment. Blocks of rooms have been reserved at three different facilities and will be held until May 1, 1999. Reservations not in by that date will be on a request only, space available basis. Rates quoted are in Canadian dollars.

Hotel Newfoundland
Cavendish Square, St. John’s, Newfoundland
Check-in: 15:00; Check-out: 12:00
Reservation Deadline: May 1, 1999
Rates: $119, single/double occupancy, Canadian Pacific
$129, single/double occupancy, Canadian Deluxe (An additional charge of $20/room for additional person.)
Applicable taxes: 15% HST
Phone: 709-726-4980 Reservations
FAX: 709-726-2025

Quality Hotel
2 Hill O’Chips, St. John’s, Newfoundland
Check-in: 13:00; Check-out: 12:00
Reservation Deadline: May 1, 1999
Rates: $85, single/double occupancy
(A complimentary upgrade to harbor side guest rooms, pending availability, is offered, free parking.)
Applicable taxes: 15% HST
Phone: 709-754-7788; Toll-free reservations: 1-800-228-5151

MUN Housing
Memorial University of Newfoundland, St. John’s, Newfoundland
Check-in: 13:00; Check-out: 12:00
Reservation Deadline: May 1, 1999
Rates: (est.) $50, single occupancy; $80, double (twin beds) occupancy
Applicable taxes: 15% HST
Phone: 709-737-4003
E-mail: ptulk@morgan.ucs.mun.ca; http://www.housing.mun.ca/

Child Care: Child care is available at the MUN Daycare Centre, located on the MUN campus, St. John’s, Newfoundland. Hours of operation are 7:45 to 17:15 from Monday to Friday. Rates are $23 per day for children from two to 10 years of age. Please contact Anne Goebel at 709-737-4728 to make arrangements.

Travel: Participants are urged to check their travel arrangements to make sure they are destined for St. John’s, Newfoundland (call YYT) and NOT Saint John, New Brunswick (call YSJ). Upon arrival, taxis are available for the 15-minute ride from the airport to the hotels. A shuttle service will be arranged from the hotels to the meeting site.

Acknowledgements: The CMS and the Meeting Committee wishes to extend its thanks to the CRM, the Fields Institute, the following sponsors from Memorial University of Newfoundland: the Faculty of Science, the Vice-President (Research), the School of Graduate Studies, and the members of the Department of Mathematics and Statistics, for its support. The CMS wishes to acknowledge the contribution of the Meeting Committee in presenting these exciting scientific, educational, and social programs.

Meeting Committee: Meeting Director: Hermann Brunner (MUN), Local Organizing Committee: Richard Charron (MUN), Rings Theory: Eric Jespers (Brussels) and Edgar Godaide (MUN), Harmonic Analysis: Kathryn Hare (Waterloo), Representation Theory: Abraham Broer (McGill), Combinatorics: Nabil Shalaby (MUN) and Doug Stinson (Waterloo), Nonlinear Analysis: Sankatha Singh (MUN) and Bruce Watson (MUN), Surveys in Mathematics: Kumar Murty (Toronto), Education: Bruce Shawyer (MUN) and Ed Williams (MUN), Monique Bouchard (CMS), Graham Wright (CMS), Rosalind English (MUN), Wanda Heath (MUN).
Speakers and Organizers: The Council has decreed that no paper, whether invited or contributed, may be listed in the program of a meeting of the Society unless an abstract of the paper has been received in Providence prior to the deadline.

Although an individual may present only one ten-minute contributed paper at a meeting, any combination of joint authorship may be accepted, provided no individual speaks more than once. An author can speak by invitation in more than one Special Session at the same meeting.

Special Sessions: The number of Special Sessions at an annual meeting is limited. Special Sessions at annual meetings are held under the supervision of the Program Committee for National Meetings and, for sectional meetings, under the supervision of each Section Program Committee. They are administered by the associate secretary in charge of that meeting with staff assistance from the Meetings and Conferences Department in Providence. (See the list of associate secretaries on the next page.)

Each person selected to give an Invited Address is also invited to generate a Special Session, either by personally organizing one or by having it organized by others. Proposals to organize a Special Session are sometimes solicited either by a program committee or by the associate secretary. Other proposals should be submitted to the associate secretary in charge of that meeting (who is an ex officio member of the program committee) at the address listed below. These proposals must be in the hands of the associate secretary at least nine months prior to the meeting at which the Special Session is to be held in order that the committee may consider all the proposals for Special Sessions simultaneously. Special Sessions must be announced in the Notices in a timely fashion so that any Society member who so wishes may submit an abstract for consideration for presentation in the Special Session.

Talks in Special Sessions are usually limited to twenty minutes; however, organizers who wish to allocate more time to individual speakers may do so within certain limits. A great many of the papers presented in Special Sessions at meetings of the Society are invited papers, but any member of the Society who wishes to do so may submit an abstract for consideration for presentation in a Special Session, provided it is received by the meeting coordinator in Providence prior to the special early deadline for consideration. Contributors should know that there is a limit to the size of a single Special Session, so sometimes all places are filled by invitation. Papers submitted for consideration for inclusion in Special Sessions but not accepted will receive consideration for a contributed paper session, unless specific instructions to the contrary are given.

The Society reserves the right of first refusal for the publication of proceedings of any Special Session. If published by the AMS, these proceedings appear in the book series Contemporary Mathematics.

Contributed Papers: The Society also accepts abstracts for ten-minute contributed papers. These abstracts will be grouped by related Mathematical Reviews subject classifications into sessions insofar as possible. The title and author of each paper accepted and the time of presentation will be listed in the program of the meeting.

Other Sessions: In accordance with policy established by the AMS Committee on Meetings and Conferences, mathematicians interested in organizing a session at an annual or sectional meeting on employment opportunities inside or outside academia for young mathematicians should contact the associate secretary for the meeting with a proposal by the stated deadline. Also, potential organizers for poster sessions on a topic of choice should contact the associate secretary before the deadline.

Abstracts: Abstracts for all papers must be received by the meeting coordinator in Providence by the stated deadline. Unfortunately, late papers cannot be accommodated.

Electronic Submission Procedures: Send a message to abs-submit@ams.org and type help as the subject to review your options, or visit the Meetings and Conferences home page on the Web at http://www.ams.org/meetings/. Completed electronic abstracts must be submitted to abs-submit@ams.org, typing submission as the subject.

Submission by U. S. Mail: AMS abstract forms are available at many departments of mathematics or may be requested by contacting the AMS Meetings and Conferences Department, P. O. Box 6887, Providence, RI 02940; telephone: 401-455-4146; e-mail: abs-info@ams.org. Your completed abstract should be sent to the same address by the stated deadline.

See the inside front cover of Abstracts of Papers Presented to the American Mathematical Society for information on abstracts published by title and not presented at a meeting.

Site Selection for Sectional Meetings

Sectional meeting sites are recommended by the associate secretary for the section and approved by the Secretariat. Recommendations are usually made eighteen to twenty-four months in advance. Host departments supply local information, ten to twelve rooms with overhead projectors for contributed paper sessions and Special Sessions, an auditorium with twin overhead projectors for Invited Addresses, and registration clerks. The Society partially reimburses for the rental of facilities and equipment and for staffing the registration desk. Most host departments volunteer; to do so or for more information, contact the associate secretary for the section.
Meetings & Conferences of the AMS

PROGRAM ALERT: In order that AMS meeting programs include the most timely information for each speaker, abstract deadlines have been moved to dates much closer to the meeting. What this means is that most meeting programs will appear in the Notices "after" the meeting takes place. However, complete meeting programs will be available on e-MATH about two to three weeks after the abstract deadline. *Remember*, e-MATH is your most comprehensive source for up-to-date meeting information. See http://www.ams.org/meetings/.

Tucson, Arizona
University of Arizona, Tucson
November 13–15, 1998
Meeting #938
Western Section
Associate secretary: Robert M. Fossum
Announcement issue of Notices: September 1998
Program issue of Notices: January 1999
Issue of Abstracts: Volume 19, Issue 4

San Antonio, Texas
Henry B. Gonzales Convention Center
January 13–16, 1999
Meeting #939
Joint Mathematics Meetings, including the 105th Annual Meeting of the AMS, 82nd Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: October 1998
Program issue of Notices: January 1999
Issue of Abstracts: Volume 20, Issue 1

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired
For summaries of papers to MAA organizers: Expired

MAA Session Updates
Special Presentation for Chairs of Mathematics Departments in Comprehensive Universities, 4-Year Liberal Arts and 2-Year Colleges, Wednesday, 9:30 a.m. to 10:55 a.m., organized by G. L. Alexanderson, Santa Clara University. Speakers at this session will include: Saeed Gharra- mani, Towson University, on the assessment of scholarship at a non-Ph.D.-granting institution; Catherine M. Murphy, Purdue University, Calumet, on problems of remediation; and A. Wayne Roberts, Macalester College, on duties of a department chair. Since this is the first session of this kind, part of the session will be devoted to discussion of suitable topics for sessions at future national meetings.

ARUME Poster Session, Saturday, 9:00 a.m. to 11:00 a.m., organized by Julie Clark; Annie Selden, Tennessee Technological University; and John Selden, MERC. Cosponsored by the MAA and the Association for Research on Undergraduate Mathematics Education (ARUME).

Mobilization to Support Higher Achievement in Mathematics, Saturday, 2:30 p.m. to 4:00 p.m. organized by Linda P. Rosen, Special Advisor, Mathematics Education, U.S. Department of Education. The U.S. Department of Education, in partnership with the NSF, developed a comprehensive strategy to improve pre-K-12 student achievement in mathematics. Part of this effort is a mobilization, effective July 1, 1999, to provide targeted support to many students. The mobilization will take advantage of a growing desire among professionals to share their enthusiasm and mathematical knowledge with school children and with college students, particularly those with an affinity for mathematics and science, who seek opportunities to mesh their interests with their commitment to community service. Existing programs will be described, and input will be invited to help shape future programs.

Other Organizations Updates
The panelists for the AWM panel on Wednesday are Claire Baribaud, ETH, Zurich, Switzerland; Ingrid Daubechies,
Registration at the Meetings

Individuals who registered by November 23 and who so elected will have their badge and the final program mailed to them before the meetings. All other registrants will receive the final program at the meetings. The additional information below is to assist those who will register at the meetings and those who registered in advance but elected not to receive their badges and final programs by mail.

Advance and on-site meeting registration fees only partially cover expenses of holding meetings. All mathematicians who wish to attend sessions are expected to register and should be prepared to show the meetings badge, if so requested. Badges are required to obtain discounts at the AMS and MAA Book Sales and to cash a check with the meetings cashier. If advance registrants should arrive too late in the day to pick up their badges, they may show the acknowledgment received from the Mathematics Meetings Service Bureau (MMSB) as proof of registration.

Registration fees may be paid at the meetings in cash, by personal or traveler's check, or by VISA, MasterCard, American Express, or Discover. Letters verifying attendance at the meetings may be obtained from the cashier or at the Registration Assistance section of the Registration Desk.

Participants wishing to attend sessions for one day only may take advantage of a one-day fee. These special fees are effective daily, January 13 through 16, and are available at the meetings to both members and nonmembers. These one-day fees are not applicable to librarians, high school teachers, unemployed or emeritus participants, or high school, undergraduate, or graduate students.

Joint Mathematics Meetings

- Member of AMS, ASL, Canadian Mathematical Society (CMS), MAA: $208
- Emeritus Member of AMS, MAA: $45
- Nonmember: $312
- Temporarily Employed: $133
- Graduate Student/Unemployed: $45
- Librarians/High School Teachers: $45
- Developing Country Participant: $45
- Undergraduate Students: $26
- High School Students: $5

Nonmathematician Guest: $5

Joint Mathematics Meetings One Day

- Member of AMS, ASL, CMS, MAA: $114
- Nonmember: $177

MAA Minicourses (if openings available)

- Minicourses #1, 3-4, 6-8, 10, 12, 13, 15-16: $55
- Minicourses #2, 5, 9, 11, 14: $75

Employment Register

- Employer (First Table): $250
- Employer (Second Table): $75
- Applicant: $75

AMS Short Course

- Student/Unemployed: $45
- Emeritus Member of AMS, MAA: $45
- All Other Participants: $90

MAA Short Course

- MAA member/Joint Meeting participant: $140
- Nonmember/non-Joint Meeting participant: $190
- Student: $60

Accommodations and Travel

Participants who did not reserve a room during advance registration but who would like to obtain a room at one of the hotels listed on pages 1276 and 1279 in the October issue of the Notices should call the hotels directly after December 23. However, we regret that after that date the MMSB can no longer guarantee availability of rooms or of the special convention rates.

Please see the October issue for special discount fare information on Delta Airlines, as well as driving directions to the Henry B. Gonzales Convention Center.

Registration Dates, Times, and Locations

AMS Short Course

- Outside the Del Rey Salons, Hilton Palacio del Río
- Monday, January 11, 9:00 a.m. to 4:00 p.m.

MAA Short Course

- Outside the Del Rey Salons, Hilton Palacio del Río
- Monday, January 11, 9:00 a.m. to 4:00 p.m.

Joint Mathematics Meetings and MAA Minicourses

- South Exhibit Hall Henry B. Gonzales Convention Center
- Tuesday, January 12, 3:00 p.m. to 7:00 p.m.
- Wednesday-Friday, January 13-15, 7:30 a.m. to 4:00 p.m.
- Saturday, January 16, 7:30 a.m. to 2:00 p.m.

Employment Register

- South Exhibit Hall, Henry B. Gonzales Convention Center
- Wednesday, January 13, 7:30 a.m. to 4:00 p.m. (registration only)
- Thursday, January 14, 7:00 a.m. to 4:40 p.m. (schedule distribution and interviews only)
- Friday, January 15, 8:15 a.m. to 4:40 p.m. (interviews only)

Employment Register participants must register and fill out interview request forms on Wednesday, January 13. There will be no registration on Thursday and Friday; only interviews will take place on these days.
Gainesville, Florida
University of Florida
March 12-13, 1999

Meeting #940
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: January 1999
Program issue of Notices: May 1999
Issue of Abstracts: Volume 20, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: January 20, 1999

Invited Addresses
Gregory F. Lawler, Duke University, Geometric and fractal properties of the path of a Brownian particle.
Michael P. Loss, Georgia Institute of Technology, Photons and stability of matter: How heavy is an electron?
John G. Thompson, University of Florida, Double cosets in the upper triangular group.

Special Sessions
Algebraic and Geometric Combinatorics (Code: AMS SS P1), Andrew J. Vince and Neil L. White, University of Florida.
Analytical Problems in Mathematical Physics (Code: AMS SS M1), Eric A. Carlen, Georgia Institute of Technology, and László Erdős, Courant Institute, NYU.
Computability Theory (Code: AMS SS G1), Douglas Cenzer, University of Florida, Geoffrey Louis LaForte, University of West Florida, and Rick L. Smith, University of Florida.

Linear Operator Theory (Code: AMS SS J1), Leiba Rodman, College of William & Mary, and Scott A. McCullough, University of Florida.
Probability on Algebraic Structures (Code: AMS SS Q1), Gregory M. Budzban and Philip Feinsilver, Southern Illinois University at Carbondale, and Arunava Mukherjea, University of South Florida.
Structure and Representation Theory of Lattice-Ordered Groups and f-Rings (Code: AMS SS L1), Jorge Martinez, University of Florida.
The Erdős Legacy and Connections to Florida (Code: AMS SS B1), Krishnaswami Alladi and Jean Larson, University of Florida.

GAINESVILLE MAP

GAINESVILLE MAP

KEY TO MAP

1 Holiday Inn
2 Rush Lake Hotel
3 University Centre Hotel
Meetings & Conferences

Special Event
After the AMS meeting Ronald L. Graham will give the first University of Florida Erdős Colloquium at 4:05 p.m. on Monday, March 15, in Little Hall. For details see www.math.ufl.edu/~jal/ams99/.

Accommodations
Participants should make their own arrangements directly with the hotel of their choice. Special rates have been negotiated at the hotels listed below, available by stating you will be attending the American Mathematical Society Meeting on the University of Florida campus. All rooms will be on a space available basis after the deadline given. The AMS is not responsible for rate changes or for the quality of the accommodations chosen. Rates quoted do not include a 9% room tax. Because the Gainesville area is a popular destination in the spring, participants should make reservations as early as possible.

Holiday Inn University Center, 1250 W. University Avenue; 1-800-HOLIDAY (1-800-465-4329), 352-376-1661; Fax: 352-336-8717; GNVUC (HOLIDEX code); e-mail: hignvuc@mindspring.com; $66/single/double; complimentary Gainesville Airport shuttle, pool, 24-hour restaurant on premises (Denny’s); approximately 2 blocks from the meeting site. Deadline for reservations is February 11, 1999.

Rush Lake Motel, 1410 SW 16th Avenue; 1-800-787-4525, 352-373-5000; Fax: 362-372-7485; $36 single/$42 double; pool, complimentary morning coffee; 15-20 minute walk from meeting site. No stated reservation deadline; however, this property may sell out quickly.

University Centre Hotel, 1535 SW Archer Road; 1-800-824-5637, 352-371-3333; $65/single/double; complimentary Gainesville Airport shuttle, restaurant/lounge on premises, free parking; 15-20-minute walk from meeting site. Deadline for reservations is February 11, 1999.

Radisson Hotel (changing to Sheraton on Feb. 1, 1999), 2900 SW 13th Street; 352-377-4000; $69/single/double; complimentary shuttle to/from the Gainesville Airport and university campus, restaurant and lounge on premises, in-room coffee, fitness room and pool; 2 miles south of University Avenue. Deadline for reservations is February 11, 1999.

Holiday Inn West, 7417 NW 8th Avenue; 1-800-HOLIDAY (in Florida 1-800-551-8206), 352-332-7500; $59/single/double; discounted breakfast buffet coupons, restaurant on premises, two pools, in-room coffee; 5 miles west of SW 13th Street on State Route 26, i.e., Newberry Rd. and University Ave. Deadline for reservations is February 18, 1999.

While no special arrangements have been made at these hotels, budget-minded participants may also be interested in the following national chains.

Motel 6, 4000 SW 40th Boulevard; 1-800-4-MOTEL-6 (in Florida 1-800-466-3356), 352-373-1604. South of Archer Road, just east of exit 75 on I-75. Go four miles along Archer and SW 13th St. to University Avenue.

Super 8 - 13th Street, 2000 SW 13th Street; 1-800-800-8000, 352-372-3654. From I-75 Exit 74 or 75, go east to U.S. 441; 1.3 miles south of University Avenue.

Days Inn University, 1901 SW 13th Street; 1-800-329-7466, 352-376-2222. From I-75 Exit 74 or 75, go east to U.S. 441; 1.3 miles south of University Avenue.

Food Service
Several restaurants are located within walking distance, and there will be information available at the registration desk.

Local Information
For information about Gainesville and the University of Florida, see www.math.ufl.edu/~jal/ams99/. Also see the pages maintained by the math department at www.math.ufl.edu/ and by the University at www.ufl.edu/.

Other Activities
AMS Book Sale: Examine the newest titles from the AMS. Most books will be available at a special 50% discount offered only at meetings. Complimentary coffee will be served courtesy of AMS Membership Services.

Parking
Parking is free on campus on the weekends and during Spring Break, when the meeting is being held; those staying at the Holiday Inn University Center also may park there. The closest university parking lot is off U.S. 441 (SW 13th Street) and may be entered on SW 2nd Avenue. Individuals staying for the Erdős Colloquium to be given by Ronald L. Graham on Monday, March 15, may need to make other arrangements. Daytime parking is available weekdays at The Center, off NW 1st Avenue between NW 17th Street and NW 18th Street. Rates range from $2/1 hr., $3.25/2 hr., up to a maximum of $8.50 for the day.

Registration and Meeting Information
The meeting will take place on the University of Florida campus near the entrance at SW 2nd Avenue and SW 13th Street, about two blocks south of the intersection of University Avenue (State Route 26) and 13th Street (U.S. 441). Registration will take place on the third floor of Little Hall in Room 353 from 7:30 a.m. to 4:00 p.m. on Friday and from 7:30 a.m. to noon on Saturday. Registration fees (payable on-site only) are $30/AMS or CMS members; $45 nonmembers; $10 emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express.

Invited Addresses will take place in Carleton Auditorium to the west of Little Hall, and Special Sessions and Contributed Paper Sessions will take place in Little Hall and the Fine Arts Building to the south.

Welcome Reception
Participants are invited to a welcome reception on Friday, March 12, 5:00-7:00 p.m., at the Keene Faculty Center, Dauer Hall.
Invited Addresses

Alexander Beilinson, MIT, Title to be announced.
Alexandra Bellow, Northwestern University, Title to be announced.
Igor Krichever, Columbia University, Title to be announced.
Steven Rallis, Ohio State University, Title to be announced.
Trevor Wooley, University of Michigan, Title to be announced.

Special Sessions

Combinatorial Designs (Code: AMS SS M1), Iiene H. Morgan, University of Missouri, Rolla, and Walter D. Wallis, Southern Illinois University, Carbondale.
Diophantine Equations, Inequalities and Related Arithmetic Problems (Code: AMS SS F1), Michael Bennett, University of Illinois, Urbana, and Trevor Wooley, University of Michigan.
Elementary and Analytic Number Theory (Code: AMS SS E1), Harold G. Diamond and A. J. Hildebrand, University of Illinois, Urbana.
Galois Representations (Code: AMS SS C1), Nigel Boston, University of Illinois, Urbana, and Michael Larsen, University of Missouri.
Graph Theory (Code: AMS SS G1), Douglas B. West, University of Illinois, Urbana.
Holomorphic Vector Bundles and Complex Geometry (Code: AMS SS L1), Maarten Bergvelt, Steven Bradlow, and John P. D'Angelo, University of Illinois, Urbana, and Lawrence Ein, University of Illinois, Chicago.
Integrable Equations (Code: AMS SS II), Igor Krichever, Columbia University, and Kirill Vaninsky, Kansas State University.
Low-Dimensional Topology (Code: AMS SS O1), Mark Brittenham, University of North Texas, Charles Delman, Eastern Illinois University, and Rachel Roberts, Washington University.
Martingales and Analysis (Code: AMS SS D1), Joseph Max Rosenblatt, Renming Song, and Richard B. Sowers, University of Illinois, Urbana.
Nonstandart Analysis (Code: AMS SS B1), C. Ward Henson and Peter Loeb, University of Illinois, Urbana.
Operator Spaces and Their Applications (Code: AMS SS J1), Gilles Pisier, Texas A&M University, and Zhong-Jin Ruan, University of Illinois, Urbana.
Optimization Problems in Geometry (Code: AMS SS N1), Robert Kusner, University of Massachusetts, Amherst, and John M. Sullivan, University of Illinois, Urbana.
Recent Progress in Elementary Geometry (Code: AMS SS A1), John E. Wetzel, University of Illinois, Urbana, and Clark Kimberling, University of Evansville.
Symplectic Geometry and Topology (Code: AMS SS K1), Eugene M. Lerman and Susan Tolman, University of Illinois, Urbana.
Wavelet Analysis and Multiresolution Methods (Code: AMS SS Q1), Tian-Xiao He, Illinois Wesleyan University.

Accommodations

Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the American Mathematical Society meeting. The AMS is not responsible for rate changes or for the quality of the accommodations.

Clarion Hotel and Convention Center, 1501 South Neil Street, Champaign, IL; 217-352-7891 or 800-257-6667; $49/single and $60/double.

Quality Hotel-University Centre, 302 East John St., Champaign, IL; 217-384-2100 or 800-322-8282; $49/single and $60/double.

Travelodge, 409 West University Ave., Urbana, IL; 217-328-3521 or 800-578-7878; $35.10/single and $43.20/double.

Food Service

The University will be officially closed during the time of the meeting due to Spring Break. There are a number of restaurants located near Altgeld Hall. A list of restaurants will be available at the registration desk.
Travel

By Air: The University of Florida is located near Interstate 75, approximately halfway between Atlanta, Georgia, and Miami, Florida. The Gainesville Regional Airport offers flights to major hub cities such as Atlanta, Charlotte, Miami, and Orlando, via US Airways Express, Continental Connection, and ASA, the Delta Connection. It is within a few hours’ driving time of major airports at Jacksonville (85 miles), Orlando (109 miles), and Tampa/St. Petersburg (128 miles).

Delta Air Lines has been selected as the official airline for this meeting. The following specially negotiated rates are available only for these meetings and exclusively to mathematicians and their families for the period March 9-16, 1999, on Delta Air Lines:

- 5% discount off published round-trip fares within the continental U.S., Hawaii, Alaska, Canada, Mexico, Bermuda, San Juan, Nassau, and the U.S. Virgin Islands. Some restrictions apply and seats are limited (no discounts apply on Delta Express). By purchasing your ticket 60 days or more prior to departure, you can receive an additional 5% bonus discount.
- 10% discount on Delta’s domestic system for travel based on the published unrestricted round-trip coach fare (Y06) rates. No advance reservations or ticketing is required; however, by purchasing your ticket 60 days or more prior to departure, you can receive an additional 5% bonus discount (no discounts on Delta Express).
- Special guaranteed round-trip Zone Fares to all cities served by Delta and Delta Express in the continental U.S., Hawaii, Alaska, Canada, Mexico, Bermuda, San Juan, Nassau, and the U.S. Virgin Islands for savings on midweek travel. Two-day minimum stay; no Saturday-night stay required; seven days’ advance reservations and ticketed. Fares are fully refundable, less administrative service fee. Zone Fares are not valid for destinations served only by a Delta Connection carrier. For reservations call (or have your travel agent call) Delta Meeting Network Reservations at 1-800-241-6760 weekdays between 7:30 a.m. and 11:00 p.m. (8:30 a.m.-11:00 p.m. on weekends) Eastern Standard Time. Refer to file number 117809A. These discounts are available only through Delta Meeting Network Reservation’s toll-free number.

Taxis service is usually available curbside at the Gainesville Airport. The approximate cost from the airport to the University of Florida campus is $12-$15 depending on luggage. Patrons of the Holiday Inn University Center, Radisson Hotel, and University Centre Hotel can use the hotel courtesy phones near the Baggage Claim area to call for a free shuttle to the hotel.

If reservations are made in advance, transportation between Gainesville and area airports is available from Gator Express (www.gatorexpress.com). City Cab (352-375-8294) also offers shuttle service with 48-hour-in-advance reservation for individuals or groups up to 7 persons: Jacksonville $60/1 person, $125/group rate; Orlando $90/1 person, $195/group rate; Tampa $95/1 person, $190/group rate.

The Gainesville Airport is about 5.8 miles from the intersection of University Avenue and 13th Street. To reach that intersection from the airport, turn left when exiting the terminal area onto NE 39th Drive, drive to the first intersection with a light, and turn left onto NE Waldo Road. Drive about 2.7 miles to University Avenue, and turn right on University Avenue. After about 1.7 miles, you’ll come to the intersection of University Avenue and 13th Street, where the Holiday Inn University Center is located. Little Hall may be reached by turning left on SW 13th Street and entering the University from SW 2nd Avenue.

Driving: The Holiday Inn University Center and Little Hall are both located near the intersection of SW 13th Street (U.S. Route 441) and University Avenue (State Route 26), also called Newberry Road when exiting from Interstate 75.

Interstate 75 skirts Gainesville on the west, its link with major metropolitan centers such as Atlanta and the Tampa/St. Petersburg area. From South Florida take the Florida Turnpike north to Interstate 75 and continue north on it.

- From I-75 take the Newberry Road exit (State Route 26) to the east; Newberry Road becomes University Avenue, which borders the University of Florida campus on the north.
- From Jacksonville take Interstate 10 west to U.S. Route 301, follow 301 south to Waldo, change to State Route 24, which brings you to Gainesville. From State Route 24, turn west on University Avenue (State Route 26).
- From Orlando take the Beeline Expressway east to the Florida Turnpike, go north on the Florida Turnpike to Interstate 75, and continue as above.

By Bus: Interstate bus transportation is offered by Greyhound Bus Lines. For fare and schedule information, call 1-800-231-2222. The local terminal is at 516 SW 4th Avenue, and the local phone number is 352-376-5252.

Weather

Azaleas and dogwoods bloom in March in Gainesville; the days are pleasant and the nights are cool. For more details, the Weather Channel reports a 5-day forecast for Gainesville: www.weather.com/weather/us/cities/FL_Gainesville.html.

Urbana, Illinois

University of Illinois, Urbana-Champaign

March 18-21, 1999

Meeting #941

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: January 1999

Program issue of Notices: May 1999

Issue of Abstracts: Volume 20, Issue 2

Deadlines

For organizers: Expired

For consideration of contributed papers in Special Sessions: Expired

For abstracts: January 27, 1999
Local Information
Please visit the Web site maintained by the Department of Mathematics at www.math.uiuc.edu/ and the University of Illinois Web site www.uiuc.edu.

Other Activities
AMS Book Sale: Examine the newest titles from the AMS. Most books will be available at a special 50% discount offered only at meetings. Complimentary coffee will be served, courtesy of AMS Membership Services.

Parking
Parking on evenings and weekends is available in the parking structure at Sixth and John Streets, one block west of Altgeld. Entry is from John Street, driving eastbound from Fifth Street to Sixth Street.

Registration and Meeting Information
The registration desk will be located on the third floor of Altgeld Hall and will be open from 7:30 a.m. to 5:00 p.m. on Friday and from 8:00 a.m. to 5:00 p.m. on Saturday. Talks will take place in Altgeld Hall and nearby buildings. The first Invited Address for this meeting will be at 6:45 p.m., Thursday, March 18, in Beckman Institute Auditorium. The speaker will be Alexandra Bellow, Northwestern University.

Registration fees: (payable on-site only) $30/AMS or CMS members; $45/nonmembers; $10/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express.

Social Event:
A reception will be held from 8:00-10:00 p.m. in the Beckman Institute Lobby immediately following the Invited Address on Thursday, March 18.

Travel
By Air: Willard Airport is located in Champaign County on Route 45. Owned and operated by the University of Illinois, the airport currently has four carriers that operate 27 flights a day: USAirways Express, American Eagle, Trans World Express, and Northwest Airlink. Taxi service to the campus is approximately $8-$14 per person. Shuttle service is available as well.

Driving: Altgeld Hall is on the southeast corner at the intersection of Green and Wright Streets. The directions below will get you to this intersection. The parking structure is one block south and one block west of there, so if you are heading there, modify the instructions appropriately.

Northbound on I-57 (alternative): Exit east onto University Avenue where eastbound I-72 terminates, go east two miles, turn right onto Neil Street (traffic signal), go south 0.25 miles, turn left onto Green Street (traffic signal), go east seven blocks to Wright Street. (Warning: University Avenue is one way eastbound in this area, so on the return trip take Church Street, which is two blocks further north.)

Southbound on I-57 (from Chicago): Take exit 235A and proceed as above eastbound on I-72; (from Decatur and Springfield): Continue into Champaign onto University Avenue, go east two miles, turn right onto Neil Street, go south 0.25 miles, turn left onto Green Street (traffic signal), go east seven blocks to Wright Street. (Warning: University Avenue is one way eastbound in this area, so on the return trip take Church Street, which is two blocks further north.)

Eastbound on I-74 (from Normal, Bloomington, and Peoria): Exit south at Prospect Street (first exit in Champaign), go south two miles, turn left on Green Street (traffic signal), go east to 6th Street.

Westbound on I-74 (from Indianapolis): Exit south on Lincoln Avenue to Green Street, and turn right on Green Street (traffic signal), go west 0.5 mile to Wright Street.

Weather
The winter months' average high temperature is 32° and low temperature is 17° Fahrenheit. The spring months' average high temperature is 65° and low is 45° Fahrenheit. Average snowfall January through March is 4 to 7 inches per month, with an average of 26 inches of snow per year. For up-to-date weather information, visit http://redrock.ncsa.uiuc.edu/AOS/home_weather.html.

Las Vegas, Nevada
University of Nevada, Las Vegas
April 10-11, 1999

Meeting #942
Western Section
Associate secretary: Bernard Russo
Announcement issue of Notices: February 1999
Program issue of Notices: June 1999
Issue of Abstracts: Volume 20, Issue 3

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: December 23, 1998
For abstracts: February 17, 1999

Invited Addresses
Igor Frenkel, Yale University, Representation theory and four-dimensional conformal field theory.
Gregory J. Kuperberg, University of California, Davis, Title to be announced.
Lorenzo A. Sadun, University of Texas, Austin, Title to be announced.
John Steel, University of California, Berkeley, *Title to be announced.*

**Special Sessions**

*Analysis and Geometry* (Code: AMS SS I1), Peter Li and Song-Ying Li, University of California, Irvine.

*Combinatorial Theory* (Code: AMS SS G1), Kequan Ding, University of Illinois, Urbana, Peter Shue, University of Nevada, Las Vegas, and Yeong-Nan Yeh, Academia Sinica.

*Control and Dynamics of Partial Differential Equations* (Code: AMS SS A1), Zhonghui Ding, University of Nevada, Las Vegas.

*Diophantine Problems* (Code: AMS SS J1), Arthur Baragar, University of Nevada, Las Vegas, and Michael Bennett, University of Illinois.

*Geometric Group Theory* (Code: AMS SS H1), Eric M. Fried, Southern Utah University, and Eric Lewis Swenson, Brigham Young University.

*Graph Theory* (Code: AMS SS B1), Hung-Lin Fu, National Chiao-Tung University, Taiwan, Chris A. Rodger, Auburn University, and Michelle Schultz, University of Nevada, Las Vegas.

*Invariants, Distributions, Differential Operators and Harmonic Analysis* (Code: AMS SS K1), Ronald L. Lipsman, University of Maryland, College Park.

*Nonlinear PDEs—Methods and Applications* (Code: AMS SS C1), David Costa, University of Nevada, Las Vegas.

*Number Theory* (Code: AMS SS F1), Gennady Bachman, University of Nevada, Las Vegas, Richard A. Mollin, University of Calgary, and Peter J. Shue, University of Nevada, Las Vegas.

*Numerical Analysis and Computational Mathematics* (Code:AMS SS E1), Jun Zhang, University of Minnesota and University of Kentucky, and Jennifer Zhao, University of Michigan, Dearborn.

*Set Theory* (Code: AMS SS D1), Douglas Burke and Derrick DuBose, University of Nevada, Las Vegas.

*Symmetries of Knots and Three-Manifolds* (Code: AMS SS M1), Swatee Naik, University of Nevada, Reno, and Jozef H. Przytycki, George Washington University.

For consideration of contributed papers in Special Sessions: January 6, 1999
For abstracts: March 3, 1999

**Invited Addresses**

Michele M. Audin, University of Louis Pasteur, *Title to be announced.*

Russel Caflisch, University of California, Los Angeles, *Title to be announced.*

Jeff Smith, Purdue University, *Title to be announced.*

Alexander Voronov, MIT, *Title to be announced.*

Gregg J. Zuckerman, Yale University, *Title to be announced.*

**Special Sessions**

*Combinatorics and Graph Theory* (Code: AMS SS C1), Harris Kwong, SUNY College at Fredonia.

*Complex Geometry* (Code: AMS SS G1), Terrence Napier, Lehigh University, and Mohan Ramachandran, State University of New York at Buffalo.

*Integrable Systems* (Code: AMS SS J1), Michèle Audin, Université Louis Pasteur and NCRS, and Lisa Claire Jeffrey, McGill University.

*Knot and 3-Manifolds* (Code: AMS SS E1), Thang T. Q. Le, State University of New York at Buffalo, William W. Menasco, SUNY at Buffalo, and Morwen B. Thistlethwaite, University of Tennessee.

*Mathematical Physics* (Code: AMS SS D1), Jonathan Dymock, SUNY at Buffalo.

*Operads, Algebras, and Their Applications* (Code: AMS SS H1), Alexander A. Voronov, MIT.

*Representations of Lie Algebras* (Code: AMS SS F1), Duncan J. Melville, Saint Lawrence University.


**Buffalo, New York**

*State University of New York at Buffalo*

**April 24-25, 1999**

**Meeting #943**

Eastern Section

Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: February 1999

Program issue of *Notices*: June 1999

Issue of *Abstracts*: Volume 20, Issue 3

**Deadlines**

For organizers: Expired

**Denton, Texas**

*University of North Texas*

**May 19-22, 1999**

**Meeting #944**

*Fourth International Joint Meeting of the AMS and the Sociedad Matematica Mexicana (SMM).*

Associate secretary: Lesley M. Sibner

Announcement issue of *Notices*: February 1999

Program issue of *Notices*: August

Issue of *Abstracts*: Volume 20, Issue 3

**Deadlines**

For organizers: To be announced
Meetings & Conferences

For consideration of contributed papers in Special Sessions: February 3, 1999
For abstracts: March 24, 1999

Invited Addresses
Raymundo Bautista, UNAM, Title to be announced.
William Fulton, University of Michigan, Ann Arbor, Title to be announced.
Francisco Gonzalez Acuna, UNAM, Title to be announced.
Ronald L. Graham, AT&T Labs, Title to be announced (Erdos Memorial Lecture).
Jack K. Hale, Georgia Institute of Technology, Title to be announced.
Onesimo Hernandez-Lerma, CINVESTAV del IPN, Title to be announced.

Special Sessions
Algebraic Geometry and Commutative Algebra (Code: AMS SS F1), Javier Elizondo, UNAM, Xavier Gomez-Mont, CIMAT, Alberto Corso, Michigan State University, and David A. Jorgensen, University of Texas at Austin.
Algebraic Topology (Code: AMS SS G1), Frederick R. Cohen and Samuel Gitler, University of Rochester, and Carlos Prieto, UNAM.
Combinatorics (Code: AMS SS N1), Jorge Urrutia, IMATE-UNAM and University of Ottawa, and Wlodzimierz Kuperberg, Auburn University.
Complex Analysis (Code: AMS SS R1), E. Ramirez de Arellano, CINVESTAV, and John E. Fornaess, University of Michigan, Ann Arbor.
Continuum Theory (Code: AMS SS D1), Wayne Lewis, Texas Tech University, and Sergio Macias and Alejandro Illanes, UNAM.
Differential Equations, Nonlinear Analysis, and Numerical Solutions to PDE (Code: AMS SS E1), John W. Neuberger, University of North Texas, and Alfredo C. Nicolas, UAM.
Functional Analysis and Its Applications (Code: AMS SS C1), S. Perez-Esteva, UNAM, and Josefina Alvarez, University of New Mexico.
Geometric and Symbolic Dynamical Systems (Code: AMS SS G1), Luca Q. Zamboni, University of North Texas, and Edgardo Ugalde, University of San Luis Potosi.
Low Dimensional Topology (Code: AMS SS H1), Mark W. Brittenham, University of North Texas, Luis G. Valdez, University of Texas at El Paso, Francisco Gonzalez Acuna, IMUNAM, and Luis Valdez-Sanchez, University of Texas at El Paso.
Noncommutative Geometry, Quantum Groups, and Applications (Code: AMS SS L1), Micho Durdjavich, UNAM, and Hanna Ewa Makaruk and Robert M. Owczarek, Los Alamos National Laboratory.
Representation Theory of Algebras (Code: AMS SS A1), Jose A. de la Pena and Christof Geiss, UNAM, and Birge Zimmermann, University of California, Berkeley.
Ring Theory (Code: AMS SS K1), Carlos Signoret-Poillon, UNAM-UAM, Sergio Lopez-Permouth, Ohio University, and Ricardo Alfaro, University of Michigan, Flint.
Smooth Dynamical Systems (Code: AMS SS P1), David A. Delatte and Dan Mauldin, University of North Texas, Jose Seade, UNAM, Mariusz Urbanskii, University of North Texas, and Alberto Verjovsky, University of Lille, I.
Stochastic Processes (Code: AMS SS J1), Frederi G. Viens, University of North Texas, Jorge A. Leon, CINVESTAV, and Juan Ruiz de Chavez, UAM.

Melbourne, Australia

Melbourne, Australia

July 12-16, 1999

Meeting #945

First International Joint Meeting of the American Mathematical Society and the Australian Mathematical Society

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: March 1999

Program issue of Notices: N/A

Issue of Abstracts: N/A

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Jennifer Chayes, Microsoft, Title to be announced.
Michael Eastwood, University of Adelaide, Title to be announced.
Roger Grimshaw, Monash University, Title to be announced.
Gerhard Huisken, University of Tuebingen, Title to be announced.
Vaughan Jones, University of California, Berkeley, Title to be announced.

Hyam Rubinstein, Melbourne University, Title to be announced.

Richard M. Schoen, Stanford University, Title to be announced.

Neil Trudinger, Australian National University, Title to be announced.
Meetings & Conferences

Special Sessions

Algebraic Groups and Related Topics (Code: AMS SS M1), Eric Friedlander, Northwestern University, and Gustav Lehrer, University of Sydney.

Fluid Dynamics (Code: AMS SS C1), Susan Friedlander, Northwestern University, and Roger H. J. Grimshaw, Monash University.

Geometric Group Theory (Code: AMS SS K1), Swarup Gadde and Walter Neumann, University of Melbourne.

Geometric Themes in Group Theory (Code: AMS SS A1), Gustav I. Lehrer, University of Sydney, Cheryl E. Praeger, University of Western Australia, and Stephen D. Smith, University of Illinois at Chicago.

Group Actions (Code: AMS SS H1), Marston Conder, Gaven Martin, and Eamonn O'Brien, University of Auckland.

Low Dimensional Topology (Code: AMS SS D1), William H. Jaco, Oklahoma State University, and Hyam Rubinstein, Melbourne University.

Mathematical Physics: Many Body Systems (Code: AMS SS B1), Alan L. Carey, University of Adelaide, Paul A. Pearce, University of Melbourne, and Mary Beth Ruskai, University of Massachusetts, Lowell.

Mathematics Learning Centers (Code: AMS SS G1), Judith Baxter, University of Illinois, Chicago, Jackie Nicholas, University of Sydney, and Jeanne Wald, Michigan State University.

Moduli Spaces of Riemann Surfaces, Mapping Class Groups and Invariants of 3-Manifolds (Code: AMS SS E1), Ezra Getzler, Northwestern University, and Richard Hain, Duke University.

Nonlinear Dynamics and Optimization (Code: AMS SS L1), A. F. Ivanov, Penn State University and University of Ballarat, A. Mees, University of Western Australia, and A. Rubinov, University of Ballarat.

Probability Theory and Its Applications (Code: AMS SS E1), Timothy Brown, University of Melbourne, Phil Pollett, University of Queensland, and Ruth J. Williams, University of California, San Diego.

Recent Trends in Operator Theory and Harmonic Analysis (Code: AMS SS J1), Michael T. Lacey, Georgia Institute of Technology, and Alan G. R. McIntosh, Macquarie University.

Deadlines
For organizers: January 21, 1999
For consideration of contributed papers in Special Sessions: June 8, 1999
For abstracts: August 3, 1999

Providence, Rhode Island
Providence College
October 2–3, 1999

Meeting #947
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1999
Program issue of Notices: November 1999
Issue of Abstracts: Volume 20, Issue 4

Deadlines
For organizers: January 6, 1999
For consideration of contributed papers in Special Sessions: June 16, 1999
For abstracts: August 11, 1999

Invited Addresses
Dan M. Barbasch, Cornell University, Title to be announced.
Henri Berestycki, Université Paris VI and Ecole Normale Superieure, Title to be announced.
David Mumford, Brown University, Title to be announced.
Guoliang Yu, University of Colorado, Title to be announced.

Special Sessions

Algebraic and Geometric Combinatorics (Code: AMS SS A1), Vesselin N. Gasharov, Cornell University, and Ira M. Gessel, Brandeis University.

Representation Theory of Reductive Groups (Code: AMS SS B1), Dan M. Barbasch and Birgit Speh, Cornell University.

Salt Lake City, Utah
University of Utah
September 25–26, 1999

Meeting #946
Western Section
Associate secretary: Bernard Russo
Announcement issue of Notices: June/July 1999
Program issue of Notices: November 1999
Issue of Abstracts: Volume 20, Issue 4

Austin, Texas
University of Texas, Austin
October 8–10, 1999

Meeting #948
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 1999
Program issue of Notices: December 1999
Issue of Abstracts: Volume 20, Issue 4

Deadlines
For organizers: January 6, 1999
For consideration of contributed papers in Special Sessions: June 16, 1999
For abstracts: August 11, 1999

Invited Addresses
Mikhail Kapranov, Northwestern University, Title to be announced.
John Roe, Oxford and Pennsylvania State University, Title to be announced.
Catherine Sulem, University of Toronto, Title to be announced.
Tatiana Toro, University of Washington, Title to be announced.

Special Sessions
Aperiodic Tiling (Code: AMS SS D1), Charles Radin and Lorenzo Sadun, University of Texas, Austin.
Banach and Operator Spaces: Isomorphic and Geometric Structure (Code: AMS SS E1), Edward Odell and Haskell P. Rosenthal, University of Texas, Austin.
DNA Topology (Code: AMS SS J1), Isabel K. Darcy, University of Texas, Austin, and Makkuni Jayaram, University of Texas, Austin.
Harmonic Analysis and PDEs (Code: AMS SS C1), William Beckner and Luis A. Caffarelli, University of Texas, Austin, Toti Daskalopoulos, University of California, Irvine, and Tatiana Toro, University of Washington.
Mathematical and Computational Finance (Code: AMS SS H1), Stathis Tompaidis, University of Texas, Austin.
Nonlinear Waves (Code: AMS SS G1), Catherine Sulem, University of Toronto.
Recent Developments in Index Theory (Code: AMS SS F1), Daniel S. Freed, University of Texas, Austin, and John Roe, Pennsylvania State University.
The Development of Topology in the Americas (Code: AMS SS A1), Cameron Gordon, University of Texas, Austin, and Joan Mackenzie James, University of Oxford.
Wavelets and Approximation Theory (Code: AMS SS B1), Don Hong, Eastern Tennessee State University, and Michael Prophet, Murray State University.

Charlotte, North Carolina
University of North Carolina, Charlotte
October 15-17, 1999

Meeting #949
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: August 1999
Program issue of Notices: December 1999
Issue of Abstracts: Volume 20, Issue 4

Deadlines
For organizers: April 20, 1999
For consideration of contributed papers in Special Sessions: August 10, 1999
For abstracts: October 5, 1999
For summaries of papers to MAA organizers: To be announced

Lowell, Massachusetts
University of Massachusetts, Lowell
April 1-2, 2000

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced
Meetings & Conferences

Deadlines
For organizers: July 1, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Invited Addresses
Walter Craig, Brown University, Title to be announced.
Erwin Lutwak, Polytechnic University, Title to be announced.
Alexander Nabutovsky, Courant Institute of Mathematical Sciences, NYU, Title to be announced.
Mary Beth Ruskai, University of Massachusetts, Lowell, Title to be announced.

Special Sessions
Invariance in Convex Geometry (Code: AMS SS A1),
Daniel A. Klain, Georgia Institute of Technology, and Elisabeth Werner, Case Western Reserve University.

Notre Dame, Indiana
University of Notre Dame
April 7–9, 2000
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 7, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Lafayette, Louisiana
University of Southwestern Louisiana
April 14–16, 2000
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: July 14, 1999
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Odense, Denmark
Location to be announced
June 12–15, 2000
First AMS-Scandinavian International Mathematics Meeting.
Sponsored by the AMS, Dansk Matematik Forening, Suomen matemaattinen yhdistys, Icelandic Mathematical Society, Norsk Matematisk Forening, and Svenska matematikernas samfundet.
Associate secretary: Robert M. Fossum
Announcement issue of Notices: To be announced
Program issue of 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

Los Angeles, California
University of California, Los Angeles
August 7–12, 2000
Associate secretary: Robert M. Fossum
Announcement issue of Notices: To be announced
Program issue of 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

Toronto, Ontario, Canada
University of Toronto
September 22–24, 2000
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
New York, New York  
*Columbia University*  
**November 3-5, 2000**  
Eastern Section  
Associate secretary: Lesley M. Sibner  
Announcement issue of *Notices*: To be announced  
Program issue of *Notices*: To be announced  
Issue of *Abstracts*: To be announced  

**Deadlines**  
For organizers: February 3, 2000  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced  

**Invited Addresses**  
*Paula Cohen*, Université des Sciences et Technologies de Lille, France, *Title to be announced.*

---

New Orleans, Louisiana  
*New Orleans Marriott and ITT Sheraton New Orleans Hotel*  
**January 10-13, 2001**  
Joint Mathematics Meetings, including the 107th Annual Meeting of the AMS, 84th Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).  
Associate secretary: Lesley M. Sibner  
Announcement issue of *Notices*: To be announced  
Program issue of *Notices*: To be announced  
Issue of *Abstracts*: To be announced  

**Deadlines**  
For organizers: April 11, 2000  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced  
For summaries of papers to MAA organizers: To be announced

---

Columbia, South Carolina  
*University of South Carolina*  
**March 16-18, 2001**  
Southeastern Section  
Associate secretary: Robert J. Daverman  
Announcement issue of *Notices*: To be announced  
Program issue of *Notices*: To be announced  

Issue of *Abstracts*: To be announced

**Deadlines**  
For organizers: January 11, 2001  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced

---

Lawrence, Kansas  
*University of Kansas*  
**March 30-31, 2001**  
Central Section  
Associate secretary: Susan J. Friedlander  
Announcement issue of *Notices*: To be announced  
Program issue of *Notices*: To be announced  
Issue of *Abstracts*: To be announced

**Deadlines**  
For organizers: June 28, 2000  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced

---

Hoboken, New Jersey  
*Stevens Institute of Technology*  
**April 28-29, 2001**  
Eastern Section  
Associate secretary: Lesley M. Sibner  
Announcement issue of *Notices*: To be announced  
Program issue of *Notices*: To be announced  
Issue of *Abstracts*: To be announced

**Deadlines**  
For organizers: July 28, 2000  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced

---

Williamstown, Massachusetts  
*Williams College*  
**October 13-14, 2001**  
Eastern Section  
Associate secretary: Lesley M. Sibner  
Announcement issue of *Notices*: To be announced  
Program issue of *Notices*: To be announced  
Issue of *Abstracts*: To be announced

**Deadlines**  
For organizers: January 11, 2001  
For consideration of contributed papers in Special Sessions: To be announced  
For abstracts: To be announced
Meetings & Conferences

San Diego, California
San Diego Convention Center
January 6-9, 2002
Joint Mathematics Meetings, including the 108th Annual Meeting of the AMS and 85th Meeting of the Mathematical Association of America (MAA).
Associate secretary: Robert J. Daverman
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: April 4, 2001
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced
Presenters of Papers


Numbers following the name indicate the speaker's position on the program.

AMS Invited Lecturer  * Special Session Speaker  Graduate Student

Program of the Sessions


Friday, November 13

Meeting Registration and AMS Book Sale and Exhibit
6:00 PM - 7:00 PM  Lobby, Mathematics

Invited Address
7:00 PM - 7:50 PM  Room 201, Physics & Atmospheric Sciences

(1) Universality of the distribution functions of random matrix theory.
Craig A. Tracy, University of California, Davis

Welcome Reception
8:00 PM - 10:00 PM  Ventana Room, Marriott University Park

Saturday, November 14

Meeting Registration and AMS Book Sale and Exhibit
8:00 AM - 5:00 PM  Lobby, Mathematics

Special Session on Integrable Systems and Random Matrix Theory, I
8:00 AM - 10:45 AM  Room 312, Physics & Atmospheric Sciences
Organizers: K. T-R McLaughlin, University of Arizona
Craig A. Tracy, University of California, Davis

(2) On the asymptotic analysis of the Fredholm determinant related to the time dependent temperature correlation function of the Heisenberg XX0 ferromagnet. Preliminary report.
Alexander R. Its, Indiana University - Purdue University Indianapolis (938-81-90)

(3) Fredholm determinants, random matrices and integrable perturbations.
Mark A. Adler, Brandeis University (938-60-52)

(4) Distribution functions for random variables.
Estelle L. Basor, California Polytechnic State University (938-82-51)

Special Session on Geometry and Lie Groups, I
9:00 AM - 10:50 AM  Room 501, Mathematics
Organizers: Samuel R. Evens, University of Arizona
Jiang-Hua Lu, University of Arizona

(5) A triangularity result for associated varieties of highest weight modules. Preliminary report.
William M. McGovern, University of Washington (938-17-27)

(6) Singular loci of Schubert varieties in a generalized flag variety.
James B. Carrell, University of British Columbia (938-14-86)

(7) Patterns, smoothness and rational smoothness of Schubert varieties.
Sara C. Billey, MIT (938-05-104)

Special Session on Spectral Geometry and Its Applications, I
9:00 AM - 10:50 AM  Room 402, Mathematics
Organizers: Xianzhe Dai, University of Southern California
Leonid Friedlander, University of Arizona

(8) Singular Sturm-Liouville theory.
Rafe Mazzeo*, Stanford University, and Robert McOwen, Northeastern University (938-58-19)

(9) Analytic torsion and R-torsion for manifolds with boundary.
Xianzhe Dai*, UCSB and USC, and Hao Fang, Princeton University (938-58-121)

(10) Spectrum of complete noncompact manifolds.
Jiaping Wang, Cornell University (938-58-15)

The time limit for each contributed paper in the sessions is ten minutes. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (•) have been designated by the author as being of possible interest to undergraduate students.

Abstracts of papers presented in the sessions at this meeting will be found in Volume 19, Issue 4 of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings. The middle two digits, e.g., 897-20-1136, refer to the Mathematical Reviews subject classification assigned by the individual author. Groups of papers for each subject are listed chronologically in the Abstracts. The last one to four digits, e.g., 897-20-1136, refer to the receipt number of the abstract; abstracts are further sorted by the receipt number within each classification.
Special Session on Mathematics and Biology, I

9:00 AM - 10:50 AM Room 220, Physics & Atmospheric Sciences
Organizers: Jim Cushing, University of Arizona
Shandelle M. Henson, University of Arizona

9:00 AM
Hamiltonian limits and subharmonic resonance in ecological models: I. From the pendulum to the Lynx and the hare. William M. Schaffer*, University of Arizona, and Aaron A. King, University of Arizona (938-92-75)

9:30 AM
Hamiltonian limits and subharmonic resonance in ecological models: II. To the lynx and the hare. Aaron A. King*, University of Arizona, and William M. Schaffer, University of Arizona (938-92-76)

10:00 AM
Variations on the complex formation approach in modeling predator prey relations, mating, and sexual disease transmission. Horst R. Thieme* and Jinling Yang, Arizona State University (938-92-37)

10:30 AM
How to construct better high-dimensional population models. Preliminary report. Yang Kuang, ASU (938-92-33)

Special Session on Classical and Quantum Mechanical Lattice Spin Systems, I

9:00 AM - 10:40 AM Room 237, Bio Sciences West
Organizer: Tom Kennedy, University of Arizona

9:00 AM
Non-mean-field behavior in finite-dimensional spin glasses. Charles M. Newman, New York University, and Daniel L. Stein*, University of Arizona (938-82-41)

9:35 AM
Phase structure of a lattice model of flux lines. Christian Borgs, Jennifer T. Chayes*, Microsoft Research, Christopher King, Northeastern University, and Neal Madras, York University (938-82-138)

10:10 AM
Edge states of quantum spin chains. Preliminary report. Bruno L. Nachtergaele, University of California, Davis (938-82-105)

Special Session on Dynamical Systems, I

9:00 AM - 10:50 AM Room 208, Bio Sciences West
Organizers: Marek Rychlik, University of Arizona
Maciej P. Wojtkowski, University of Arizona

9:00 AM
Bootstrap estimates of chaotic dynamics. Eric Kostelich, Arizona State University (938-58-44)

9:30 AM
Understanding renormalization. Ricardo Perez-Marco, UCLA (938-30-47)

10:00 AM
The spectra of nonnegative integer matrices via formal power series. Ormes S. Nicholas*, University of Texas, Ki H. Kim and Fred W. Roush, Alabama State University (938-15-30)

10:30 AM
Rational attractors and irrational continua for maps in the Lozi family. Chris Cleveland, Adjunct (938-58-22)

Special Session on Arithmetic Algebraic Geometry, I

9:00 AM - 10:50 AM Room 219, Bio Sciences West
Organizer: Douglas Ulmer, University of Arizona

9:00 AM
Low-degree points on curves: A worked example. Preliminary report. Joseph L. Wetherell, University of Southern California (938-11-125)

9:30 AM
Arithmetic of some curves of high genus. Pavlos Tzermias, University of Arizona (938-11-89)

10:00 AM

10:30 AM
Jacobians of genus one curves. Catherine H. O'Neill, Harvard University (938-11-83)

Special Session on Filaments, Interfaces and Patterns, I

9:00 AM - 10:40 AM Room 224, Physics & Atmospheric Sciences
Organizers: Nicholas Ercolani, University of Arizona
Jerry Moloney, University of Arizona

9:00 AM
Phase field theories and material interfaces. Chaim Charach, Ben-Gurion University, and Paul C. Fife*, University of Utah (938-82-57)

9:30 AM
Boundary homogenization of kinetic and fluid models for thin film deposition. Christian A. Ringhofer, Arizona State University (938-70-131)

10:15 AM
Atomistic, continuum and bulk models for epitaxial growth. Preliminary report. Russel E. Caflisch, UCLA (938-82-78)

Special Session on Striking the Balance: Theory, Technique, and Applications in Lower Division Mathematics Courses, I

9:00 AM - 10:50 AM Room 242E, Shantz
Organizer: Joseph Watkins, University of Arizona

9:30 AM
A non-radical version of 'calculus reform'. Preliminary report. Neal Koblitz, University of Washington (938-98-09)

10:00 AM

10:30 AM
Stirling's approximation for int(n!): An elementary proof and applications. Preliminary report. Keith A. Brandt* and Anton S. Wallner, Missouri Western State College (938-98-21)

Invited Address

11:15 AM - 12:05 PM Room 201, Physics & Atmospheric Sciences

Preliminary report. Poisson geometry and some applications. Jiang-Hua Lu, University of Arizona (938-53-137)

Invited Address

1:30 PM - 2:20 PM Room 201, Physics & Atmospheric Sciences

On the asymptotic speed of a stochastic invasion. Mark A. Lewis, University of Utah (938-60-140)
Program of the Sessions – Tucson, AZ, Saturday, November 14 (cont’d.)

Special Session on Groups and Computation
3:00 PM - 4:20 PM Room 404, Physics & Atmospheric Sciences
Organizer: Robert M. Beals, University of Arizona
3:00PM Algorithms in representation theory. Preliminary report.
Klaus M. Lux, University of Arizona (938-20-127)
3:30PM Algorithms for matrix groups over number fields.
Robert M. Beals, University of Arizona (938-20-130)
4:00PM Discussion

Special Session on Geometry and Lie Groups, II
3:00 PM - 6:10 PM Room 501, Mathematics
Organizers: Samuel R. Evens, University of Arizona
Jiang-Hua Lu, University of Arizona
3:00PM Invariant theory and entanglement in quantum computing. Preliminary report.
David Meyer and Nolan Wallach*, University of California, San Diego (938-22-94)
3:40PM Representations and deformations of Lie bialgebroids.
Arkady Vaintrob, New Mexico State University (938-53-107)
4:20PM Poisson brackets on projective spaces and trilinear forms. Preliminary report.
Alexander Polishchuk, Harvard University (938-14-60)
5:00PM Moduli of polygons and n-pointed projective lines. Preliminary report.
Philip A. Foth, Northwestern University, University of Arizona (938-14-61)
5:40PM Compact weakly symmetric spaces and spherical pairs.
Hieu D. Nguyen, Rowan University (938-53-11)

Special Session on Spectral Geometry and Its Applications, II
3:00 PM - 4:50 PM Room 402, Mathematics
Organizers: Xianzhe Dai, University of Southern California
Leonid Friedlander, University of Arizona
3:00PM Inverse scattering problems in two-dimensional anisotropic media.
Gregory Eskin* and James V. Ralston, UCLA (938-35-20)
3:40PM An invariant of the smooth structure related to the first eigenvalue of the Laplacian.
Leonid Friedlander*, University of Arizona, and Nikolai Nadirashvili, University of Chicago (938-35-99)
4:20PM On the small-scale mass concentration of modes. Preliminary report.
John A. Toth, McGill University (938-35-12)

Special Session on Mathematics and Biology, II
3:00 PM - 5:50 PM Room 220, Physics & Atmospheric Sciences
Organizers: Jim Cushing, University of Arizona
Shandelle M. Henson, University of Arizona
3:00PM Consistency and fluctuation theorems for discrete time structured population models having demographic stochasticity.
Joseph C. Watkins, University of Arizona (938-92-55)
3:30PM From individuals to population dynamics: A method and an example.
Wade Leitner, University of Arizona (938-60-95)
4:00PM A stochastic continuous-time age-structured population model. Preliminary report.
Edward J. Allen* and Murul Chowdhury, Texas Tech University (938-92-10)
5:00PM A model of the population dynamics and coevolution of mutualisms. Preliminary report.
Brian J. McGill, University of Arizona (938-92-123)
Peter W. White, Tarleton State University (938-92-66)

Special Session on Classical and Quantum Mechanical Lattice Spin Systems, II
3:00 PM - 5:15 PM Room 237, Bio Sciences West
Organizer: Tom Kennedy, University of Arizona
3:00PM Hyperscaling in percolation.
Christian Borgs*, Jennifer T. Chayes, Microsoft Research, Harry Kesten, Cornell University, and Joel Spencer, New York University (938-82-119)
3:35PM Power-law corrections to exponential decay of connectivities and correlations.
Kenneth S. Alexander, University of Southern California (938-60-102)
4:10PM Surprises in the hydrodynamics of driven lattice gases.
Gregory Eyink, University of Arizona (938-70-135)
4:45PM Status of the two dimensional nonlinear Sigma models.
Adrian Patrascioiu*, University of Arizona, and Erhard Seiler, Max Planck Institut fuer Physik (938-82-129)

Special Session on Dynamical Systems, II
3:00 PM - 5:50 PM Room 208, Bio Sciences West
Organizers: Marek Rychlik, University of Arizona
Maciej P. Wojtkowski, University of Arizona
3:00PM Multi-dimensional piecewise smooth expanding maps.
William J. Cowieson, UCLA (938-58-48)
3:30PM Dynamics of Anosov diffeomorphisms with small holes.
Nikolai Chernov, University of Alabama at Birmingham (938-58-50)
4:00PM Distribution of return times for rational maps.
Nicolai T. A. Haydn, University of Southern California (938-58-55)
Oliver R. Knill, University of Texas (938-58-54)
5:00PM Chaotic billiards on surfaces of constant curvature.
Eugene Gutkin, USC (938-58-28)
5:30PM Discussion
Special Session on Arithmetic Algebraic Geometry, II

3:00 PM - 4:50 PM Room 219, Bio Sciences West

Organizer: Douglas Ulmer, University of Arizona

3:00 PM The central derivative of certain Hecke series.
   Preliminary report.
   Tonghai Yang, SUNY at Stony Brook (938-11-88)

3:30 PM Stark-type Conjectures "over Z".
   Preliminary report.
   Cristian D. Popescu, University of Texas at Austin (938-11-64)

4:00 PM Isogeny covariant differential modular forms.
   Preliminary report.
   Chris M. Hurlburt, University of New Mexico (938-14-40)

4:30 PM Moduli of vector bundles on curves in characteristic
   p > 0.
   Preliminary report.
   Kirti Joshi and Eugene Z. Xia, University of Arizona (938-14-38)

Special Session on Filaments, Interfaces and Patterns, II

3:00 PM - 5:40 PM Room 224, Physics & Atmospheric Sciences

Organizers: Nicholas Ercolani, University of Arizona
   Jerry Moloney, University of Arizona

3:00 PM Modelling bioconvection patterns produced by
   swimming bacteria.
   Joceline C. Lega and Neil H. Mendelson, University of Arizona (938-92-108)

3:30 PM Convolution based methods for cellular automata
   models.
   Steven J. Ruuth, Barry Merriman and Stanley Osmer, UCLA (938-65-118)

4:00 PM Dynamics of axial separation in long rotating
   drums.
   Igor S. Aranson, Argonne National Laboratory, and
   Lev S. Tsimring, University of California, San Diego (938-35-85)

4:45 PM The stability of waves for modulation equations.
   Todd M. Kapitula, University of New Mexico (938-35-95)

5:15 PM Singularities and defects in patterns far from
   threshold.
   Nicholas M. Ercolani, Robert Indik, University of Arizona, Alan C. Newell, University of Warwick, and
   Thierry Passot, CNRS (938-35-110)

Special Session on Striking the Balance: Theory, Technique, and Applications in Lower Division
Mathematics Courses, II

3:00 PM - 5:20 PM Room 242E, Shantz

Organizer: Joseph Watkins, University of Arizona

3:00 PM Encouraging effective change within an atmosphere of flexibility.
   Preliminary report.
   John W. Hagood, Northern Arizona University (938-98-100)

3:30 PM Within the balance, a tilt toward applications.
   Lynne B. Small, University of San Diego (938-98-81)

4:00 PM Where will the applications be coming from?
   Preliminary report.
   Brad G. Osgood, Stanford University (938-98-18)

4:30 PM The balance - a moving target: Experiences from 5
   years teaching in an integrated engineering curriculum.
   Matthias Kawski, ASU (938-98-112)

5:00 PM Discussion

Special Session on Integrable Systems and Random Matrix Theory, II

3:00 PM - 5:45 PM Room 312, Physics & Atmospheric Sciences

Organizers: K. T-R McLaughlin, University of Arizona
   Craig A. Tracy, University of California, Davis

3:00 PM An electrostatics model for zeros of general
   orthogonal polynomials.
   Mourad E.H. Ismail, University of South Florida (938-33-07)

4:00 PM Statistics at the edge of the spectrum of Wigner
   random matrices.
   Yakov G. Sinai, Princeton University, and
   Alexander B. Soshnikov, California Institute of Technology (938-60-08)

5:00 PM Determinantal formulas for the correlation
   functions and the infinite symmetric group.
   Alexei Borodin, University of Pennsylvania, and
   Grigori Olshanski, Institute for Problems of Information Transmission (938-60-39)

Session for Contributed Papers

4:15 PM - 5:25 PM Room 210, Bio Sciences West

4:15 PM Selected tessellations and the nature of the Schaffli
   numbers.
   C. S. Felicitas, Pan Asian Congress of Mathematicians (American and New York Branch)
   (938-14-01)

4:30 PM Mathematics basic skills for the first three grades.
   Preliminary report.
   Abdullah Alharbey, King Abdulaziz University (938-96-06)

4:45 PM Kernel inspired factorizations of partial differential
   operators.
   Alex Kasman, MSRI (938-35-29)

5:00 PM The conditional empirical distribution as a decision
   making tool.
   Preliminary report.
   Rod A. Freed, California State University, Dominguez Hills (938-00-92)

5:15 PM Generalized functions and approximate solutions to
   the abstract Cauchy problem.
   Preliminary report.
   Boris Baeumer, University of Nevada, Reno (938-44-109)

Sunday, November 15

Meeting Registration and AMS Book Sale and Exhibit
8:00 AM - NOON Lobby, Mathematics

Special Session on Integrable Systems and Random Matrix Theory, III

8:00 AM - 10:45 AM Room 312, Physics & Atmospheric Sciences

Organizers: K. T-R McLaughlin, University of Arizona
   Craig A. Tracy, University of California, Davis

8:00 AM Scaling limits for correlations between zeros of
   random polynomials.
   Pavel M. Bleher, IUPUI (938-60-23)
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:30 AM</td>
<td><strong>Special Session on Mathematics and Biology, III</strong></td>
<td>Room 220, Physics &amp; Atmospheric Sciences</td>
</tr>
<tr>
<td></td>
<td><strong>Organizers:</strong> Jim Cushing, University of Arizona</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Shandelie M. Henson, University of Arizona</strong></td>
<td></td>
</tr>
<tr>
<td>8:30 AM</td>
<td><strong>A mathematical model of microbial growth and competition in a plug</strong></td>
<td><strong>A model of the gut.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>flow reactor:</strong></td>
<td><strong>Hal L. Smith, Arizona State University (938-92-49)</strong></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>Temporal and spatial synchronization in microbial ecology.</strong></td>
<td><strong>Frank C. Hoppenstead, ASU (938-92-62)</strong></td>
</tr>
<tr>
<td>9:30 AM</td>
<td><strong>Differentiability and species coexistence.</strong></td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Frederick R. Adler, AMS (938-92-59)</strong></td>
<td></td>
</tr>
<tr>
<td>10:00 AM</td>
<td><strong>The dynamics of a simple food chain.</strong></td>
<td><strong>Sophia R.-J. Jang, Texas Tech University (938-92-101)</strong></td>
</tr>
<tr>
<td>10:30 AM</td>
<td><strong>A dynamical system modeling meristematic plant development and</strong></td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>reproducing the observed phylotactic patterns.</strong></td>
<td><strong>Pau Atela, Christophe Gole, Smith College, and</strong></td>
</tr>
<tr>
<td></td>
<td><em><em>Scott hoton</em>, University of California, Santa Cruz (938-92-106)</em>*</td>
<td>* University of California, Santa Cruz (938-92-106)</td>
</tr>
<tr>
<td>8:30 AM</td>
<td><strong>Special Session on Classical and Quantum Mechanical Lattice Spin</strong></td>
<td><strong>Systems, III</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Spin Systems, III</strong></td>
<td><strong>Room 237, Bio Sciences West</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Organizer:</strong> Tom Kennedy, University of Arizona</td>
<td></td>
</tr>
<tr>
<td>8:30 AM</td>
<td><strong>Central limit theorem for stochastic Hamilton-Jacobi equations.</strong></td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Fraydoun Rezakhanlou, Associate Professor</strong></td>
<td><strong>(938-35-82)</strong></td>
</tr>
<tr>
<td>9:05 AM</td>
<td><strong>Nonlinear wave equations with randomness.</strong></td>
<td><strong>Jan Wehr, University of Arizona (938-60-116)</strong></td>
</tr>
<tr>
<td>9:40 AM</td>
<td><strong>Localization of classical waves: A general framework.</strong></td>
<td><em><em>Andrew J. Kones</em> and Abel Klein, University of California, Irvine</em>*</td>
</tr>
<tr>
<td></td>
<td><em><em>Abel Klein and Maximilian Seifert</em>, University of California, Irvine</em>*</td>
<td><strong>(938-78-122)</strong></td>
</tr>
<tr>
<td>10:15 AM</td>
<td><strong>Generalized eigenfunction expansion of second order partial</strong></td>
<td><strong>differential operators defined by quadratic forms.</strong></td>
</tr>
<tr>
<td></td>
<td><em><em>Abel Klein and Maximilian Seifert</em>, University of California, Irvine</em>*</td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Room 237, Bio Sciences West</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Special Session on Geometry and Lie Groups, III</strong></td>
<td><strong>Room 501, Mathematics</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Organizers:</strong> Samuel R. Evens, University of Arizona</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Jiang-Hua Lu, University of Arizona</strong></td>
<td></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>Gauge equivalence of Poisson structures.</strong></td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Alan Weinstein, University of California, Berkeley</strong></td>
<td><strong>(938-58-58)</strong></td>
</tr>
<tr>
<td>9:40 AM</td>
<td><strong>Groupoid and the integration of Lie algebroids.</strong></td>
<td><strong>Victor Nistor, Penn State (938-58-26)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Room 237, Bio Sciences West</strong></td>
<td></td>
</tr>
<tr>
<td>10:20 AM</td>
<td><strong>Braid representations and exceptional Lie groups.</strong></td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><em><em>Hans Wenzl</em> and Imre Tuba, UC San Diego (938-22-70)</em>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Special Session on Spectral Geometry and Its Applications, III</strong></td>
<td><strong>Room 402, Mathematics</strong></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>Organizers:</strong> Xianzhe Dai, University of Southern California</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Leonid Friedlander, University of Arizona</strong></td>
<td></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>Bernstein-type theorem for Lagrangian stationary surfaces.</strong></td>
<td><strong>Chikako Mese, University of Southern California (938-53-16)</strong></td>
</tr>
<tr>
<td>9:40 AM</td>
<td><strong>Poisson problems, diffusions, and comparison theorems for complete</strong></td>
<td><strong>Riemannian manifolds.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>M. A. Ricci, Assoc. Adjunct Professor</strong></td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Patrick T. McDonald, New College of USF</strong></td>
<td><strong>(938-58-111)</strong></td>
</tr>
<tr>
<td>10:20 AM</td>
<td><strong>Ginzburg-Landau vortex and Mandelstam Diagram.</strong></td>
<td><strong>Preliminary report.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Jie Qing, UCSC (938-58-17)</strong></td>
<td></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>Special Session on Dynamical Systems, III</strong></td>
<td><strong>Room 208, Bio Sciences West</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Organizers:</strong> Marek Rychlik, University of Arizona</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Maciej P. Wojtkowski, University of Arizona</strong></td>
<td></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>Fast singular oscillating limits of 3D Euler-Boussinesq equations.</strong></td>
<td><em><em>Alex Mahalov</em>, Arizona State University, Anatoli Babin, UC Irvine, and</em>*</td>
</tr>
<tr>
<td></td>
<td><strong>M. A. Ricci, Assoc. Adjunct Professor</strong></td>
<td><strong>MIIT, Moscow, and BASIL Nicolaenko, Arizona State University (938-58-46)</strong></td>
</tr>
<tr>
<td>9:30 AM</td>
<td><strong>Exponential attractors and finite dimensional inertial dynamical</strong></td>
<td><strong>systems for Navier-Stokes and general dissipative equations.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>systems for Navier-Stokes and general dissipative equations.</strong></td>
<td><strong>Basil Nicolaenko, Arizona State University (938-58-45)</strong></td>
</tr>
<tr>
<td>10:00 AM</td>
<td>The Hill's region of the four-body problem.</td>
<td><strong>Quidong Wang, UCLA (938-58-25)</strong></td>
</tr>
<tr>
<td>10:30 AM</td>
<td>The horseshoe: Pruning and homoclinic families.</td>
<td><em><em>Andre S. de Carvalho</em>, IMS - SUNY at Stony Brook, and</em>*</td>
</tr>
<tr>
<td></td>
<td><strong>Toby Hall, University of Liverpool (938-58-42)</strong></td>
<td><strong>Toby Hall, University of Liverpool (938-58-42)</strong></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>Special Session on Arithmetic Algebraic Geometry, III</strong></td>
<td><strong>Room 219, Bio Sciences West</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Organizer:</strong> Douglas Ulmer, University of Arizona</td>
<td></td>
</tr>
<tr>
<td>9:00 AM</td>
<td><strong>The parameters of trace codes from curves over rings.</strong></td>
<td><em><em>Felix Voloch, University of Texas, and Judy L. Walker</em>, University of</em>*</td>
</tr>
<tr>
<td></td>
<td><strong>University of Nebraska (938-11-77)</strong></td>
<td><strong>(938-11-77)</strong></td>
</tr>
<tr>
<td>9:30 AM</td>
<td><strong>Improved bounds for the number of rational points on curves over</strong></td>
<td><strong>finite fields.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>finite fields.</strong></td>
<td><strong>Kristin E. Lauter, University of Michigan (938-11-69)</strong></td>
</tr>
<tr>
<td>10:00 AM</td>
<td>Trigonal modular curves. Preliminary report.</td>
<td><strong>Matthew H. Baker, UC Berkeley (938-11-53)</strong></td>
</tr>
<tr>
<td>10:30 AM</td>
<td>On a conjecture of Fontaine and Mazur.</td>
<td><strong>Yihsiang Liow, University of Arizona (938-14-143)</strong></td>
</tr>
</tbody>
</table>
Special Session on Filaments, Interfaces and Patterns, III

9:00 AM - 10:40 AM  Room 224, Physics & Atmospheric Sciences

Organizers: Nicholas Ercolani, University of Arizona
Jerry Moloney, University of Arizona

9:00 AM  Spectra, multi-phase solutions of vortex filament flow, and knot types. Preliminary report.
Annalisa M. Calini*, College of Charleston, and Thomas A. Ivey, Ball State University (938-35-80)

9:30 AM  Pulses, fronts and oscillations of an elastic rod.
> (107) Alain Goriely*, Dept of Mathematics, and Joceline Lega, Department of Mathematics (938-73-65)

10:15 AM  Viscous nonlinear dynamics of twist and writhe.
> (108) Raymond E. Goldstein, University of Arizona (938-35-36)

Special Session on Striking the Balance: Theory, Technique, and Applications in Lower Division Mathematics Courses, III

9:00 AM - 10:50 AM  Room 242E, Shantz

Organizer: Joseph Watkins, University of Arizona
Applications inspire student confidence. Preliminary report.
Simon J. Bernau*, Cal Poly Pomona, and Nancy C. Marcus, University of Texas at El Paso (938-98-13)

9:30 AM  Modular pre calculus and clustering: Evolution of a successful program. Preliminary report.
Simon J. Bernau*, Cal Poly Pomona, and Nancy C. Marcus*, University of Texas at El Paso (938-98-14)

10:00 AM  An introductory modeling course for non-science majors: Using Mathematica to convey mathematical concepts.
Silvia P. Heubach, California State University Los Angeles (938-98-79)

10:30 AM  Discussion

Invited Address

11:15 AM - 12:05 PM  Room 201, Physics & Atmospheric Sciences

Differential algebraic geometry and derivatives of integers. Preliminary report.
Alexandru Buicu, Unv of Illinois (938-14-35)

Invited Address

1:30 PM - 2:20 PM  Room 201, Physics & Atmospheric Sciences

Renormalization group methods in Hamiltonian dynamics.
Hans A. Koch, The University of Texas at Austin (938-70-103)

Special Session on Dynamical Systems

3:00 PM - 4:50 PM  Room 208, Bio Sciences West

Organizers: Marek Rychlik, University of Arizona
Maciej P. Wojtkowski, University of Arizona

3:00 PM  Abundance of piecewise isometries with self-similar structure in dimension one and two.
Arek Goetz, Boston University (938-58-133)

3:30 PM  Positive stretch and rigidity for group actions and foliations.
Alberto Candel*, Caltech, and Raul Quiroga-Barranco, Cinvestav (938-53-126)

3:30 PM  Several examples of multi-valued dynamics.
Marek R. Rychlik, University of Arizona (938-58-113)

4:30 PM  Magnetic flows and Gaussian thermostats. Preliminary report.
Maciej P. Wojtkowski, University of Arizona (938-58-114)

Special Session on Arithmetic Algebraic Geometry, IV

3:00 PM - 4:50 PM  Room 219, Bio Sciences West

Organizer: Douglas Ulmer, University of Arizona
Arithmetic Schubert calculus.
Harry Tamvakis, University of Pennsylvania (938-14-120)

3:30 PM  Deformations of large fundamental groups.
Bruno N. De Oliveira*, Lecturer of Mathematics, and Ludmil Katzarkov, Assistant Professor
(938-14-93)

4:00 PM  Algebraic cycles and arithmetic on degenerations.
Caterina Consani, Massachusetts Institute of Technology (938-14-84)

4:30 PM  On Frobenius splittings and ordinary varieties.
Kirti Joshi, University of Arizona (938-14-142)

Special Session on Filaments, Interfaces and Patterns, IV

3:00 PM - 5:40 PM  Room 224, Physics & Atmospheric Sciences

Organizers: Nicholas Ercolani, University of Arizona
Jerry Moloney, University of Arizona

3:00 PM  A generalized level set method for computing the motion of filaments and objects of any codimension. Preliminary report.
Li-Tien Cheng, Paul Burchard, Barry Merriman*, Stanley J. Osher and Steven J. Ruuth, UCLA (938-65-128)

3:30 PM  A diffusion-generated approach to the curvature motion of filaments. Preliminary report.
Steven J. Ruuth, Barry Merriman, University of California, Los Angeles, Jack Xin, University of Arizona, and Stanley Osher*, University of California, Los Angeles (938-65-32)

4:00 PM  Dynamics of the geodynamo.
Dieter Armbruster, Arizona State University (938-86-119)

4:45 PM  Average dynamics of the optical soliton in communication lines with dispersion management.
Alejandro B. Aceves*, University of New Mexico, C.K.R.T. Jones, Vadim Zharnitsky, Brown University, and Sergei K. Turitsyn, University of Dusseldorf (938-78-97)

5:15 PM  Role of the critical collapse singularity in sustaining a novel femtosecond light guide. Preliminary report.
Jerry V. Moloney, University of Arizona (938-78-135)

Special Session on Striking the Balance: Theory, Technique, and Applications in Lower Division Mathematics Courses, IV

3:00 PM - 4:50 PM  Room 242E, Shantz

Organizer: Joseph Watkins, University of Arizona
This volume develops a systematic study of time-dependent control processes. The basic problem of null controllability of linear systems is first considered. Using methods of ergodic theory and topological dynamics, general local null controllability criteria are given. Then the subtle question of global null controllability is studied. Next, the random linear feedback and stabilization problem is posed and solved. Using concepts of exponential dichotomy and rotation number for linear Hamiltonian systems, a solution of the Riccati equation is obtained which has extremely good robustness properties and which also preserves all the smoothness and recurrence properties of the coefficients. Finally, a general version of the local nonlinear feedback stabilization problem is solved.


Almost Automorphic and Almost Periodic Dynamics in Skew-Product Semiflows

Wenxian Shen, Auburn University, AL, and Yingfei Yi, Georgia Institute of Technology, Atlanta, GA

This volume is devoted to the study of almost automorphic dynamics in differential equations. By making use of techniques from abstract topological dynamics, it is shown that almost automorphy, a notion which was introduced by S. Bochner in 1955, is essential and fundamental in the qualitative study of almost periodic differential equations.

Fundamental notions from topological dynamics are introduced in the first part of the book. Harmonic properties of almost automorphic functions such as Fourier series and frequency module are studied. A module containment result is provided. In the second part, lifting dynamics of ω-limit sets and minimal sets of a skew-product semiflow from an almost periodic minimal base flow are studied. Skew-product semiflows with (strongly) order preserving or monotone natures on fibers are given particular attention. It is proved that a linearly stable minimal set must be almost automorphic and become almost periodic if it is also uniformly stable. Other issues such as flow extensions and the existence of almost periodic global attractors, etc., are also studied.

The third part of the book deals with dynamics of almost periodic differential equations. In this part, the general theory developed in the previous two parts is applied to study almost automorphic and almost periodic dynamics which are lifted from certain coefficient structures (e.g., almost automorphic or almost periodic) of differential equations. It is shown that (harmonic or subharmonic) almost automorphic solutions exist for a large class of almost periodic ordinary, parabolic and delay differential equations.

Presenters of Papers

San Antonio, Texas; January 13–16, 1999

Numbers following the name indicate the speaker’s position on the program.

- AMS-MAA Invited Lecturer, • AMS Invited Lecturer, © MAA Invited Lecturer, □ AWM Emmy Noether Lecturer, ◆ NAM Invited Lecturer, ○ ASL Invited Lecturer, ♦ MAA Student Lecturer, * Special Session Speaker, ▲ Graduate Student, ▲ Undergraduate Student
<table>
<thead>
<tr>
<th>Names</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jacobson, A. A.</td>
<td>301</td>
</tr>
<tr>
<td>Jaffe, C.</td>
<td>120</td>
</tr>
<tr>
<td>James, E. W.</td>
<td>996</td>
</tr>
<tr>
<td>Jardine, D. J.</td>
<td>419</td>
</tr>
<tr>
<td>Jardine, D.</td>
<td>1110</td>
</tr>
<tr>
<td>Jarosz, R.</td>
<td>1079</td>
</tr>
<tr>
<td>Jones, D. A.</td>
<td>508</td>
</tr>
<tr>
<td>Johnson, J. A.</td>
<td>612</td>
</tr>
<tr>
<td>Johnson, J. L.</td>
<td>1118</td>
</tr>
<tr>
<td>Johnson, M. R.</td>
<td>558</td>
</tr>
<tr>
<td>Johnson, O. C.</td>
<td>292</td>
</tr>
<tr>
<td>Johnsonbaugh, R.</td>
<td>424</td>
</tr>
<tr>
<td>Johnson, R.</td>
<td>95</td>
</tr>
<tr>
<td>Johnson, H. M.</td>
<td>15</td>
</tr>
<tr>
<td>Jones, D. A.</td>
<td>905</td>
</tr>
<tr>
<td>Jones, J.</td>
<td>53</td>
</tr>
<tr>
<td>Jones, A. C.</td>
<td>434</td>
</tr>
<tr>
<td>Jorgensen, P. E.</td>
<td>343</td>
</tr>
<tr>
<td>Judson, T. W.</td>
<td>626</td>
</tr>
<tr>
<td>Kainrath, F.</td>
<td>532</td>
</tr>
<tr>
<td>Kairman, M. T.</td>
<td>533</td>
</tr>
<tr>
<td>Kalman, M. T.</td>
<td>818</td>
</tr>
<tr>
<td>Kandria, C.</td>
<td>154</td>
</tr>
<tr>
<td>Karimov, A.</td>
<td>997</td>
</tr>
<tr>
<td>Karonovitz, M.</td>
<td>560</td>
</tr>
<tr>
<td>Kappe, L. C.</td>
<td>65</td>
</tr>
<tr>
<td>Kapravelov, M.</td>
<td>596</td>
</tr>
<tr>
<td>Kanser, J. R.</td>
<td>401</td>
</tr>
<tr>
<td>Karp, K.</td>
<td>371</td>
</tr>
<tr>
<td>Kasdan, A.</td>
<td>625</td>
</tr>
<tr>
<td>Kasturirachchi, B.</td>
<td>762</td>
</tr>
<tr>
<td>Katok, S.</td>
<td>5</td>
</tr>
<tr>
<td>Katok, S.</td>
<td>115</td>
</tr>
<tr>
<td>Katsoulis, E. G.</td>
<td>975</td>
</tr>
<tr>
<td>Keats, K.</td>
<td>584</td>
</tr>
<tr>
<td>Keidar, A.</td>
<td>564</td>
</tr>
<tr>
<td>Kedzierskiwski, A. W.</td>
<td>796</td>
</tr>
<tr>
<td>Kesling, E. T.</td>
<td>541</td>
</tr>
<tr>
<td>Kellman, M. E.</td>
<td>118</td>
</tr>
<tr>
<td>Kennedy, J. A.</td>
<td>542</td>
</tr>
<tr>
<td>Kennedy, R. E.</td>
<td>233</td>
</tr>
<tr>
<td>Kent, C. B.</td>
<td>185</td>
</tr>
<tr>
<td>Kevan, K.</td>
<td>305</td>
</tr>
<tr>
<td>Kharemarkov, O.</td>
<td>139</td>
</tr>
<tr>
<td>Khavinson, D.</td>
<td>637</td>
</tr>
<tr>
<td>Khoury, R. N.</td>
<td>590</td>
</tr>
<tr>
<td>Kicey, C. J.</td>
<td>356</td>
</tr>
<tr>
<td>Kihlhe, P. L.</td>
<td>449</td>
</tr>
<tr>
<td>Kilpatrick, J.</td>
<td>852</td>
</tr>
<tr>
<td>Kim, A. K.</td>
<td>1020</td>
</tr>
<tr>
<td>Kim, B.</td>
<td>440</td>
</tr>
<tr>
<td>Kimm, S.</td>
<td>365</td>
</tr>
<tr>
<td>Kimber, C. M.</td>
<td>448</td>
</tr>
<tr>
<td>King, J. P.</td>
<td>807</td>
</tr>
<tr>
<td>King, J. P.</td>
<td>809</td>
</tr>
<tr>
<td>King, R.</td>
<td>438</td>
</tr>
<tr>
<td>Kinyon, M. K.</td>
<td>1049</td>
</tr>
<tr>
<td>Kirk, C. M.</td>
<td>473</td>
</tr>
<tr>
<td>Kirk, C. M.</td>
<td>998</td>
</tr>
<tr>
<td>Kirschkink, S. J.</td>
<td>1046</td>
</tr>
<tr>
<td>Kiss, V. B.</td>
<td>485</td>
</tr>
<tr>
<td>Kleiner, A. F.</td>
<td>808</td>
</tr>
<tr>
<td>Kleins, M. L.</td>
<td>615</td>
</tr>
<tr>
<td>Klepsis, M. L.</td>
<td>646</td>
</tr>
<tr>
<td>Kline, B. J.</td>
<td>527</td>
</tr>
<tr>
<td>Knall, O. R.</td>
<td>467</td>
</tr>
<tr>
<td>Knott, C. A.</td>
<td>1045</td>
</tr>
<tr>
<td>Koch, A. F.</td>
<td>1586</td>
</tr>
<tr>
<td>Kochanowski, P.</td>
<td>1089</td>
</tr>
<tr>
<td>Kocic, V. L.</td>
<td>184</td>
</tr>
<tr>
<td>Koker, J. R.</td>
<td>803</td>
</tr>
<tr>
<td>Kopell, N. J.</td>
<td>281</td>
</tr>
<tr>
<td>Korchagin, A. B.</td>
<td>574</td>
</tr>
<tr>
<td>Korenblum, B.</td>
<td>969</td>
</tr>
<tr>
<td>Kortoff, M. S.</td>
<td>76</td>
</tr>
<tr>
<td>Kosygina, E.</td>
<td>999</td>
</tr>
<tr>
<td>Kozlov, D. N.</td>
<td>165</td>
</tr>
<tr>
<td>Kremer, D. J.</td>
<td>935</td>
</tr>
<tr>
<td>Kremerski, R.</td>
<td>64</td>
</tr>
<tr>
<td>Kremerski, R.</td>
<td>198</td>
</tr>
<tr>
<td>Kreyzig, E.</td>
<td>1000</td>
</tr>
<tr>
<td>Kski, A. E.</td>
<td>1000</td>
</tr>
<tr>
<td>Kuchenbrod, J. A.</td>
<td>940</td>
</tr>
<tr>
<td>Kubendorf, T.</td>
<td>78</td>
</tr>
<tr>
<td>Kuhlmann, F. V.</td>
<td>142</td>
</tr>
<tr>
<td>Kuhlmann, F. V.</td>
<td>519</td>
</tr>
<tr>
<td>Kuhlmann, S.</td>
<td>64</td>
</tr>
<tr>
<td>Kulenovic, M. R.</td>
<td>83</td>
</tr>
<tr>
<td>Kulman, D. E.</td>
<td>861</td>
</tr>
<tr>
<td>Kundgen, A.</td>
<td>937</td>
</tr>
<tr>
<td>Kuperberg, K. M.</td>
<td>431</td>
</tr>
<tr>
<td>Kuzmicki, C. C.</td>
<td>838</td>
</tr>
<tr>
<td>Lamp, J. F. Jr.</td>
<td>653</td>
</tr>
<tr>
<td>Lamp, C. G.</td>
<td>640</td>
</tr>
<tr>
<td>Larmor, C. G.</td>
<td>775</td>
</tr>
<tr>
<td>Lenti, M. L.</td>
<td>164</td>
</tr>
<tr>
<td>Lapidus, M. L.</td>
<td>164</td>
</tr>
<tr>
<td>Leung, N. C.</td>
<td>193</td>
</tr>
<tr>
<td>Leuschke, G. J.</td>
<td>703</td>
</tr>
<tr>
<td>Levin, J.</td>
<td>530</td>
</tr>
<tr>
<td>Levin, J.</td>
<td>982</td>
</tr>
<tr>
<td>Lewis, A. C.</td>
<td>664</td>
</tr>
<tr>
<td>Lewis, J. H.</td>
<td>757</td>
</tr>
<tr>
<td>Lesser, L. M.</td>
<td>296</td>
</tr>
<tr>
<td>Lesser, L. M.</td>
<td>1072</td>
</tr>
<tr>
<td>Lesser, S. J.</td>
<td>1072</td>
</tr>
<tr>
<td>Lewis, W.</td>
<td>1015</td>
</tr>
<tr>
<td>Li, M. Y.</td>
<td>585</td>
</tr>
<tr>
<td>Li, T. J.</td>
<td>45</td>
</tr>
<tr>
<td>Li, J. X.</td>
<td>15</td>
</tr>
<tr>
<td>Lib, C. A.</td>
<td>239</td>
</tr>
<tr>
<td>Lightboume, J. H.</td>
<td>651</td>
</tr>
<tr>
<td>Lipkin, L. J.</td>
<td>302</td>
</tr>
<tr>
<td>Lipschitz, S.</td>
<td>241</td>
</tr>
<tr>
<td>Lipschitz, S.</td>
<td>126</td>
</tr>
<tr>
<td>Lipschitz-Yevick, M. A.</td>
<td>472</td>
</tr>
<tr>
<td>Lipsman, R.</td>
<td>309</td>
</tr>
<tr>
<td>Lipshitz, Y.</td>
<td>130</td>
</tr>
<tr>
<td>Lipshitz, Y.</td>
<td>422</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
<tr>
<td>Lithusk, J. L.</td>
<td>363</td>
</tr>
</tbody>
</table>
Hyperbolic Equations and Frequency Interactions
Luis Caffarelli and Weinan E., Courant Institute, New York University, NY, Editors

The research focus for this IAS/PCMI Summer Session was nonlinear wave phenomena. Mathematicians from the more theoretical areas of PDEs were brought together with those involved in applications. The goal was to share ideas, knowledge, and perspectives.

How waves, or “frequencies”, interact in nonlinear phenomena has been a central issue in many of the recent developments in pure and applied analysis. It is believed that wavelet theory—with its simultaneous localization in both physical and frequency space—and its successful use in a wide variety of applications—will be a fundamental new tool in the treatment of the phenomena.

Included in this volume are write-ups of the general methods and tools’ courses held by Jeff Rauch and Ingrid Daubechies. Rauch’s article discusses geometric optics as an asymptotic limit of high-frequency phenomena. He shows how nonlinear effects are reflected in the asymptotic theory. In the article “Harmonic Analysis, Wavelets and Applications” by Daubechies and Gilbert the main structure of the wavelet theory is presented.

Also included are articles on the more “specialized” courses that were presented, such as “Nonlinear Schrödinger Equations” by Jean Bourgain and “Waves and Transport” by George Papanicolaou and Leonid Ryzhik. Susan Friedlander provides a written version of her lecture series “Stability and Instability of an Ideal Fluid”, given at the Mentoring Program for Women in Mathematics, a preliminary program to the Summer Session.

This Summer Session brought together students, fellows, and established mathematicians from all over the globe to share ideas in a vibrant and exciting atmosphere. This book presents the compelling results.

Geometric Control and Non-holonomic Mechanics
V. Jurdjevic and R.W. Sharpe, University of Toronto, ON, Canada, Editors
Control theory, a synthesis of geometric theory of differential equations enriched with variational principles and the associated symplectic geometry, emerges as a new mathematical subject of interest to engineers, mathematicians, and physicists. This collection of articles focuses on several distinctive research directions having origins in mechanics and differential geometry, but driven by control theory.

The first of these directions deals with the singularities of small balls for problems of sub-Riemannian geometry and provides a geometric classification of singularities for two-dimensional distributions of contact type in a three-dimensional ambient space.

The second direction deals with invariant optimal problems on Lie groups exemplified through the problem of Dubins extended to symmetric spaces, the elastic problem of Kirchhoff and its relation to the heavy top.

The results described in the book are explicit and demonstrate convincingly the power of geometric formalism.

The remaining directions deal with the geometric nature of feedback analyzed through the language of fiber bundles, and the connections of geometric control to non-holonomic problems in mechanics, as exemplified through the motions of a sphere on surfaces of revolution.

This book provides quick access to new research directions in geometric control theory. It also demonstrates the effectiveness of new insights and methods that control theory brings to mechanics and geometry.

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


Differential Equations with Applications to Biology
Shigu Ruan, Dalhousie University, Halifax, NS, Canada, Gail S. K. Wolkowicz, McMaster University, Hamilton, ON, Canada, and Jianhong Wu, York University, North York, ON, Canada, Editors

This book presents the proceedings from the International Conference held in Halifax, NS in July 1997. Funded by the Fields Institute and the Centre de Recherches Mathématiques, the conference was held in honor of the retirement of Professors Lynn Ede and Herb I. Freedman (University of Alberta). Featured topics include ordinary, partial, functional, and stochastic differential equations and their applications to biology, epidemiology, neurobiology, and other related fields.

The 41 papers included in this volume represent the recent work of leading researchers over a wide range of subjects, including bifurcation theory, chaos, stability theory, boundary value problems, persistence theory, neural networks, disease transmission, population dynamics, pattern formation, and more. The text would be suitable for a graduate or advanced undergraduate course study in mathematical biology.

Features:
• An overview of current developments in differential equations and mathematical biology
• Authoritative contributions from over 60 leading worldwide researchers.
• Original, refereed contributions.

Fields Institute Communications, Volume 21; 1999; 458 pages; Hardcover; ISBN 0-8218-2146-X; List $129; Individual member $77; Order code FIC/21A

All prices subject to change. Charges for delivery are $3.00 per order. For optional air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P.O. Box 6248, Providence, RI 02940-6248, USA. For credit card orders, call toll-free 1-800-321-4AMS (4AMS) in the U.S. and Canada (410) 455-4000 worldwide. Or place your order through the AMS bookstore at http://www.ams.org/bookstore. Residents of Canada, please include 7% GST.
Program of the Sessions
San Antonio, Texas, January 13–16, 1999

Monday, January 11
AMS Short Course on Nonlinear Control
9:00 AM – 5:00 PM
Organizers: Héctor J. Sussmann, Rutgers University
Kevin Grasse, University of Oklahoma

MAA Short Course on Mathematics in Finance
9:00 AM – 5:00 PM
Organizer: Robert F. Almgren, University of Chicago

Tuesday, January 12
MAA Board of Governors
8:30 AM – 4:00 PM

AMS Short Course on Nonlinear Control
9:00 AM – 5:00 PM
Organizers: Héctor J. Sussmann, Rutgers University
Kevin Grasse, University of Oklahoma

MAA Short Course on Mathematics in Finance
9:00 AM – 5:00 PM
Organizer: Robert F. Almgren, University of Chicago

AMS Council
1:00 PM – 10:00 PM

Joint Meetings Registration
3:00 PM – 7:00 PM

The time limit for each AMS contributed paper in the sessions is ten minutes. The time limit for each MAA contributed paper varies. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced. For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (△) have been designated by the author as being of possible interest to undergraduate students.

Abstracts of papers presented in the sessions at this meeting will be found in Volume 20, Issue 1 of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings.
AMS-ASL Special Session on Model Theory and Its Applications, I

8:00 AM - 10:55 AM

Organizer: Anand Pillay, MSRI and University of Illinois, Urbana

8:00 AM Smooth stratification in the Pfaffian closure of an o-minimal structure.
Jean-Maire Lion, Universites de Bourgogne, and Patrick U. Speissegger*, University of Toronto (939-14-587)

8:30 AM Complexity of the complement of a sub-Pfaffian set. Preliminary report.
Andrei Gabrielov, Purdue University (939-03-359)

9:00 AM Hardy fields of arbitrary models of polynomially bounded plus exp.
Salma Kuhlmann* and Franz-Viktor Kuhlmann, University of Saskatchewan at Saskatoon (939-03-477)

9:30 AM A remark on linear differential operators over the differential field of logarithmic-exponential series.
Lou Van den Dries, University of Illinois, Urbana, Illinois (939-13-533)

10:00 AM Weakly o-minimal structures: A brief survey.
Charles I. Steinhorn, Vassar College (939-03-905)

10:30 AM "Complex Analysis" over o-minimal fields. Preliminary report.
Sergei Starchenko, University of Notre Dame (939-03-737)

AMS Special Session on Banach Spaces of Holomorphic Functions and Operators on These Spaces, I

8:00 AM - 10:50 AM

Organizers: Benjamin A. Lotto, Vassar College
Pamela B. Gorkin, Bucknell University

8:00 AM Curves in C^2. Preliminary report.
John Wermer, Brown University (939-32-25)

8:30 AM Pure subnormal operators have cyclic adjoints.
Nathan S. Feldman, Michigan State University (939-47-151)

9:00 AM Operators determining the norm topology.
Krzysztof Jarosz, Southern Illinois University at Edwardsville (939-46-157)

9:30 AM Banach spaces of Fourier series.
Scott F. Sascoine, University of Missouri-Columbia (939-46-801)

10:00 AM Function theory on model spaces. Preliminary report.
Tavan T. Trent, University of Alabama (939-47-173)

10:30 AM Interpolation bodies for a finite Riemann surface. Preliminary report.
Brian J. Cole, Brown University (939-30-218)

AMS Special Session on Commutative Algebra, I

8:00 AM - 10:50 AM

Organizer: Scott Thomas Chapman, Trinity University

8:00 AM Mori domains of integer-valued polynomials.
Paul-Jean Cahen, Universite d'Aix Marseille Ill, Stefania Gabeli, Univ. di Roma I, and Evan Houston*, Univ. of North Carolina at Charlotte (939-13-322)

8:30 AM Polynomially bounded plus exp.
Paul-Jean Cahen, Universite d'Aix Marseille Ill, Alan Loper*, Ohio State University - Newark, and Francesca Tantarone, Universita La Sapienza (939-13-487)

9:00 AM Interpolation domains.
Paul-Jean Cahen, Univ. d'Aix Marseille Ill, France, Jean-Luc Chabert, Univ. de Picardie, France, and Sophie Frisch, Technische Universitaet Graz, Austria (939-13-532)

9:30 AM Interpolation subsets. Preliminary report.
Paul-Jean Cahen*, Universite d'Aix Marseille Ill, Jean-Luc Chabert, Universite de Picardie, and Sophie Frisch, Graz Technical University (939-13-463)

10:00 AM Integer-valued polynomials on a subset and Prüfer domains.
Jean-Luc Chabert*, Universite de Picardie, and Alan Loper, Ohio State University (939-13-367)

10:30 AM Nagata transform and localizing systems. Preliminary report.
Marco Fontana*, Universita degli Studi, Rome III, and Nicolae Popescu, Academie de Roumanie (939-13-687)

AMS Special Session on Combinatorial Topology, I

8:00 AM - 10:50 AM

Organizers: Laura M. Anderson, Texas A&M University
Jonathan P. McCammond, Texas A&M University

8:00 AM Which Artin groups are 3-manifold groups?
Susan M. Hermiller, University of Nebraska, and John Meier*, Lafayette College (939-20-593)

8:30 AM Automorphisms of automorphism groups of free groups. Preliminary report.

9:00 AM Eigenvalues of combinatorial Laplacians. Preliminary report.
Art Duval*, University of Texas at El Paso, and Victor Reiner, University of Minnesota (939-05-784)

9:30 AM Fundamental groups of blow-ups of Coxeter arrangements. Preliminary report.
Tadeusz Januszewicz, University of Wrocław, and Richard Scott*, Santa Clara University (939-57-881)

10:00 AM Rigidity of right-angled Coxeter groups.
David G. Radcliffe, University of Wisconsin-Milwaukee (939-20-58)

10:30 AM Topological invariants of deduction in algebra.
Nikolai E. Mnev, POMI, St.Petersburg (939-18-824)

AMS Special Session on The Functional and Harmonic Analysis of Wavelets, I

8:00 AM - 10:50 AM

Organizers: Lawrence W. Baggett, University of Colorado
David R. Larson, Texas A&M University
8:00AM A mathematical framework for tensor image processing.
(31)
Akrum Aldroubi*, Vanderbilt University, and Peter Bassler, National Institutes of Health (939-46-54)
(32)
Radu V. Balan, IMAG-IBM (939-42-401)
9:00AM Single orthonormal wavelets in d-dimensions. Preliminary report.
(33)
John J. Benedetto* and Manuel Leon, University of Maryland at College Park (939-42-191)
9:30AM The classification of tight Weyl-Heisenberg frames.
(34)
Peter G. Casazza*, University of Missouri, and Ole Christensen, Mathematical Institute, Technical University of Denmark (939-46-115)
10:00AM Construction of dilation-d wavelets.
(35)
Jennifer E. Courter, University of Colorado (939-43-867)
10:30AM Quantization of redundant expansions: the special case of oversampled bandlimited functions.
(36)
Ingrid Daubechies, Princeton University (939-42-529)

AMS Special Session on Discrete Models and Difference Equations, I

AMS Special Session on Recent Developments in Differential Geometry, I

AMS Special Session on Singularities in Algebraic and Analytic Geometry, I

8:00AM - 10:50 AM
Organizers: Saber Elaydi, Trinity University
Gerry Ladas, University of Rhode Island
8:00AM Stochastic and determinstic discrete age-structured models. Preliminary report.
(37)
Linda J. S. Allen* and Garry L. Block, Texas Tech University (939-39-723)
8:30AM Lyapunov functions for discrete population models. Preliminary report.
(38)
J. M. Cushing, University of Arizona (939-92-658)
9:00AM Multiple attractors and resonance in periodically-forced discrete models.
(39)
Shandelle M. Henson, University of Arizona (939-39-794)
9:30AM Extinction, weak extinction, and persistence in a discrete, competitive Lotka-Volterra model. Preliminary report.
(40)
David M. Chan* and John E. Franke, North Carolina State University (939-92-122)
10:00AM Competition and predation in size-structured discrete models. Preliminary report.
(41)
Abdul-Aziz Yakubu, Howard University (939-39-109)
10:30AM Discrete models of Lotka-Volterra type. Preliminary report.
(42)
Saber N. Elaydi*, Trinity University, and Pingzhou Liu, Flinders University (939-39-585)

8:00AM - 10:50 AM
Organizers: Huai-Dong Cao, Texas A&M University
Jian Zhou, Texas A&M University
8:00AM Triunduloids: embedded constant mean-curvature surfaces with three ends.
(43)
John M. Sullivan*, Univ. of Illinois, Rob Kusner, Univ. of Massachusetts, and Karsten Grosse-Brauckmann, Uni. Bonn (939-53-400)
8:30AM Non-commutative Gelfand-Fuks cohomology and foliations. Preliminary report.
(44)
Jerry M. Lodder, New Mexico State University (939-57-685)
9:00AM Symplectic 4-manifolds with torsion canonical class. Preliminary report.
(45)
Tian-Jun Li*, Yale University, and AI-Ko Liu, MIT (939-57-812)
9:30AM Complex ASD connections and threholomorphic curves. Preliminary report.
(46)
Jingyi Chen, UBC and MIT (939-53-835)
10:00AM Singular Lagrangian fibrations. Preliminary report.
(47)
Nai-Chung Conan Leung, University of Minnesota, and Margaret F. Symington*, University of Texas (939-53-954)
10:30AM Special Lagrangian tori on a Borcea-Voisin threefold.
(48)
Peng Lu, University of Minnesota (939-58-1201)

8:00 AM - 10:40 AM
Organizers: Caroline Grant Melles, U.S. Naval Academy
Ruth I. Michler, University of North Texas
8:00AM Isolated hypersurface singularities with "large" torsion module of differentials. Preliminary report.
(49)
Ruth I. Michler, University of North Texas (939-14-1169)
8:30AM Berger's conjecture: A problem in which algebraic geometry, commutative algebra, and Hochschuld homology meet. Preliminary report.
(50)
Sue Geller, Texas A&M University (939-13-763)
9:00AM Weighted Chern-Mather classes and Milnor classes. Preliminary report.
(51)
Paolo Aluffi, Florida State University (939-14-715)
9:30AM Graph manifolds for algebraic plane curves. Preliminary report.
(52)
Eriko Hironaka, Florida State University (939-14-747)
10:00AM Cohomology of the link of a surface singularity in positive characteristic.
(53)
Aise J. de Jong, MIT (939-14-1037)

8:00 AM - 10:00 AM
Mathematics, calculus, and modeling using the TI-92.
Organizers: Phoebe T. Judson, Trinity University
William C. Bauldry, Appalachian State University
Richard D. West, U. S. Military Academy

8:00 AM - 10:00 AM
Developing materials for liberal arts mathematics that use elementary graph theory and emphasize applications to everyday experience.
Organizer: Helen Christensen, Loyola University

8:00 AM - 10:00 AM
The mathematics of the perfect shuffle.
Organizer: S. Brent Morris, National Security Agency
### AMS Session on the History of Mathematics

**8:00AM - 8:55AM**

8:00AM  | Dynamic visualizations of historical arguments using the geometers' sketchpad. Preliminary report.<br>--- Martin E. Flashman, Humboldt State University (939-01-43)
8:15AM  | Famous trails to Paul Erdős: Distances in the collaboration graph are small.<br>--- Jerrold W. Grossman\(^*\), Oakland University, and Rodrigo De Castro, Universidad Nacional de Colombia (939-01-584)
8:30AM  | Hardy and Ramanujan. Preliminary report.<br>--- Baikunth P. Ambasht, Benedict College, and Sanjay Tiwari, Gaya, India (999-01-759)
8:45AM  | Pi expressed in terms of nested radicals of 2.<br>--- Kanagarajah Prabaharan, Southern University, Baton Rouge (939-00-1012)

### AMS Session on Number Theory, I

**8:00AM - 10:40 AM**

8:00AM  | On the extensions of Eratosthenes' sieve.<br>--- (58) Preliminary report.<br>--- Bao Qi Feng\(^*\), Kent State University, and Dong Ning Zhao, Arlington, VA (939-11-34)
8:15AM  | A problem of continued fractions on Hausdorff dimension.<br>--- (59) Shi-jenn Tseng\(^*\), TamKang University, and Jyh-Ching Liang, LeeMing Institute of Technology (939-11-188)
8:30AM  | An extension of Brauer and Shockley's algorithm to solve the problem of Frobenius. Preliminary report.<br>--- Robert W. Owens, Lewis and Clark College (939-11-190)
8:45AM  | Reciprocity equivalence and Witt equivalence.<br>--- (61) Preliminary report.<br>--- Thomas C. Palfrey, Xavier University of LA (939-11-310)
9:00AM  | Theta functions of quadratic forms.<br>--- (62) Preliminary report.<br>--- Olof K. Richter, University of California, San Diego (939-11-455)
9:15AM  | Targeted searches for number fields with prescribed ramification.<br>--- (63) John W. Jones\(^*\), Arizona State University, and David P Roberts, Rutgers University (939-11-488)
9:30AM  | High-accuracy numerical estimations of Stieltjes constants and multiple zeta (Euler/Zagier) sums.<br>--- (64) Preliminary report.<br>--- Rick Kremerski, Texas A&M University - Commerce (939-11-536)
9:45AM  | On the mean value of an analogue of the Dedekind sum. Preliminary report.<br>--- (65) Jeffrey L. Meyer, Syracuse University (939-11-604)
10:00AM | Generalized Kloosterman sums over the ring of integers modulo 2<sup>*</sup>.<br>--- (66) Michelle R. DeDeo, Univ. of North Florida (939-11-621)
10:15AM | Jacobi forms over number fields.<br>--- (67) Howard J. Skogman, UCSD (939-11-639)
10:30AM | On the nonasymptotic prime number distribution.<br>--- (68) Libomir Alexandrov, Institute for Nuclear Research and Nuclear Energy (939-11-83)

### AMS Session on Numerical Analysis

**8:00AM - 10:10 AM**

8:00AM  | The method of scaling factors for non-uniform fast Fourier transforms.<br>--- (69) Nhu To N. Nguyen\(^*\), UTEP, and Qing Huo Q. H. Liu, NMSU (939-65-149)
8:15AM  | A new concurrent iterative method in solving symmetric Tridiagonal Eigenvalue Problems. Preliminary report.<br>--- Qingchuan Yao, University of Pittsburgh at Bradford (939-65-180)
8:30AM  | A Josephson junction in the high kappa, high field setting.<br>--- Qiang Du, Hong Kong Univ. of Science and Technology, and Jean Remski\(^*\), University of Michigan-Dearborn (939-65-189)
8:45AM  | Future polynomial regularization of one-smoothing ill-posed Volterra problems. Preliminary report.<br>--- Aaron C. Cinzori\(^*\), Allegheny College, and Patricia K. Lamm, Michigan State University (939-65-619)
9:00AM  | The numerical solution of mechanical systems using outer inverses. Preliminary report.<br>--- Dan L. Coroian, Indiana-Purdue University at Fort Wayne (939-65-647)
9:15AM  | An efficient high order algorithms for solving reaction-diffusion equations.<br>--- (74) Lilun Cao and Jianping Zhu\(^*\), Mississippi State University (939-65-696)
9:30AM  | Convergence properties of Heron recursive algorithm for roots. Preliminary report.<br>--- Constantine E. Georgakis, DePaul University (939-65-806)
9:45AM  | Particle modeling of liquid drop evaporation. Preliminary report.<br>--- Mark S. Korsle, Montclair State University (939-65-958)
10:00AM | A collocation method for solving the exterior Neumann problem.<br>--- Sandra Micula, Western Oregon University (939-65-965)

### MAA Session on The Use of Technology in Teaching Abstract Mathematics, I

**8:00AM - 9:55 AM**

8:00AM  | Using Mathematica to explore abstract algebra.<br>--- (78) Preliminary report.<br>--- Allen C. Hibbard, Central College (939-A1-531)
8:15AM  | Using Mathematica to explore finite semirings.<br>--- (79) Francisco E. Alarcon, IUP (939-A1-764)
8:30AM  | Teaching group theory using “Geometry SketchPad” and “Mathematica”. Preliminary report.<br>--- May C. Abboud, Lebanese American University (939-A1-677)
8:45AM  | Web-based linear algebra modules for use with Maple or Mathematica. Preliminary report.<br>--- Stephanie A. Fitchett\(^*\), Lawrence C. Moore and David A. Smith, Duke University (939-A1-1035)
9:00AM  | Visualizing concepts in a complex variables course.<br>--- (81) Paul E. Fishback, Grand Valley State University (939-A1-1091)
9:15AM  | Programming projects with Mathematica.<br>--- (83) Kevin F. McDougall, University of Wisconsin-Oshkosh (939-A1-1041)
Program of the Sessions - San Antonio, TX, Wednesday, January 13 (cont’d.)

9:30AM Cryptography, number theory, and Maple in the classroom. Preliminary report.

   Robert S. Smith, Miami University (939-A1-892)

MAA Session on Quantitative Literacy, I

8:00 AM - 10:10 AM

Organizers: Barbara A. Jur, Macomb Community College
Richard A. Gillman, Valparaiso University
Jimmy L. Solomon, Georgia Southern University
Allen E. Pulsin, College of Science and Technology
Linda R. Sons, Northern Illinois University

8:00AM The quantitative reasoning program at DePauw University: Nearly twenty years of experience.
   Janet E. Teegarden, DePauw University (939-B1-1219)

8:15AM Piloting a quantitative literacy course at a liberal arts institution: Pedagogical issues, interesting projects, and assessment criteria.
   Thomas G. Wangler, Benedictine University (939-B1-1228)

8:30AM Incorporating QL widely into the curriculum.
   Barry Schiller, Idaho College (939-B1-387)

8:45AM A precalculus quantitative reasoning course for liberal arts students.
   William L. Briggs*, University of Colorado, and Jeffrey O. Bennett, University of Colorado at Boulder (939-B1-418)

9:00AM Helping students take responsibility for their learning. Preliminary report.
   Todd M. Swanson, Hope College (939-B1-998)

   Shandy Hauk, Chapman University (939-B1-410)

9:30AM Precalculus: Labs and literacy. Preliminary report.
   Kate G. McGinley* and Deborah Hughes Hallett, University of Arizona (939-B1-278)

9:45AM An award-winning quantitative literacy course.
   James R. Smith* and Holly Peters Hirst, Appalachian State University (939-B1-1219)

10:00AM Connecting science and mathematics general education courses – one approach to quantitative literacy. Preliminary report.
   Janet L. Andersen, Hope College (939-B1-531)

MAA Session on Teaching Statistics: Teaching the Reasoning and New Technological Tools, I

8:00 AM - 10:55 AM

Organizers: Dexter C. Whittinghill, Rowan University
Franklin A. Wattenberg, National Science Foundation
Mary R. Parker, Austin Community College
Donald L. Bentley, Pomona College

8:00AM Introduction by Dexter C. Whittinghill.

8:05AM Computer power for your statistics calculator.
   Bill Johnston, Centre College (939-C1-210)

8:25AM Making connections in elementary statistics.
   Tena Long Golding, Southeast Louisiana University (939-C1-862)

8:40AM Integrating the TI-83 into an introductory statistics course.
   Emmett C. Dennis, Dillard University (939-C1-535)

8:55AM Modeling binomial and multinomial experiments using virtual coins and virtual dice on the TI-83 calculator. Preliminary report.
   Gerald Busald, San Antonio College (939-C1-563)

9:25AM Testing of hypothesis on population mean and proportion using TI-83 calculator.
   Sivanandan Balakumar, Lincoln University (939-C1-497)

9:35AM Understanding type I and type II errors.
   Penelope H. Dunham, Muhlenberg College (939-C1-600)

9:55AM Use data in stock market to do a project in linear regression on TI-82. Preliminary report.
   Wenyao Zhang, Union County College (939-C1-354)

10:00AM Tuneful residuals from Opus CBL.
   Judy S. O’Neal, North Georgia College & State University (939-C1-992)

   Patricia B. Humphrey, Georgia Southern University (939-C1-491)

   Linda Brant Collins* and Kathleen Cage Mittag, University of Texas at San Antonio (939-C1-506)

MAA Session on Mathematics Competitions, I

8:00 AM - 10:35 AM

Organizers: Harold B. Reiter, University of North Carolina at Charlotte
Stephen B. Maurer, Swarthmore College
William P. Fox, U.S. Military Academy
Susan Schwartz Wildstrom, Walt Whitman High School, Bethesda, MD

8:00AM Conducting a MATHCOUNTS coaching workshop.
   Roy Barnes, Arkansas Department of Education, Ralph S. Butcher*, Jo Ann Royster and Xiaoshen Wang, University of Central Arkansas (939-D1-485)

8:20AM The U.S.A. mathematical talent search.
   Gene A. Berg, National Security Agency (939-D1-100)

8:40AM The Michigan Mathematics Competition (MMPC).
   Ruth G. Favro, Lawrence Technological University (939-D1-973)

9:00AM The Little Hawkeye Mathematics Contest.
   Alexander F. Kleiner, Drake University (939-D1-358)

9:20AM Texas UIL Mathematics Contest.
   Donald P. Skow, University of Texas-Pan American (939-D1-959)

9:40AM Math Tournaments – hosts’ and competitors’ views.
   Brenda S. Carter and David R. Stone*, Georgia Southern University (939-D1-877)

10:00AM Alfred University’s High School Competition.
   Roger H. Moritz and Robert C. Williams*, Alfred University (939-D1-423)

10:20AM The Bay Area Mathematical Olympiad and Math Circles Project. Preliminary report.
   Paul A. Zeitz, University of San Francisco (939-D1-717)
MAA Committee on the Profession Panel Discussion
8:00 AM - 9:20 AM
A dean's view of mathematics departments.
Moderator: Bernard L. Madison
Organizers: Bernard L. Madison, University of Arkansas
David J. Lutzer, College of William & Mary
Panelists: Sheryl Smith-Kappus, Collin County Community College District, McKinney, TX
Mary Ann Rankin, University of Texas at Austin
Jane L. Winer, Texas Tech University

MAA Special Presentation
8:00 AM - 10:55 AM
The use of history in the teaching of mathematics.
Organizers: Florence Fasanelli, College-University Resource Institute
V. Frederick Rickey, U. S. Military Academy
Presenters: Robin Wilson, The Open University
Ed Sandifer, Western Connecticut State University
V. Frederick Rickey
Victor J. Katz, University of the District of Columbia
Shirley B. Gray, California State University Los Angeles

AMS Special Session on Development of Electronic Communications in Mathematics, I
8:30 AM - 10:50 AM
Organizers: Alfonso Castro, University of Texas at San Antonio
Rafael De La Llave, University of Texas at Austin
8:30 AM - (113)
Competition and cooperation: Libraries and publishers in the transition to electronic scholarly journals. Preliminary report.
Andrew Odlyzko, AT&T Labs - Research (939-00-676)
9:00 AM - (114)
Electronic journal publishing at SIAM.
James M. Crowley, Society for Industrial and Applied Mathematics (939-99-701)
9:30 AM - (115)
To the new era of electronic communication with ERA-AMS.
Svetlana Katok, The Pennsylvania State University (939-99-542)
10:00 AM - (116)
Henry A. Warchall, University of North Texas (939-00-203)
10:30 AM - (117)
Electronic delivery and publishing of conference abstracts.
Elliott Pearl*, Ohio University, John Schommer, University of Tennessee at Martin, Dimitri Shakhmatov, Ehime University, and Stephen Watson, York University (939-00-1183)

AMS Special Session on Hamiltonian Mechanics: Applications to Celestial Mechanics and Chemistry, I
8:30 AM - 10:50 AM
Organizers: Michael K. Rudnev, The University of Texas at Austin
Stephen R. Wiggins, California Institute of Technology
8:30 AM - (118)
Bifurcation and cantorus analysis of quantizing structures in molecular spectra.
Michael E. Kellman, University of Oregon (939-70-1147)
9:00 AM - (119)
Two examples of the appearance of complex trajectories in semi-classical estimates. Preliminary report.
Alejandro Uribe, University of Michigan (939-81-1168)
9:30 AM - (120)
A global analysis of the bifurcations of periodic orbits with the Hénon map as an example.
Charles Jaffe*, West Virginia University, and Masa Tsuchiya, Cornell University (939-70-1162)
10:00 AM - (121)
Periodic orbit analysis of quantum spectra of atoms and molecules.
Gregory S. Ezra, Cornell University (939-81-266)
10:30 AM - (122)
Two conjectures of G. D. Birkhoff.
Kenneth R. Meyer, University of Cincinnati (939-34-385)

AMS Special Session on Mathematics Education and Mistaken Philosophies of Mathematics, I
9:00 AM - 10:50 AM
Organizers: Saunders Mac Lane, University of Chicago
Richard A. Askey, University of Wisconsin-Madison
9:00 AM - (123)
Mathematics as illustrated in textbooks. Preliminary report.
Richard Askey, Univ. of Wisconsin-Madison (939-97-721)
9:30 AM - (124)
What is (school) mathematics, really? Preliminary report.
Anthony D. Gardiner, University of Birmingham (939-97-879)
10:00 AM - (125)
Some contradictions of education reform.
Owen Thomas, Columbus, OH (939-98-896)
10:30 AM - (126)
Mistaken philosophies in teaching linear algebra.
Seymour Lipschutz, Temple University (939-98-111)

MAA Special Event
9:30 AM - 10:55 AM
Presentation for chairs of mathematics departments in comprehensive universities, four-year liberal arts and two-year colleges.
Organizer: Gerald L. Alexanderson, Santa Clara University
Presenters: Saeed Ghahramani, Towson University
Catherine M. Murphy, Purdue University Calumet
A. Wayne Roberts, Macalester College
AMS Invited Address

10:05 AM - 10:55 AM

Chia-Lian Terng, Northeastern University
(939-83-548)

AMS-MAA Invited Address

11:10 AM - NOON

(128) Phase transitions in probability theory and computer science.
Jennifer T. Chayes, Microsoft Research
(939-82-956)

Books Sales and Exhibits

NOON - 5:00 PM

AMS Colloquium Lectures: Lecture I

1:00 PM - 2:00 PM

(129) Symplectic geometry from a dynamical systems point of view. I.
Helmut H. Hofer, Courant Institute (939-58-494)

MAA Invited Address

2:15 PM - 3:05 PM

(130) Extending and generalizing the Pascal Triangle: An interplay of algebra and geometry.
Jean Pedersen, Santa Clara University (939-05-09)

AMS-MAA-MER Special Session on Mathematics and Education Reform, II

2:15 PM - 6:05 PM

Organizers: William H. Barker, Bowdoin College
Jerry L. Bona, University of Texas at Austin
Naomi Fisher, University of Illinois at Chicago
Kenneth C. Millet, University of California Santa Barbara

2:15 PM

(131) Changes in methods for examining gender bias.
Jere Confrey*, University of Texas at Austin, and Catherine Good, The University of Texas at Austin (939-98-1015)

2:45 PM

(132) Why the caged bird sings: Some challenges and opportunities in the life of a mathematician.
Carolyn R. Mahoney, CSU San Marcos (939-98-865)

3:15 PM

(133) The REACH program: A summer program in mathematics and computer science for academically talented students.
Vernise Y. Steadman, University of the District of Columbia (939-97-1006)

3:45 PM

(134) The crisis in urban public school mathematics: What should college mathematics departments do?
Robert W. Case, Northeastern University (939-97-1080)

4:15 PM

Joaquin Bustoz*, Millie M. Trotter, Erica R. Gonzalez, Arizona State University, Kristie Harris, South Mountain High School, and Jennifer Tom, Humanities and Sciences Institute (939-97-722)

4:45 PM

Creating successful outcomes in the teaching and learning of mathematics and statistics for high school teachers and students from the inner-city of Detroit: Beating the odds.
Martha B. Alliga, The University of Michigan (939-97-803)

5:15 PM

Enlarging the pool of black mathematics Ph.D.s.
(137) What we are learning at the University of Maryland.
Duane A. Cooper, University of Maryland (939-98-163)

5:45 PM

Vitality of some very old ideas.
(138) Arnold E. Ross, Ohio State University, and Glenn Stevens*, Boston University (939-97-850)

AMS-ASL Special Session on Model Theory and Its Applications, II

2:15 PM - 5:40 PM

Organizer: Anand Pillay, MSRI and University of Illinois, Urbana

2:15 PM

(139) Implicit function theorems on a free group and Tarski's problems. Preliminary report.
Olga Kharlampovich, McGill University, Montreal, Canada (939-20-777)

2:45 PM

C. Ward Henson, Univ. of Illinois (939-03-413)

3:15 PM

(141) Pure-global dimensions of modules and their model-theoretic content.
Philipp S. Rothmaler, University of Illinois (939-03-655)

3:45 PM

Break.

4:15 PM

(142) Local uniformization and the model theory of valued fields in positive characteristic.
Franz-Viktor Kuhlmann, University of Saskatchewan at Saskatoon (939-03-440)

4:45 PM

(143) A new proof to the new intersection theorem.
Hans Schoutens, Wesleyan University (939-03-434)

5:15 PM

(144) Elimination of imaginaries in algebraically closed valued fields. Preliminary report.
Deirdre Haskell*, College of the Holy Cross, Ehud Hrushovski, Hebrew University of Jerusalem, and H. D. Macpherson, University of Leeds (939-03-336)

AMS Special Session on Banach Spaces of Holomorphic Functions and Operators on These Spaces, II

2:15 PM - 6:05 PM

Organizers: Benjamin A. Lotto, Vassar College
Pamela B. Gorkin, Bucknell University

2:15 PM

(145) The Berezin transform on the Toeplitz algebra.
Sheldon Axler*, San Francisco State University, and Dechao Zheng, Vanderbilt University (939-47-206)

2:45 PM

(146) Toeplitz operators on Dirichlet-type spaces. Preliminary report.
Rick S. Chartrand, University of California, Berkeley (939-47-112)

3:15 PM

(147) Zero products of Toeplitz operators on the Bergman space. Preliminary report.
Patrick Ahern, University of Wisconsin-Madison, and Zeljko Cuckovic*, University of Toledo (939-47-133)

3:45 PM

(148) Compact Toeplitz operators on Bergman and Fock spaces.
Karel Stroethoff, University of Montana (939-47-208)

4:15 PM

Informal problem session.
AMS Special Session on Commutative Algebra, II

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker/Institution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:15 PM</td>
<td>Preliminary report.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:15 PM</td>
<td>Kronecker function rings and generalized integral closures.</td>
<td>Franz Halter-Koch, Karl-Franzens-Universität Graz</td>
<td>(152)</td>
</tr>
<tr>
<td>2:45 PM</td>
<td>Nagata's theorem for the class group, II.</td>
<td>Stefania Gabelli, University of Rome, &quot;La Sapienza&quot;</td>
<td>(153)</td>
</tr>
<tr>
<td>3:15 PM</td>
<td>On Mockor's question.</td>
<td>Byung Gun Kang* and Mi-Hee Park, Pohang Institute of Science and Technology</td>
<td>(154)</td>
</tr>
<tr>
<td>3:45 PM</td>
<td>Finite condition conductors in localizations of polynomial rings.</td>
<td>Sarah Glaz, The University of Connecticut</td>
<td>(155)</td>
</tr>
<tr>
<td>4:45 PM</td>
<td>The canonical module of a one-dimensional reduced local ring.</td>
<td>Marco D'Anna, Università di Catania</td>
<td>(157)</td>
</tr>
<tr>
<td>5:15 PM</td>
<td>Analytically unramified one-dimensional semilocal rings and their value semigroups.</td>
<td>Valentina Barucci*, Università di Roma 'La Sapienza', Marco D'Anna, Università di Catania, and Ralf Fröberg, Stockholm University</td>
<td>(158)</td>
</tr>
<tr>
<td>5:45 PM</td>
<td>Normal Hilbert functions of one-dimensional local rings.</td>
<td>Ralf Fröberg, Stockholm University</td>
<td>(159)</td>
</tr>
</tbody>
</table>

AMS Special Session on Combinatorial Topology, II

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker/Institution</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:15 PM</td>
<td>Preliminary report.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:15 PM</td>
<td>Morse theory and evasiveness.</td>
<td>Robin Forman, Rice University</td>
<td>(160)</td>
</tr>
<tr>
<td>2:45 PM</td>
<td>Combinatorics of topological posets.</td>
<td>Rade T. Živaljević, Mathematics Institute SANU</td>
<td>(161)</td>
</tr>
<tr>
<td>3:15 PM</td>
<td>Mod 2 cohomology of the combinatorial Grassmannians.</td>
<td>Laura Anderson, Texas A&amp;M University, and James F. Davis*</td>
<td>(162)</td>
</tr>
<tr>
<td>3:45 PM</td>
<td>Tame combings, quasi-geodesics, and almost convexity for groups.</td>
<td>Susan Hermiller, University of Nebraska Lincoln, and John Meier, Lafayette College</td>
<td>(163)</td>
</tr>
<tr>
<td>4:15 PM</td>
<td>The coherence and quasiconvexity of Coxeter groups.</td>
<td>Jonathan P. McCammond*, Texas A&amp;M University, and Daniel T. Wise, Cornell University</td>
<td>(164)</td>
</tr>
<tr>
<td>4:45 PM</td>
<td>On Betti numbers of quotients of order complexes of certain sublattices of a partition lattice by the action of the symmetric group.</td>
<td>Dmitry N. Kozlov, Institute for Advanced Study</td>
<td>(165)</td>
</tr>
</tbody>
</table>
AMS Special Session on Mathematics Education and Mistaken Philosophies of Mathematics, II

Program of the Sessions - San Antonio, TX, Wednesday, January 13 (cont'd.)

5:15PM Frames, bases and group representations.
   (177) Deguang Han*, McMaster University, and David R. Larson, Texas A&M University (939-46-1105)


AMS Special Session on Discrete Models and Difference Equations, II

2:15PM - 6:05PM
Organizers: Saber Elaydi, Trinity University
          Gerry Ladas, University of Rhode Island

2:15PM Effects of temporal heterogeneity in the Baumol-Wolff productivity growth model.
   Hassan Sedaghat, Virginia Commonwealth University (939-39-277)

2:45PM Properties of a certain Lyapunov equation.

3:15PM On the behavior of solutions of
   ▶ (181) x(n+1) = a + x(n-1) /x(n).
   E. A. Grove*, G. Ladas, A. M. Amleh, University of Rhode Island, and D. A. Georgiou, Democritus University of Thrace (939-39-242)

3:45PM Global stability of x(n+1) = 4 /x(n) + 1 /x(n-1).

4:15PM On the recursive sequence.
   ▶ (183) x(n+1) = (Ax(n) + Bx(n-1))/(Cx(n) + Dx(n-1)).
   ▶ (184) Global behavior of a nonlinear second order difference equation.
   ▶ (185) x(n+1) = max{1 /x(n), A[n] /x(n-1)}. Preliminary report.
   ▶ (186) Stability of solutions of systems of linear difference equations with almost periodic, near constant coefficients. Preliminary report.
   ▶ (187) Social constructivism as a philosophy of mathematics.
   ▶ (188) How can the constructivist critique be used to make introduction to real analysis more accessible. Preliminary report.
   ▶ (189) Between Platonism and constructivism: Is there a mathematics acquisition device? Preliminary report.
   Carl Winsløw, Royal Dan. School of Ed. St. (939-00-143)

AMS Special Session on Recent Developments in Differential Geometry, II

2:15PM - 5:45PM
Organizers: Huai-Dong Cao, Texas A&M University
          Jian Zhou, Texas A&M University

2:15PM Recent applications of global geometry to anomalies. Preliminary report.
   Daniel S. Freed, University of Texas at Austin (939-58-1022)

2:45PM On Quantum de Rham Theory.
   ▶ (190) Huai-Dong Cao* and Jian Zhou, Texas A&M University (939-53-869)

3:15PM Counting curves on K3 and Abelian surfaces.
   ▶ (191) Caltech (939-39-492)

3:45PM Counting curves on irrational surfaces.
   ▶ (192) Caltech (939-14-906)

4:15PM Counting curves on irrational surfaces.
   ▶ (193) Caltech (939-53-1040)

4:45PM Extremal Kahler metrics in conical surface.
   ▶ (194) XIUXIONG CHEN, Princeton University (939-58-922)

5:15PM Discussion.

AMS Special Session on Singularities in Algebraic and Analytic Geometry, II

2:15PM - 5:40PM
Organizers: Caroline Grant Melles, U.S. Naval Academy
          Ruth I. Michler, University of North Texas

2:15PM Canonical resolution of quasi-ordinary surface singularities. Preliminary report.
   Chunsheng Ban and Lee J. McEwan*, Ohio State University (939-14-44)

2:45PM Deforming Artin Gorenstein algebras, and singularities. Preliminary report.
   Anthony A. Iarrobino Jr., Northeastern University (939-13-945)

3:15PM Valuations and binomial ideals. Preliminary report.
   ▶ (196) Bernard H. Teissier, C.N.R.S. (939-14-859)

4:15PM Euler obstruction and indices of vector fields.
   ▶ (197) Preliminary report.
   ▶ (198) Michael K. Rudnev, The University of Texas at Austin
   ▶ (199) Stephen R. Wiggins, California Institute of Technology

5:15PM The weak subintegral closure of a monomial ideal.
   ▶ (200) Les Reid, Southwest Missouri University, and Marie A. Vitulli*, University of Oregon (939-13-762)

AMS Special Session on Hamiltonian Mechanics: Applications to Celestial Mechanics and Chemistry, II

2:15PM - 5:05PM
Organizers: Michael K. Rudnev, The University of Texas at Austin
          Stephen R. Wiggins, California Institute of Technology
2:15 PM-4:15 PM

Ergodic properties of particle systems. Preliminary report.
Marek R. Rychlik* and Maciej P. Wojtkowski, University of Arizona (939-70-1045)

2:45 PM-4:15 PM

Scar formation and the transition from order to chaos in the vibrations of molecular systems.
Florentino Borondo*, Francisco J. Arranz, Universidad Autonoma de Madrid, Spain, and Rosa M. Benito, Universidad Politecnica de Madrid, Spain (939-81-1010)

3:15 PM-5:15 PM

On non-twist Hamiltonian flows and symplectic maps of the plane.
Philip J. Morrison, The University of Texas at Austin (939-70-997)

Three-dimensional, volume-preserving flows and maps.
Igor Mezic, University of California, Santa Barbara (939-76-934)

4:15 PM-4:45 PM

Horseshoes near normally hyperbolic invariant manifolds. Preliminary report.
Richard B. Moeckel, University of Minnesota (939-70-886)

Double resonances in four dimensional symplectic maps. Preliminary report.
Arturo Olvera, IIMAS, UNAM (939-58-883)

MAA Minicourse #10: Part A

2:15 PM - 4:15 PM
Facilitating active learning: Concrete ways to foster student participation.
Organizer: Sandra L. Rhoades, Keene State College

MAA Minicourse #13: Part A

2:15 PM - 4:15 PM
Getting students involved in undergraduate research.
Organizers: Aparna W. Higgins, University of Dayton
Joseph A. Gallian, University of Minnesota-Duluth

MAA Minicourse #2: Part A

2:15 PM - 4:15 PM
Mathematical finance.
Organizer: Walter R. Stromquist, Berwyn, PA

MAA Minicourse #8: Part A

2:15 PM - 4:15 PM
Teaching a course in the history of mathematics.
Organizers: Victor J. Katz, University of the District of Columbia
V. Frederick Rickey, U. S. Military Academy

AMS Session on Complex Analysis

2:15 PM - 5:25 PM

On the factorizations of f(p). Preliminary report.
Chung-chun Yang, Hong Kong University of Science and Technology (939-30-96)

On a strengthened version of Julia’s Lemma.
Peter R. Mercer, SUNY College - Buffalo (939-30-164)

A quadratic approximation to the Sendov radius near the unit circle.
Michael J. Miller, Le Moyne College (939-30-172)

Traveling through parameter space for groups of Möbius transformations. Preliminary report.
David J. Pinchbeck, Saint Joseph’s College of Maine (939-30-347)

Discrete and continuous sampling in several variables.
Peter A. McCoy, U.S. Naval Academy (939-30-373)

Composition and pullbacks on families of Cauchy transforms.
Yusuf I. Abu Muanna, American University of Sharjah (939-30-546)

Mary R. Goodloe, University of Kentucky (939-30-634)

The Szegö kernel in triply connected domains. Preliminary report.
Thomas J. Tegtmeyer, Purdue University (939-30-770)

Approximation by rational functions. Preliminary report.
N. V. Rao, University of Toledo (939-30-792)
AMS Session on Number Theory, II

2:15PM - 4:55PM

2:15PM Sign codes from number fields. Preliminary report.
   Maura Murray, University of Massachusetts, Amherst (939-11-648)

2:30PM The universal Kummer congruences.
   David Adelberg, Grinnell College (939-11-752)

2:45PM Divisibility properties of numerators of sums of reciprocals.
   II. Preliminary report.
   Scott H. Hochwald, University of North Florida (939-11-793)

3:00PM On the residues of certain digital sums.
   Robert E. Kennedy* and Curtis N. Cooper, Central Missouri State University (939-11-848)

3:15PM An explicit expression for digital sum sums in base B expansions.
   Curtis N. Cooper* and Robert E. Kennedy, Central Missouri State University (939-11-849)

3:30PM Block product sequences. Preliminary report.
   Abigail Holt, University of Illinois at Urbana-Champaign (939-11-894)

3:45PM Renormalization and special values of certain triple product L-functions. Preliminary report.
   Jennifer E. Beineke, Trinity College (939-11-908)

4:00PM How many points are there on that CM elliptic curve? Preliminary report.
   Wendy L. Miller, UC San Diego (939-11-937)

4:15PM On determining class numbers of certain bi-quatric fields. Preliminary report.
   Michael W. Mastropietro, University of California, San Diego (939-11-962)

4:30PM Sums of powers of integers via inner products.
   Preliminary report.
   Carl A. Libis, AMS (939-11-1099)

4:45PM Bounds for the class numbers of cyclotomic function fields.
   Joseph J. Palen, Univ. of Michigan (939-11-1198)

MAA Session on Innovations in Teaching Abstract Algebra

2:15PM - 5:25PM

Organizers: Vesna Kilibarda, University of Alaska Southeast
Allen C. Hibbard, Central College
Ellen Maycock Parker, DePauw University

2:15PM Using Pascal’s triangle to visualize abstract algebra concepts. Preliminary report.
   Michael J. Bardzell*, Salisbury State University, and Kathleen M. Shannon, Salisbury State University (939-E1-300)

3:00PM Active learning in three classes. Preliminary report.
   Sarah-Marie Belcastro, University of North Iowa, Laurie J. Burton*, Central Washington University, and Moira A. McDermott, Gustavus Adolphus College (939-E1-654)

2:45PM Enhancing introductory group theory through symmetry: A collection of multimedia tutorials. Preliminary report.
   Darren D. Wick, Millsaps College (939-E1-1120)

2:45PM Subnormality conditions in non-torsion groups.
   Luisa-Giordano, SUNY at Binghamton, and Gunnar Traustason, University of Bath (939-20-194)

3:00PM On restricting representations of the symmetric group to certain embeddings. Preliminary report.
   Jagat K. Sheth, University of Oregon (939-20-220)

3:15PM Commutative nilsemigroups with zero cohomology.
   P. A. Girlet, Tulane University (939-20-471)

3:30PM Infinite metacyclic groups and their nonabelian tensor squares.
   James R. Beuerle* and Luisa-Giordano Kappe, SUNY at Binghamton (939-20-474)

3:45PM On some generalized characters of Thompson.
   Preliminary report.
   Stephen M. Gagola Jr.* and Mark L. Lewis, Kent State University (939-20-476)

4:00PM Conditions for which Fischer F-subgroups in finite solvable groups are F-Injectors.
   Preliminary report.
   Arnold D. Feldman, Franklin & Marshall College (939-20-636)

4:15PM A presentation for the unipotent group over rings with identity. Preliminary report.
   Samit Dasgupta*, Harvard University, and Daniel K. Biss, Massachusetts Institute of Technology (939-20-652)

4:30PM Classification of radical semigroups. Preliminary report.
   David D. Fei, Rhodes College (939-20-788)

4:45PM Identifying group automorphisms with graph automorphisms.
   Preliminary report.
   Debra L. Boutin, Trinity College (939-20-823)

5:00PM Locally nilpotent groups with weak chain conditions. Preliminary report.
   Vonn Walter, Allegheny College (939-20-910)

5:15PM Perfect order subsets. Preliminary report.
   Carrie F. Weiman* and Lenny K. Jones, Shippensburg University (939-20-980)

5:30PM Algebraic structures in the projective system of semigroups $Z_m \times Z_n$. Preliminary report.
   Y. Phoebe Ho, Central Missouri State University (939-20-1101)

AMS Session on Group Theory

2:15PM - 5:40PM

   Seymour Lipschutz*, Temple University, and Wujie Shi, Southwest-China Normal University (939-20-40)

2:30PM Moufang loops of order 2m.
   Preliminary report.
   Orin Chein, Temple University (939-20-155)

2:45PM Subnormality conditions in non-torsion groups.
   Luisa-Giordano, SUNY at Binghamton, and Gunnar Traustason, University of Bath (939-20-194)

3:00PM On restricting representations of the symmetric group to certain embeddings. Preliminary report.
   Jagat K. Sheth, University of Oregon (939-20-220)

3:15PM Commutative nilsemigroups with zero cohomology.
   P. A. Girlet, Tulane University (939-20-471)

3:30PM Infinite metacyclic groups and their nonabelian tensor squares.
   James R. Beuerle* and Luisa-Giordano Kappe, SUNY at Binghamton (939-20-474)

3:45PM On some generalized characters of Thompson.
   Preliminary report.
   Stephen M. Gagola Jr.* and Mark L. Lewis, Kent State University (939-20-476)

4:00PM Conditions for which Fischer F-subgroups in finite solvable groups are F-Injectors.
   Preliminary report.
   Arnold D. Feldman, Franklin & Marshall College (939-20-636)

4:15PM A presentation for the unipotent group over rings with identity. Preliminary report.
   Samit Dasgupta*, Harvard University, and Daniel K. Biss, Massachusetts Institute of Technology (939-20-652)

4:30PM Classification of radical semigroups. Preliminary report.
   David D. Fei, Rhodes College (939-20-788)

4:45PM Identifying group automorphisms with graph automorphisms.
   Preliminary report.
   Debra L. Boutin, Trinity College (939-20-823)

5:00PM Locally nilpotent groups with weak chain conditions. Preliminary report.
   Vonn Walter, Allegheny College (939-20-910)

5:15PM Perfect order subsets. Preliminary report.
   Carrie F. Weiman* and Lenny K. Jones, Shippensburg University (939-20-980)

5:30PM Algebraic structures in the projective system of semigroups $Z_m \times Z_n$. Preliminary report.
   Y. Phoebe Ho, Central Missouri State University (939-20-1101)
San Antonio, TX, Wednesday, January 13 - Program of the Sessions

3:15PM Active learning in abstract algebra.
   (259) Nancy L. Hagelgans, Ursinus College (939-E1-330)
3:30PM Teaching group theory with games and puzzles.
   ▶ (260) Preliminary report.
   Chung-wu Ho, Southern Illinois University at Edwardsville (939-E1-181)
3:45PM A few basic algebraic aspects of elliptic curves, viewed interrelationally.
   ▶ (261) Simon R. Quin, Richard Stockton College of New Jersey (939-E1-501)
   4:00PM SO(3), in pictures: A good example of lots of things.
   ▶ (262) Preliminary report.
   Rick Kreminski, Texas A&M University (939-E1-534)
   4:15PM A successful student research project. Preliminary report.
   ▶ (263) Suzanne Doree, Augsburg College, Minneapolis, MN (939-E1-1138)
   4:30PM Polynomial number magic.
   ▶ (264) Garret E. Sobczyk, Universidad de Las Americas
   (939-E1-192)
   4:45PM Star algebra.
   ▶ (265) Jerry D. Taylor, MAA (939-E1-750)
   5:00PM The lights out problem: An application of finite fields.
   ▶ (266) John H. Wilson, Centre College (939-E1-307)
   5:15PM Centralizers and centers: A natural site for reinforcing ideas about definitions, conjectures, proofs. Preliminary report.
   ▶ (267) Mary T. Treanor, Valparaiso University (939-E1-657)

MAA Session on Ethical, Humanistic, and Artistic Mathematics, I

2:15PM - 5:55PM
   Organizers: Alvin M. White, Harvey Mudd College
               Robert P. Webber, Longwood College
               Stefanos P. Gialamas, Illinois Institute of Art
   2:15PM Discussion.
   2:30PM Integrating mathematics and culture in a developing nation.
   ▶ (268) Deane E. Arganbright†, University of Papua New Guinea,
   and Susan C. Arganbright, Gonzaga University (939-F1-437)
   2:45PM Abstraction emerging from mathematics and interpreted literature.
   ▶ (269) Phyllis L. Pustilnik†, Bronx Community College (CUNY),
   and Seymour W. Pustilnik, New York City Technical College (CUNY) (939-F1-473)
   3:00PM Discussion.
   3:30PM Information, data, and decisions. Preliminary report.
   ▶ (270) Deborah Hughes Hallett, University of Arizona
   (939-F1-955)
   3:45PM A guide to blazing a math trail.
   ▶ (271) Mary-Margaret Shoaf, Baylor University
   (939-F1-324)
   4:00PM Art and geometry: Proportion and similarity.
   ▶ (272) Catherine A. Corin, Maharishi University of Management
   (939-F1-200)
   4:15PM Does the evidence of authority prevail over the authority of evidence? Preliminary report.
   ▶ (273) Shandy Hauk†, Chapman University, and Mark K. Davis,
   Educational Testing Service (939-F1-409)
   4:30PM A course called pattern.
   ▶ (274) Dorothy I. Wallace† and Pippa Drew, Dartmouth College
   (939-F1-334)

4:45PM Putting the 'hunch' back where it belongs: Intuition in the classroom.
   ▶ (275) Janet Heine Barnett, University of Southern Colorado
   (939-F1-185)
   5:00PM A collection of ideas on systems and their extensions. Preliminary report.
   ▶ (276) Paul Fjelstad, St. Olaf (emeritus) (939-F1-438)
   5:15PM Mathematics, metaphor, and metonymy.
   ▶ (277) Lawrence A. D’Antonio, Ramapo College of New Jersey
   (939-F1-565)
   5:30PM Matrix model, fertility rate, and human population.
   ▶ (278) Preliminary report.
   Mohammad Moazzam†, Salisbury State University,
   and Richard Schwartz, The College of Staten Island
   (939-F1-226)
   5:45PM Using writing to connect with our mathematics students.
   ▶ (279) Ann M. Sitomer, Grossmont College (939-F1-1000)

MAA Invited Address

3:20PM - 4:10PM
   ▶ (280) The symmetries of things: Real and conceptual.
   John H. Conway, Princeton University (939-S1-80)

AWM Panel Discussion

3:20PM - 4:20PM
   The education of women in mathematics: An international perspective.
   Organizers: Sylvia Wiegand, University of Nebraska
               Bettye Anne Case, Florida State University
   Panelists: Claire Baribaud, EPF, Lausanne, Switzerland
             Ingrid Daubechies, Princeton University
             Anna Guerrieri, University of L’Aquila, Italy
             Gloria C. Hewitt, University of Montana
             Gail Ratcliff, University of Missouri at St. Louis
             Hema Srinivasan, University of Missouri at Columbia
             Chuu-Lian Terng, Northeastern University

AWM Business Meeting

4:20PM - 4:50PM

MAA Minicourse #1: Part B

4:30PM - 6:30PM
   Mathematics, calculus, and modeling using the TI-92.
   Organizers: Phoebe T. Judson, Trinity University
               William C. Bauldry, Appalachian State University
               Richard D. West, U. S. Military Academy

JANUARY 1999
NOTICES OF THE AMS
MAA Minicourse #3: Part B

4:30 PM - 6:30 PM
Developing materials for liberal arts mathematics that use elementary graph theory and emphasize applications to everyday experience.
Organizer: Helen Christensen, Loyola University

MAA Minicourse #5: Part A

4:30 PM - 6:30 PM
Building custom classroom capsules with Maple programming.
Organizer: Douglas E. Ensley, Shippensburg University

MAA Minicourse #7: Part A

4:30 PM - 6:30 PM
Finding motivation for upper division mathematics through original sources.
Organizers: Jerry M. Lodder, New Mexico State University; David J. Pengelley, New Mexico State University

MAA Section Officers

4:30 PM - 6:30 PM
Reception for First-Time Participants

6:00 PM - 7:00 PM

MAA Dramatic Presentation

7:00 PM - 8:00 PM
The mathematics of Lewis Carroll.
Presenter: Robin Wilson, The Open University

Young Mathematicians Network Discussion

7:15 PM - 8:15 PM
Concerns of young mathematicians: A town meeting.

AMS Josiah Willard Gibbs Lecture

8:30 PM - 9:30 PM
We got rhythm: Dynamical systems of the nervous system.
Nancy J. Kopell, Boston University

AWM Reception

9:30 PM - 11:00 PM

Thursday, January 14

Joint Meetings Registration

7:30 AM - 4:00 PM

MAA Session on Geometry in the Classroom in the Next Millennium, I

7:30 AM - 10:55 AM
Organizers: Colm K. Mulcahy, Spelman College; David W. Henderson, Cornell University; Barry Schiller, Rhode Island College

- (282) Geometry is alive:
  - Consciousness: The last frontier of geometry. Catherine A. Gorini, Maharishi University of Management (939-H1-199)
  - Geometry and the arts. Ann Robertson* and Stanley J. Wertheimer, Connecticutt College (939-H1-660)
  - Geometry is alive - long live geometry! Colm K. Mulcahy, Spelman College (939-H1-1143)

8:20 AM Discussion.

- (283) Geometry in the World.
  - Teaching the geometry needed for communication industry technologies. Joseph Malkevitch, York College (CUNY) (939-H1-428)
  - Discrete geometry as applied mathematics. Preliminary report. Walter J. Whiteley, York University (939-H1-507)
  - Symmetry, rigid motions, and a fourth dimension. John McCuan, UC Berkeley (939-H1-743)

9:40 AM Discussion.

- (285) Multiple Aspects of Teaching Geometry.
  - Integrating approaches to geometry. Thomas Q. Sibley, St. John's University (939-H1-246)
  - Internet mentoring for isolated geometry professors. David E. Boliver, Univ. of Central Oklahoma (939-H1-362)
  - What's going on in Rhode Island high school geometry. Ann E. Moskol, Rhode Island College (939-H1-493)
  - Geometry--a multiple perspective approach. Ockle E. Johnson, Keene State College (939-H1-641)

10:40 AM Discussion.

MAA Session on Teaching Statistics: Teaching the Reasoning and New Technological Tools, II

7:40 AM - 10:55 AM
Organizers: Dexter C. Whittinghill, Rowan University; Franklin A. Wattenberg, National Science Foundation; Mary R. Parker, Austin Community College; Donald L. Bentley, Pomona College

7:40 AM Introduction by Mary Parker.

- (293) Census 2000, a statistical opportunity.
  - Stanley E. Seltzer* and John C. Maceli, Ithaca College (939-C1-1215)

8:05 AM Life's a risk! An interdisciplinary and interactive statistics course.
Linda C. Thiel, Ursinus College (939-C1-296)
AMS-MAA-MER Special Session on Mathematics and Education Reform, III

8:00 AM - 11:50 AM

Organizers: William H. Barker, Bowdoin College
Jorry L. Bona, University of Texas at Austin
Naomi Fisher, University of Illinois at Chicago
Kenneth C. Millett, University of California Santa Barbara

8:00 AM
Alignment of mathematics tests and mathematics reforms. Preliminary report.
Norman L. Webb, University of Wisconsin-Madison, Wisconsin Center for Education Research (939-97-1024)

8:30 AM
Standardized tests: What do they tell you about students? What do they tell students (teachers, parents, school boards, and administrators) about mathematics? Preliminary report.
Cathy Kessel, University of California, Berkeley (939-98-703)

9:00 AM
Gender differences in problem solving strategies.
Ann Gallahger and Mary Morley*, Educational Testing Service (939-98-1047)

9:30 AM
Let’s evaluate education reforms, past and present. Preliminary report.
Andrew M. Gleason, Harvard University (939-98-913)

10:00 AM
Seven years of calculus reform at the University of Michigan.
Morton Brown, University of Michigan (939-98-594)

10:30 AM
Calculus reform at Maryland—past and future.
Ron Lipsman, University of Maryland (939-98-398)

11:00 AM
Moving ahead together.
William J. Davis, The Ohio State University (939-98-1017)

AMS Special Session on Banach Spaces of Holomorphic Functions and Operators on These Spaces, III

8:00 AM - 11:50 AM

Organizers: Benjamin A. Lotto, Vassar College
Pamela B. Gorkin, Bucknell University

8:00 AM
Angular distribution of mass by Bergman functions.
Donald E. Marshall*, University of Washington, and Wayne Smith, University of Hawai‘i (939-30-168)

8:30 AM
Interpolating sequences in the spectrum of \(H^p\).
Raymond R. Mortini, Universite de Metz (France) (939-46-45)

9:00 AM
A peak point theorem. Preliminary report.
Alexander J. Izzo*, Bowling Green State University, and John T. Anderson, College of the Holy Cross (939-46-603)

9:30 AM
Bourgain and minimal envelope algebras of Douglas algebras.
Carroll Guillory, University of Southwestern Louisiana (939-46-216)

10:00 AM
A distance estimate for finitely generated ideals in Douglas algebras.
Daniel Suarez, University of Buenos Aires (939-46-179)

10:30 AM
Vertical variation of harmonic functions.
Michael D. O’Neill, University of Texas, El Paso (939-30-139)

11:00 AM
Weak infinite powers of Blaschke products.
Keiji Izuchi, Niigata University, Japan (939-46-145)

11:30 AM
Interpolating sequences in spaces with complete Nevanlinna-Pick kernels.
Jim Agler, UC San Diego, and John E. McCarthy*, Washington University (939-46-166)
## AMS Special Session on Commutative Algebra, III

**Organizer:** Scott Thomas Chapman, Trinity University

**Schedule:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00AM</td>
<td>Lifting trees of prime ideals to Bezout extension domains.</td>
</tr>
<tr>
<td></td>
<td>David E. Dobbs*, University of Tennessee, and</td>
</tr>
<tr>
<td></td>
<td>Marco Fontana, Universita degli Studi, Roma Tre (939-13-35)</td>
</tr>
<tr>
<td>8:30AM</td>
<td>Distinguished domains. Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>(328) Daniel D. Anderson* and Muhammad Zafrullah, The University of Iowa</td>
</tr>
<tr>
<td>9:00AM</td>
<td>A bracket power characterization of analytic spread and ideals.</td>
</tr>
<tr>
<td></td>
<td>Louis J. Ratliff and David E. Rush*, University of California (939-13-449)</td>
</tr>
<tr>
<td>9:30AM</td>
<td>Divisibility in $A+X\mathfrak{B}[X]$ domains. Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>(330) David F. Anderson, University of Tennessee (939-13-498)</td>
</tr>
<tr>
<td>10:00AM</td>
<td>Sets of lengths. Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>(331) Alfred Geroldinger, Karl-Franzens-Universitat-Graz (939-13-340)</td>
</tr>
<tr>
<td>10:30AM</td>
<td>Elasticity of finitely generated domains. Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>Florian Kainrath, Institut f. Mathematik, Universitaet Graz (939-13-591)</td>
</tr>
<tr>
<td>11:00AM</td>
<td>Some combinatorial problems related to arithmetic properties of Krull domains. Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>Wielong Gao, University of Petroleum, Beijing (939-13-379)</td>
</tr>
<tr>
<td>11:30AM</td>
<td>An application of homology to the group of divisibility. Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>Jim B. Coykendall, North Dakota State University (939-13-699)</td>
</tr>
</tbody>
</table>

## AMS Special Session on Combinatorial Topology, III

**Organizers:** Laura M. Anderson, Texas A&M University

**Jonathan P. McCammond, Texas A&M University**

**Schedule:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00AM</td>
<td>Secondary 2-complexes and link invariants.</td>
</tr>
<tr>
<td></td>
<td>Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>(335) Mike Dyer, University of Oregon, Jens Harlander,</td>
</tr>
<tr>
<td></td>
<td>IWC-Universitat Frankfurt, Michael P. Hitchman*, Lewis &amp; Clark College,</td>
</tr>
<tr>
<td></td>
<td>and Jim Howie, Heriot-Watt University (939-57-933)</td>
</tr>
<tr>
<td>8:30AM</td>
<td>Nontrivial embeddings of polygonal intervals and unknots in 3-space.</td>
</tr>
<tr>
<td></td>
<td>(336) Heather M. Johnston*, Rutgers University, and</td>
</tr>
<tr>
<td></td>
<td>Jason H. Cantarella, University of Pennsylvania (939-57-729)</td>
</tr>
<tr>
<td>9:00AM</td>
<td>Geometric embeddings of simplicial complexes in a Euclidean space.</td>
</tr>
<tr>
<td></td>
<td>(337) Isabella Novik, The Hebrew University (939-05-544)</td>
</tr>
<tr>
<td>9:30AM</td>
<td>On new lower bound theorems for polytopes and combinatorial manifolds.</td>
</tr>
<tr>
<td></td>
<td>(338) Eric Sparla, Universit&quot;at Stuttgart (939-52-1180)</td>
</tr>
<tr>
<td>10:00AM</td>
<td>Recoverable subgroups of the Hawaiian earring group.</td>
</tr>
<tr>
<td></td>
<td>(339) William A. Bogley*, Oregon State University, and</td>
</tr>
<tr>
<td></td>
<td>Allan J. Sieradski, University of Oregon (939-57-735)</td>
</tr>
<tr>
<td>10:30AM</td>
<td>On the cohomology of orbit configuration spaces.</td>
</tr>
<tr>
<td></td>
<td>(340) Eva-Maria E. Feichtner*, Institute for Advanced Study, and</td>
</tr>
<tr>
<td></td>
<td>G&quot;unter M. Ziegler, Technische Universit&quot;at Berlin (939-55-923)</td>
</tr>
</tbody>
</table>

## AMS Special Session on Discrete Models and Difference Equations, III

**Organizers:** Saber Elaydi, Trinity University

**Gerry Ladas, University of Rhode Island**

**Schedule:**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00AM</td>
<td>Inclusion principle for discrete dynamic systems.</td>
</tr>
<tr>
<td></td>
<td>Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>(351) Dragoslav D. Siljak*, Santa Clara University, and</td>
</tr>
<tr>
<td></td>
<td>Srdjan S. Stankovic, University of Belgrade (939-93-457)</td>
</tr>
<tr>
<td>8:30AM</td>
<td>Difference equations and discriminants for discrete orthogonal polynomials. Preliminary report.</td>
</tr>
<tr>
<td></td>
<td>(352) Mourad E. H. Ismail, University of South Florida (939-33-131)</td>
</tr>
</tbody>
</table>
AMS Special Session on Recent Developments in Differential Geometry, III

8:00 AM - 11:20 AM

Organizers: Huai-Dong Cao, Texas A&M University
Jian Zhou, Texas A&M University

8:00 AM
Virasoro constraints for quantum cohomology.
(359) Xiaobo Liu* and Gang Tian, MIT (939-53-269)

8:30 AM
Frobenius manifolds and Virasoro constraints.
(360) Boris Dubrovin, International School For Advanced Studies, Trieste, and Youjin Zhang*, Kyoto University (939-53-567)

9:00 AM
DG*BV algebras of Calabi-Yau manifolds and mirror symmetry.
(361) Huai-Dong Cao and Jian Zhou*, Texas A&M University (939-53-872)

9:30 AM
Kalkman localization in generalized equivariant cohomology theories.
(362) David S. Metzler, Rice University (939-53-898)

10:00 AM
On the equivalence of multiplicative structures in Floer homology and quantum homology.
(363) Gang Liu*, UCLA, and Gang Tian, MIT (939-53-931)

10:30 AM
On fundamental groups of positively curved manifolds.
(364) Karsten Grove and Krishnan Shankar*, University of Maryland (939-53-420)

11:00 AM
An obstruction to the conformal compactification of Riemannian manifolds.
(365) Seongtag Kim, SungKyunKwan University, South Korea (939-53-1173)

AMS Special Session on Singularities in Algebraic and Analytic Geometry, III

8:00 AM - 11:55 AM

Organizers: Caroline Grant Melles, U.S. Naval Academy
Ruth I. Michler, University of North Texas

8:00 AM
An explicit construction of complete Kahler Saper metrics by means of desingularization.
(366) Caroline Grant Melles*, U.S. Naval Academy, and Pierre Milman, University of Toronto (939-14-814)

8:30 AM
Stratification conditions, plane sections and equisingularity.
(367) Terence J. Gaffney, Northeastern University (939-32-352)

9:00 AM
Resolution of singularities and its history.
(368) Shreeram S. Abhyankar, Purdue University (939-14-32)

10:00 AM
"Weakly" elliptic Gorenstein singularities of surfaces.
(369) András Nemethi, The Ohio State University (939-14-119)

11:00 AM
A resolution algorithm for a special class of hypersurface singularities.
(370) András Nemethi and Agnes Szilárd*, The Ohio State University (939-14-144)

11:30 AM
Minimal models and boundedness of stable varieties. Preliminary report.
(371) Kalle Karu, Boston University (939-14-664)

MAA Minicourse #2: Part B

8:00 AM - 10:00 AM

Mathematical finance.
Organizer: Walter R. Stromquist, Berwyn, PA

MAA Minicourse #8: Part B

8:00 AM - 10:00 AM

Teaching a course in the history of mathematics.
Organizers: Victor J. Katz, University of the District of Columbia
V. Frederick Rickey, U. S. Military Academy

AMS Session on Associative Algebras

8:00 AM - 10:55 AM

8:00 AM
A note on the radical of a convolution algebra.
(372) Jason P. Huffman*, University of Southwestern Louisiana, and Henry E. Heatherly, AMS (939-16-236)

8:15 AM
Weighted quantum planes and Veronese embeddings.
(373) Darin R. Stephenson, Hope College (939-16-429)

8:30 AM
Quantitative three spaces which embed weighted quantum planes.
(374) Preliminary report.
Geoffrey D. Dietz*, University of Dayton, Ryan S. Higginbottom*, Bucknell University, and Darin R. Stephenson, Hope College (939-16-432)

8:45 AM
Lie isomorphisms in prime GPI rings.
(375) Philip S. Blau*, College of General Studies, Boston University, and W. S. Martindale III, University of Massachusetts (939-16-461)

9:00 AM
Images of quadratic functions on the ring Zp.
(376) Preliminary report.
Lenny K. Jones and Gary C. Hul, Shippensburg University (939-16-479)

9:15 AM
Rings that contain exactly one zero divisor.
(377) Preliminary report.
Lenny K. Jones and Beth A. Stocksie, Shippensburg University (939-16-480)

9:30 AM
Global dimension four extensions of Artin-Schelter regular algebras.
(378) Thomas Cassidy, University of Oregon (939-16-628)

9:45 AM
On Artin-Schelter regular algebras of global dimension four with finite point schemes.
(379) Preliminary report.
Christopher J. Brawfield, University of Oregon (939-16-916)
AMS Session on Fourier Analysis

8:00 AM - 9:25 AM

8:00 AM Determining sets for trigonometric series.
(384) J. Marshall Ash*, DePaul University, and Sh. T. Tetunashvili, Georgian Technical University (939-42-775)

8:15 AM Constructing multicoiflets.
(385) David K. Ruch, Sam Houston State University (939-42-123)

8:30 AM Singular integrals related to block spaces.
(386) Abdelnasser J. Al-Hasan*, University of Wisconsin-Whitewater, and Dashan Fan, University of Wisconsin-Milwaukee (939-42-526)

8:45 AM Projective Fourier analysis for patterns.
(387) Jacek Turski, University of Houston-Downtown (939-42-653)

9:00 AM Limiting cases of Sobolev inequalities. Preliminary report.
(388) Michael Pearson, Mississippi State University (939-42-693)

(389) Magdalena Mosbo, Kansas State University (939-42-897)

AMS Session on Sequences and Series

8:00 AM - 10:25 AM

8:00 AM Absolute comparison theorems for double weighted mean and double Cesaro means.
(390) Billy E. Rhoades, Indiana University (939-40-82)

8:15 AM Conditional convergence of infinite products.
(391) William F. Trench, Trinity University, San Antonio, TX (939-40-135)

8:30 AM Four dimensional characterization of double sequences limit points.
(392) Richard F. Patterson, Duquesne University (939-40-700)

8:45 AM Matrix transformations of statistical cores of complex sequences. Preliminary report.
(393) Jinlu Li, Shawnee State University, and John A. Fridy*, Kent State University (939-40-711)

9:00 AM When Ermakov meets Dini. Preliminary report.
(394) Joseph G. Gaskin*, Oswego State University, and William F. Ford, NASA, Lewis, CSD (939-40-1050)

(395) Joseph Wiener and Miguel Paredes*, University of Texas-Pan American (939-98-94)

9:30 AM DeMoivre's theorem in summation and integration formulas. Preliminary report.
(396) Bella Wiener* and Joseph Wiener, University of Texas-Pan American (939-98-103)

AMS Session on Geometry

8:00 AM - 11:55 AM

8:00 AM An extension of Harvey's formula.
(400) Robert J. Gregorac, Iowa State University (939-51-225)

8:15 AM Two propositions related to Steiner-Lehmus theorem.
(401) Rahim G. Karimpour, Southern Illinois University (939-51-471)

8:30 AM Isoperimetric inequalities for some types of polygons. Preliminary report.
(402) Alan E. Feldman, University of Massachusetts (Amherst) (939-51-1025)

8:45 AM Quantised resolutions: topological properties and geometric applications. Preliminary report.
(403) Stephen H. Harnish, Bluffton College (939-51-1178)

9:00 AM Fluctuation of sectional curvature for closed hypersurfaces. Preliminary report.
(404) Marius Overholt, University of Tromso (939-53-41)

(405) Dorin Ghisa*, York University, Toronto, Canada, and Ilie Barza, Lulea University, Lulea, Sweden (939-53-147)

9:30 AM Gauge transformations and Thomas-Whitehead projective connections.
(406) Craig William Roberts, Southeast Missouri State University (939-53-215)

9:45 AM Finiteness theorems for fiber bundles.
(407) Kristopher R. Tapp, University of Pennsylvania (939-53-389)

10:00 AM Product submanifolds of almost r-paracontact Riemannian manifolds.
(408) Andrew J. Bucki, OSSM (939-53-451)

10:15 AM The geometry of foliations. Preliminary report.
(409) Richard Escobales Jr., Canisius College (939-53-627)

10:30 AM The isoperimetric problem for curl. Preliminary report.
(410) Jason H. Cantarella, University of Pennsylvania (939-53-672)

10:45 AM Asymptotically flat eight dimensional manifolds. Preliminary report.
(411) Raquel E. Maderazo, The University of California, Los Angeles (939-53-738)

11:00 AM Self-linking and convexity of space curves.
(412) Edgar J. Fuller Jr, University of Georgia (939-53-996)

11:15 AM Simple closed elastic curves in hyperbolic 2-space.
(413) Daniel H. Steinberg, Brigham Young University (939-53-1108)

11:30 AM Area minimization and holonomy on the Veronese surface. Preliminary report.
(414) Luis Verde-Star, Universidad Autonoma Metropolitana, Mexico City (939-39-1048)
MAA Session on Discrete Mathematics Revisited, I

8:00 AM - 10:55 AM
Organizers: Richard K. Molnar, Macalester College
Suzanne M. Molnar, College of St. Catherine

8:00 AM
Discrete math revisited—why, when, and how?
Richard K. Molnar, Macalester College
Suzanne M. Molnar*, College of St. Catherine (939-J-680)

8:20 AM
Discrete mathematics, then and now. Preliminary report.
Stephen B. Maurer, Swarthmore College (939-J-538)

8:40 AM
Linkages, applications, and challenges in teaching discrete math.
Michael J. Bradley and Thomas C. Hull*, Merrimack College (939-J-500)

9:00 AM
An entry-level discrete dynamical systems course.
Dick J. Jardine, USMA (939-J-817)

9:20 AM
The role of difference equations as a precursor to calculus and differential equations courses.
Sheldon P. Gordon, SUNY at Farmingdale (939-J-519)

9:40 AM
Epidemic modeling: MATLAB exercises for an undergraduate course in mathematical methods in biology.
Elizabeth S. Allman, UNCA (939-J-839)

10:00 AM
Using the MATLAB software package to teach the discrete mathematics needed by computer science majors.
Dick A. Wood, Seattle Pacific University (939-J-539)

10:20 AM
Infusion of algorithms, recursion, and induction into a discrete mathematics course.

10:40 AM
A prerequisite discrete math course for prospective master’s students in computer science.
Richard Johnsonbaugh, DePaul University (939-J-302)

MAA Women and Mathematics Network Poster Session

8:00 AM - 10:00 AM
Outreach programs for women and girls in mathematics.
Organizer: Kathleen A. Sullivan, Seattle University

Project NExT Panel Discussion

8:00 AM - 9:30 AM
Summer research opportunities for faculty in industry and government.
Moderator: Joseph A. Gallian
Organizer: Joseph A. Gallian, University of Minnesota-Duluth
Panelists: Alfred Hales, Center for Communications, San Diego
M. Leigh Lunsford, Alabama A&M University
William Y. Velez, University of Arizona

Mathematical Sciences Employment Register

8:15 AM - 7:30 PM
Interviews only.

AMS Special Session on Hamiltonian Mechanics: Applications to Celestial Mechanics and Chemistry, III

8:30 AM - 11:20 AM
Organizers: Michael K. Rudnev, The University of Texas at Austin
Stephen R. Wiggins, California Institute of Technology

8:30 AM
Geometric approaches to low-dimensional manifolds in chemical systems approaching equilibrium. Preliminary report.
Michael J. Davis*, Chemistry Division, Argonne National Laboratory, and Rex T. Skodje, University of Colorado (939-70-852)

9:00 AM
Altering the course of Hamiltonian dynamics.
Herschel Rabitz, Princeton University (939-49-847)

9:30 AM
Molecular gyroscopes: Model studies of torsion-rotation interaction in molecules.
John H. Fedorik*, University of Nevada, and James T. Vivian, University of California, Davis (939-70-630)

10:00 AM
Simultaneous binary collision singularities.
Mohamed S. Elbialy, University of Toledo (939-70-626)

10:30 AM
Geometric structures and diffusions.
Rafael de la Llave, University of Texas (939-34-602)

11:00 AM
The anisotropic Manev problem.
Florin Diacu, University of Victoria (939-70-607)

AWM Emmy Noether Lecture

9:00 AM - 9:50 AM
Aperiodic dynamical systems.
Krystyna M. Kuperberg, Auburn University (939-58-599)

MAA Special Presentation on the Legacy of R. L. Moore

9:00 AM - 9:00 PM
Organizers: Albert C. Lewis, Indiana University-Purdue University Indianapolis
Ben G. Fitzpatrick, North Carolina State University
Donald J. Albers, MAA

Books Sales and Exhibits

9:30 AM - 5:30 PM

MAA Invited Address

10:05 AM - 10:55 AM
The history of mathematics and its future.
John Fauvel, The Open University (939-01-912)
AMS Invited Address

2:15 PM - 3:05 PM

> (434) Alterations in algebraic geometry. Preliminary report.
Aise Johan de Jong, MIT (939-14-1073)

AMS Colloquium Lectures: Lecture II

1:00 PM - 2:00 PM

(433) Symplectic geometry from a dynamical systems point of view, II.
Helmut H. Hofer, Courant Institute (939-58-495)

AMS-MAA-MER Special Session on Mathematics and Education Reform, IV

2:15 PM - 4:05 PM

Organizers: William H. Barker, Bowdoin College
Jerry L. Bona, University of Texas at Austin
Naomi Fisher, University of Illinois at Chicago
Kenneth C. Millett, University of California Santa Barbara

2:15 PM A regional partnership.
> (435) Ramesh Gangolli, University of Washington (939-97-960)
2:45 PM A new approach to "math for elementary teachers".
> (436) Patricia Baggett, New Mexico State University (939-96-512)
Richard H. Herman, University of Illinois (939-98-1106)
3:45 PM Between a rock and a hard place. Preliminary report.
Ronald G. Douglas, Texas A&M University (939-00-325)

AMS Special Session on Combinatorial Topology, IV

2:15 PM - 4:05 PM

Organizers: Laura M. Anderson, Texas A&M University
Jonathan P. McCammond, Texas A&M University

AMS Special Session on Banach Spaces of Holomorphic Functions and Operators on These Spaces, IV

2:15 PM - 4:05 PM

Organizers: Benjamin A. Lotto, Vassar College
Pamela B. Gorkin, Bucknell University

Theodore W. Gamelin, UCLA (939-46-860)
2:45 PM Commuting analytic self-maps of the ball. Preliminary report.
Barbara D. MacCluer, University of Virginia (939-32-153)
3:15 PM Compactness criteria for holomorphic composition operators on the Hardy and Bergman spaces of the unit ball.
Dana D. Clahane, University of California, Irvine (939-32-101)
Carl C. Cowen, Purdue University (939-47-205)

AMS Special Session on Banach Spaces of Holomorphic Functions and Operators on These Spaces, IV

2:15 PM - 4:05 PM

Organizers: Benjamin A. Lotto, Vassar College
Pamela B. Gorkin, Bucknell University

Theodore W. Gamelin, UCLA (939-46-860)
2:45 PM Commuting analytic self-maps of the ball. Preliminary report.
Barbara D. MacCluer, University of Virginia (939-32-153)
3:15 PM Compactness criteria for holomorphic composition operators on the Hardy and Bergman spaces of the unit ball.
Dana D. Clahane, University of California, Irvine (939-32-101)
Carl C. Cowen, Purdue University (939-47-205)
2:15 PM - 4:05 PM

AMS Special Session on The Functional and Harmonic Analysis of Wavelets, IV

Organizers: Lawrence W. Baggett, University of Colorado
David R. Larson, Texas A&M University

2:15 PM
Arbitrarily smooth nonseparable wavelets in higher dimensions.
Yang Wang*, and Eugene Belogay, Georgia Institute of Technology (939-42-1214)

2:45 PM
Some applications of the wavelet multiplicity function. Preliminary report.
Eric S. Weber, University of Colorado (939-43-622)

3:15 PM
Algebras of singular integral operators.
David B. Weiland, Univ. of Texas, Austin (939-42-1186)

3:45 PM
Characterizations of filters, scaling sets and related topics.
Manos Papadakis, Hrvoje Sikic and Guido Weiss*, Washington University (939-41-274)

AMS Special Session on Discrete Models and Difference Equations, IV

2:15 PM - 4:05 PM

Organizers: Saber Elaydi, Trinity University
Gerry Ladas, University of Rhode Island

2:15 PM
Multiple symmetric positive solutions for discrete Lidstone boundary value problems.
Johnny Henderson, Auburn University (939-39-31)

2:45 PM
Comparison of solutions of difference inequalities.
Paul W. Eloe, University of Dayton (939-39-118)

3:15 PM
A variable step second order time reversible symplectic integrator for Hamiltonian systems generated from Lagrangians.
Calvin D. Ahlbrandt, University of Missouri, Columbia, Missouri (939-39-116)

3:45 PM
Allan C. Peterson, University of Nebraska (939-39-92)

AMS Special Session on Singularities in Algebraic and Analytic Geometry, IV

2:15 PM - 3:55 PM

Organizers: Caroline Grant Melles, U.S. Naval Academy
Ruth I. Michler, University of North Texas

3:15 PM
Monomialization and factorization of morphisms. Preliminary report.
Steven Dale Cutkosky, University of Missouri (939-14-705)

AMS Special Session on Hamiltonian Mechanics: Applications to Celestial Mechanics and Chemistry, IV

2:15 PM - 4:05 PM

Organizers: Michael K. Rudnev, The University of Texas at Austin
Stephen R. Wiggins, California Institute of Technology

2:15 PM
Quantum propagation on classically invariant structures.
Wolfgang Schweizer*, Wilfried Jans, Theoretical Astrophysics, Tuebingen, and Turgay Uzer, Georgia Institute of Technology (939-81-576)

2:45 PM
Some recent results in multiphase averaging theory for ODEs.
H. Scott Dumas, University of Cincinnati (939-34-1125)

3:15 PM
On the problem of estimating the entropy of the Chirikov Standard map. Preliminary report.
Oliver R. Knill, University of Texas (939-58-1154)

3:45 PM
Rydberg atoms in crossed external fields: Order, chaos, and non-dispersive wavepackets. Preliminary report.
Turgay Uzer*, Georgia Institute of Technology, David Farrelly, Utah State University, and Jan von Milczewski, Georgia Institute of Technology (939-70-99)

MAA Minicourse #12: Part A

2:15 PM - 4:15 PM

Writing and the teaching of mathematics.
Organizers: John E. Meier, Lafayette College
Thomas W. Rishel, Cornell University

MAA Minicourse #16: Part A

2:15 PM - 4:15 PM

Using hand-held CAS throughout the mathematics curriculum.
Organizers: Wade Ellis, West Valley College
L. Carl Leinbach, Gettysburg College
Bert K. Waits, Ohio State University

MAA Minicourse #7: Part B

2:15 PM - 4:15 PM

Finding motivation for upper division mathematics through original sources.
Organizers: Jerry M. Lodder, New Mexico State University
David J. Pengelley, New Mexico State University

MAA Minicourse #9: Part A

2:15 PM - 4:15 PM

Exploring abstract algebra through interactive labs.
Organizers: Allen C. Hibbard, Central College
Kenneth M. Levasseur, University of Massachusetts, Lowell
AMS Session on Set Theory and Foundations
2:15PM - 3:40PM
2:15PM On the automata hiding of quantifiers in Gödel’s class theory.
Johan G. F. Belinfante, Georgia Institute of Technology (939-04-537)
2:30PM Cohen algebras and nowhere dense ultrafilters.
Aleskander Blaszczycz, Silesian University, and Andrzej A. Szynanski*, Slippery Rock University (939-04-868)
2:45PM Generalized extension principle and operations of fuzzy numbers.
Zengxiang Tong* and Zhen Huang, Otterbein (939-99-921)
3:00PM Essential steps in the proof of a theorem.
William H. Rowan, Electron Mantra Research (939-03-569)
3:15PM Semiotic impediments to formalizations.
Miriam A. Lipschutz-Yevick, Rutgers University (939-03-858)

AMS Session on Integral Equations and Transforms
2:15PM - 3:40PM
2:15PM The influence of two moving heat sources on blow-up in a reactive-diffusive medium.
Colleen M. Kirk* and W. E. Olmstead, Northwestern University (939-45-328)
2:30PM Meyer wavelet regularization. Preliminary report.
Xiaoping Shen, University of St. Thomas (939-45-699)
2:45PM Solution of inverse scattering problem by a spectral method.
Mohsen Razzaghi*, and Falih Ahmad, Mississippi State University (939-45-328)
3:00PM Two dimensional heat equations involving Laplace transform and Green’s function.
R. S. Dahiya, Iowa State University (939-44-261)
3:15PM The Phragmen-Mikusinski inversion for the Laplace transform.
Boris Baeumer, University of Nevada, Reno (939-44-1002)
3:30PM Wavelet transforms of distributions and applications.
George K. Yang, Sam Houston State University (939-44-1100)

AMS Session on Real Analysis
2:15PM - 3:55PM
2:15PM Extensions of Grüss’ inequality.
A. M. Fink, Iowa State University (939-26-372)
2:30PM Sampling theorems in n-dimensional space.
Nasser Dastrange, Buena Vista University (939-26-470)
2:45PM Composition of functions. Preliminary report.
Kandasamy Muthuvel, University of Wisconsin-Oshkosh (939-26-108)
3:00PM New generalizations of Hardy-Hilbert inequality.
Lokenath Debnath*, University of Central Florida, and Yang Bicheng, Guangdong Education College (939-26-1221)
3:15PM The monotonic property of $L^{(n)}$-averaging domains and weighted weak reverse Holder inequality. Preliminary report.
Bing Liu*, College of St. Scholastica, and Shusen Ding, University of Minnesota, Duluth (939-28-213)
3:30PM Finite staircase $Z^d$ actions. Preliminary report.
Jeffrey A. Kaye, Cesar Silva and Alexandre L. Wolfe*, Williams College (939-28-1127)
3:45PM Some local properties for mean-bounded operators. Preliminary report.
Driss Drissi, Kuwait University (939-47-1216)

AMS Session on Codes and Ordered Structures
2:15PM - 3:40PM
2:15PM Basic interval orders. Preliminary report.
Amy N. Myers, Dartmouth College (939-06-460)
2:30PM Lattice-ordered groups associated to whales in a boolean algebra. Preliminary report.
Jason D. Holland, Abilene Christian University (939-06-789)
2:45PM A family of unit parallelogram orders of dimension at least four. Preliminary report.
Kenneth P. Bogart, Dartmouth College (939-06-909)
3:00PM A method for bounding poset dimension and a family of unit parallelogram orders of dimension exactly four.
Stephen P. Ryan, Dartmouth College (939-06-917)
3:15PM The dual of cyclic codes over $Z_m$.
Taher A. Abu Al-Rub, The American University of Sharjah (939-94-288)
3:30PM An impulsively initialized, digital chaotic communication scheme.
Andrew T. Parker* and Kevin M. Short, University of New Hampshire (939-94-1055)

MAA Session on Projects That Work in Applied Mathematics Courses, I
2:15PM - 3:55PM
Organizers: Alexandra Kurepa, North Carolina A&T State University
Henry A. Warchall, University of North Texas
Gilbert Strang, MIT (939-K1-259)
2:45PM Discovering wavelets.
Edward F. Aboufadel* and Steven Schlicker, Grand Valley State University (939-K1-304)
3:15PM Fourier series for high school students. Preliminary report.
Aaron T. Ekstrom and Alexander R. Perlis*, The University of Arizona (939-K1-559)
3:45PM Jerks don’t jump: Mathematical modelling with an impact.
Douglas B. Meade, University of South Carolina (939-K1-902)
4:05PM Teaching the first steps in modeling problems in applied calculus. Preliminary report.
Agnes M. Rash*, St. Joseph’s University, and Jean Marie McDill, Calif. Polytechnic State University (939-K1-907)

MAA Session on Innovative Use of Distance Learning Techniques to Teach Post-Secondary Mathematics, I
2:15PM - 3:55PM
Organizers: Brian E. Smith, McGill University
Marcelle Bessman, Jacksonville University
2:15PM  Teaching linear algebra and abstract algebra with two way video and audio.
Edward G. Reinko, Concordia University, Nebraska (939-L1-714)

2:30PM  Teaching Calculus III and IV over the Rochester area interactive television network.
Marcia K. Birken, Rochester Institute of Technology (939-L1-406)

2:45PM  Investigative hypertext materials supporting distance courses.
Larry Copes, Institute for Studies in Educational Mathematics and Augsburg College (939-L1-408)

3:00PM  A distance education course using Java Applets and computer whiteboards.
William Hammack, Nova Southeastern Univ. (939-L1-281)

3:15PM  Role models and information about careers in mathematics: A distance-learning approach.
Mary K. Porter, Saint Mary’s College (939-L1-961)

3:30PM  Using a computer algebra system to produce WEB notes. Preliminary report. Preliminary report.
Paul R. Patten, North Georgia College & State University (939-L1-333)

3:45PM  A Web based calculus course. Preliminary report.
G. Donald Allen, Maury Rafe, Michael Stecher*, Texas A&M University, and Philip B. Yasskin, Texas A&M University (939-L1-357)

MAA Session on Integrating Mathematics and Other Disciplines, I

2:15PM - 4:10PM

Organizers: William G. McCallum, University of Arizona
Nicholas T. Losito, SUNY at Farmingdale
Yajun Yang, SUNY at Farmingdale

2:15PM  Using chemical kinetics in the teaching of calculus and differential equations.
Michel Helfgott, University of Wyoming (939-M1-637)

Sarah B. James, Kelly J. Black and Lee L. Zia*, University of New Hampshire (939-M1-1137)

2:45PM  The effects of earthquakes on mathematicians and engineers. Preliminary report.
Ethan J. Berkove* and Richard J. Marchand, U.S. Military Academy (939-M1-1136)

3:00PM  A course and text integrating calculus and physics.
Martin Jackson* and Andrew Rex, University of Puget Sound (939-M1-1018)

Jerry A. Johnson, University of Nevada, Reno (939-M1-433)

3:30PM  Mathematics in action: Social and industrial problems.
Morteza Shafii-Mousavi* and Paul Kochanski, Indiana University South Bend (939-M1-416)

3:45PM  “The science of art”.
Catherine A. Roberts, Northern Arizona University (939-M1-382)

4:00PM  An interdisciplinary algebra/science course.
Karla J. Oty* and Brett M. Elliott, Southeastern Oklahoma State University (939-M1-396)

MAA CUPM Subcommittee on Calculus Reform and the First Two Years Panel Discussion

2:15 PM - 3:45 PM

College algebra reform.
Organizer: Donald B. Small, U. S. Military Academy
Panelists: Sandi Athanassiu, University of Missouri, Columbia
General G. Marshall, Huston-Tillotson College
Kathleen Heid, Pennsylvania State University
Philip Quarataro, Southern University

MAA Panel Discussion

2:15 PM - 3:45 PM

Discovery-based teaching of undergraduate mathematics courses.
Moderators: William T. Mahavier
James P. Ochoa
Organizers: William T. Mahavier, Nichols State University
James P. Ochoa, Hardin-Simmons University
Panelists: Stuart J. Anderson, Texas A&M at Commerce
Steve Armentrout, Pennsylvania State University
Mary Ellen Rudin, University of Wisconsin, Madison
Jerome Dancis, University of Maryland, College Park
Tom Ingram, University of Missouri at Rolla

MAA Committee on the Participation of Women Panel Discussion

2:15 PM - 3:45 PM

Exemplary women in mathematical careers.
Organizer: Carolyn C. Connell, Westminster College

ASA-MAA Committee on Statistics Panel Discussion

2:15 PM - 3:45 PM

Involving undergraduate students in industrial consulting experiences.
Organizers: Mary R. Parker, Austin Community College
Dexter C. Whittinghill, Rowan University
Panelists: Donald L. Bentley, Pomona College
Cary Marcot, CardioGenesis Corporation
Julie Buring, Harvard University
MAA Committee on Computers in Mathematics Education Poster Session

2:15 PM - 4:10 PM

Using the Web in teaching undergraduate mathematics.
Organizers: V. S. Ramamurthi, University of North Florida
Rebecca E. Hill, Rochester Institute of Technology

MAA Committee on Computers in Mathematics Education Panel Discussion

2:15 PM - 3:45 PM

Using the web as a tool for teaching calculus: What we've learned; successes and problem areas.
Organizers: Lawrence S. Husch, University of Tennessee
Earl D. Fife, Calvin College
Eugene A. Klotz, Swarthmore College

MAA Session on Mathematics Competitions, II

2:20 PM - 4:15 PM

Organizers: Harold B. Reiter, University of North Carolina at Charlotte
Stephen B. Maurer, Swarthmore College
William P. Fox, U. S. Military Academy
Susan Schwartz Wildstrom, Walt Whitman High School, Bethesda, MD

2:20PM Enhancing the MCM experience for undergraduates.
 Edward A. Connors, United States Military Academy and University of Massachusetts Amherst (939-D1-253)

2:40PM The North Central Section Team Contest.
 Gerald A. Heuer, Concordia College (939-D1-248)

3:00PM Math bowls at Long Island Colleges.
 Raymond N. Greenwell, Hofstra University (939-D1-254)

3:20PM A Web-based weekly mathematics competition.
 Christopher Eastburg, Richard Johnson, Thomas H. Meyer and Joseph D. Myers, U.S. Military Academy (939-D1-260)

3:40PM The Michigan autumn take home challenge.
 Timothy A. Sipka, Alma College (939-D1-746)

4:00PM The mathematical contest in modeling (MCM).
 William P. Fox, COMAP (939-D1-719)

AMS Invited Address

3:20 PM - 4:10 PM

Midpoints: Preliminary report.
Alan D. Weinstein, University of California, Berkeley (939-00-17)

Joint Prize Session and Reception

4:25 PM - 6:00 PM

MAA Reception for Two-Year Colleges

5:45 PM - 7:00 PM

MAA Committee on the Mathematical Education of Teachers Poster Session

6:00 PM - 8:00 PM

Innovations in mathematics programs which benefit future teachers.
Organizer: Marjorie Enneking, Portland State University

AMS Special Session on Singularities in Algebraic and Analytic Geometry, V

6:30 PM - 9:30 PM

Organizers: Caroline Grant Melles, U.S. Naval Academy
Ruth I. Michler, University of North Texas

6:30PM A valuation theoretic approach to local uniformization.
 Franz-Viktor Kuhlmann, University of Saskatchewan at Saskatoon (939-14-442)

7:30PM Discussions on and open problems in resolution or uniformization of singularities.

MER Banquet

6:30 PM - 10:00 PM

AMS Special Session on Discrete Models and Difference Equations, V

7:00 PM - 9:20 PM

Organizers: Saber Elaydi, Trinity University
Gerry Ladas, University of Rhode Island

7:00PM Global behavior of solutions of the period 7 Max equation.
Jeffrey J. Feuer, Merrimack College, Edward J. Janowski, Gerry Ladas and Chris Telek, University of Rhode Island (939-39-585)

7:30PM Global stability of a difference equation.
Edward Grove, Gerry Ladas and Soudabeh Valicenti, University of Rhode Island (939-39-229)

8:00PM Using recurrence relations in Ramsey theory.
Preliminary report.
Aaron J. Robertson and Doron Zeilberger, Temple University (939-05-57)

8:30PM On the nonautonomous difference equation
William J. Briden, Gerry Ladas and Tim Nesemann, University of Rhode Island (939-39-297)

9:00PM Convergence theorems for iterative processes.
Zhivko S. Athanassov, Bulgarian Academy of Sciences, Sofia (939-39-1191)

MAA-ARUME Special Presentation

7:00 PM - 9:30 PM

Research on undergraduate mathematics education.
Organizer: Thomas P. Dick, Oregon State University
MAA-Young Mathematicians Network Panel Discussion

7:00 PM – 8:30 PM

Solving the two body problem.

Moderator: Gregory P. Dresden
Organizers: Philip E. Gustafson, Mesa State College
Gregory P. Dresden, Washington and Lee University

Panelists: Jean E. Taylor, Rutgers University
Elizabeth G. Yanik, Emporia State University
Albert W. Schueller, Whitman College

MAA Musical Presentation

7:30 PM – 9:00 PM

Eine Kleine Mathematische Nachtmusik.

Panelists: Eric Newirth, University of Vienna

MAA Special Presentation

7:30 PM – 9:00 PM

Student reports: Explorations in using the World Wide Web to enhance the teaching of mathematics.
Organizer: Donald B. Small, U. S. Military Academy

Friday, January 15

Joint Pi Mu Epsilon and MAA Student Chapter Advisors’ Breakfast

7:00 AM – 8:00 AM

Joint Meetings Registration

7:30 AM – 4:00 PM

MAA Session on The Use of Technology in Teaching Abstract Mathematics, II

7:30 AM – 9:55 AM

Organizer: Douglas E. Ensley, Shippensburg University

7:30 AM
Using Maple animations to show how linear transformations “morph” R3.
John F. Putz, Alma College (939-A1-435)

7:45 AM
Visualizing fundamental linear algebra concepts.
Steven Schlicker, Grand Valley State University (939-A1-683)

8:00 AM
Geometric intuition in complex variables a la Mathematica. Preliminary report.

8:15 AM
Can your computer do complex analysis?
Helmer Aslaksen, National Univ. of Singapore (939-A1-464)

8:30 AM
Illustrating the contraction mapping principle using Mathematica. Preliminary report.
Bruce W. Atkinson, Samford University (939-A1-422)

8:45 AM
Scientific Notebook as an instructional tool in the teaching of analysis.
Jonathan Lewin, Kennesaw State University (939-A1-152)

9:00 AM
Using CAS’s in teaching introductory abstract analysis.
Phil Novinger, Florida State University (939-A1-732)

9:15 AM
Introducing Fourier analysis via sound. Preliminary report.
John W. Davenport*, Georgia Southern University, and Sharon M. Bards, Georgia Southern University (939-A1-217)

9:30 AM
Visualizing a distribution of primes. Preliminary report.
Tomas M. Kalmar, California State University Monterey Bay (939-A1-1092)

9:45 AM
Cryptography for high school students. Preliminary report.
Aaron T. Ekstrom* and Alexander R. Perlis, The University of Arizona (939-A1-560)

AMS-MAA Special Session on Research in Mathematics by Undergraduates, I

8:00 AM – 10:50 AM

Organizers: John E. Meier, Lafayette College
Leonard A. VanWyk, James Madison University

8:00 AM
Cwatsets and groups - some parallels. Preliminary report.

8:30 AM
Digit loops, a curiosity of numbers extended to higher powers. Preliminary report.
Jeremy M. Dill* and Timothy W. Flood, Pittsburg State University (939-11-751)

9:00 AM
A length inequality for complete semigroup rings.
Leanne C. Leier*, Bucknell University, Hope College REU, and Raluca Muntean, Western Michigan University, Hope College REU (939-13-150)

9:30 AM
Constructing chains of excellent rings with local generic formal fibers.
Mark A. Florenz, Davina Kunvipsukul* and Junghee Yang, Williams College (939-13-89)

10:00 AM
Galois embedding problems and rational points on onics. Preliminary report.
F. Nathan E. Thiern, Macalester College (939-12-283)

10:30 AM
Fun with Gröbner bases: A new look at three old triangle theorems.
Joshua I. Hughes*, Lander University, and Kevin De Guelle, St. Norbert’s College (939-13-171)

AMS-AWM Special Session on Geometry in Dynamics, I

8:00 AM – 10:50 AM

Organizer: Krystyna Kuperberg, Auburn University

8:00 AM
The homeomorphisms of generalized Knaster continua and possible application to a problem posed by Ingram. Preliminary report.
James E. Keesling, University of Florida (939-58-748)

9:00 AM
Shift dynamics and topology. Preliminary report.
Judy A. Kennedy, University of Delaware (939-58-388)

9:30 AM
Blowup and fixed points, II (Preliminary report).
Christopher W. Stark, National Science Foundation and University of Florida (939-57-1122)
AMS Special Session on Commutative Algebra and Algebraic Geometry, I

8:00 AM - 10:50 AM
Organizers: Roger A. Wiegand, University of Nebraska and Purdue University
Susan Elaine Morey, Southwest Texas State University

8:00 AM Linkage classes and tensor products of algebras.
Mark R. Johnson, University of Arkansas
(939-13-665)

8:30 AM Filtrations of modules, the Chow group and the Grothendieck group.
C-Y. Jean Chan, University of Utah (939-13-728)

9:00 AM Applications of Goodwillie calculus in commutative algebra.
Miriam Ruth Kantrovitz, University of Illinois (939-13-625)

9:30 AM Finite projective dimension and ideals over isolated singularities.
David A. Jorgensen, University of Texas at Arlington (939-13-757)

10:00 AM Cohomology and cohomological varieties over complete intersections.
Lucaszar L. Avramov, Purdue University, and Ragnar-Olaaf Buchweitz, University of Toronto (939-13-790)

10:30 AM Computations of Buchsbaum-Rim multiplicities.
Elizabeth Jones, University of Utah (939-13-661)

AMS Special Session on Computational Algebraic Geometry for Curves and Surfaces, I

8:00 AM - 10:50 AM
Organizers: Mika K. Seppala, Florida State University
Emil J. Volcheck, National Security Agency

8:00 AM The algebraic closure of the Laurent series field in characteristic p.
Kiran Kedlaya, MIT (939-14-975)

8:30 AM An algorithm for determining possible zeta functions of curves over finite fields.
Kristin E. Lauter, University of Michigan (939-14-1097)

9:00 AM Break.

9:30 AM Computing Cartier points on curves.
Matthew H. Baker, UC Berkeley (939-14-381)

10:00 AM Factoring polynomials over local fields.
David Cantor, CCR-LaJolla (939-14-1153)

10:30 AM Third order splitting of genus two hyperelliptics.
Harvey Cohn, Center for Computing Sciences (939-14-376)

AMS Special Session on The Mathematics of the Navier-Stokes Equations, I

8:00 AM - 10:45 AM
Organizers: Peter A. Perry, University of Kentucky
Zhong-Wei Shen, University of Kentucky

8:00 AM Structural analysis of 2D incompressible flows.
Shouhong Wang, Indiana University (939-35-146)
San Antonio, TX, Friday, January 15 – Program of the Sessions

8:00AM - 10:00AM
Facilitating active learning: Concrete ways to foster student participation.
Organizer: Sandra L. Rhoades, Keene State College

MAA Minicourse #10: Part B
8:00AM - 10:00AM
Robust control of Navier-Stokes equations.
Organizer: Roger M. Temam, Indiana University (939-35-414)

MAA Minicourse #9: Part B
8:00AM - 10:00AM
Exploring abstract algebra through interactive labs.
Organizers: Allen C. Hibbard, Central College
Kenneth M. Levasseur, University of Massachusetts, Lowell

AMS Session on Algebraic Geometry
8:00AM - 9:40AM
Double meanders of real projective M-curves of degree 5. Preliminary report.
Anatoly B. Korchagin, Texas Tech University (939-14-79)

8:15AM
Complexity estimates of the Schmudgen positivstellensatz.
Elizabeth K. Mauch* and Gilbert Stengle, Lehigh University (939-14-209)

8:30AM
Weierstrass pairs and minimum distance of Goppa codes.
Gretchen L. Matthews, Louisiana State University (939-14-258)

8:45AM
Examples of differential operators on noncommutative rings. Preliminary report.
Uma N. Iyer, Indiana University (939-14-465)

9:00AM
A description of certain affine open subschemes that form an open covering of Hilb^n_{K[x]}
Mark E. Huibregtse, Skidmore College (939-14-530)

9:15AM
A generic cubic surface contains no involutive curves. Preliminary report.
Timothy C. McCune, Indiana University (939-14-543)

9:30AM
K₁ of curves over finite fields. Preliminary report.
Andrew E. Nestler, University of Southern California (939-19-561)

AMS Session on Linear Algebra
8:00AM - 10:25AM
The reduced echelon form of a matrix.

8:15AM
Systems of linear congruences with individual moduli.
David C. Torney*, Theoretical Division, and Jun Wang, Institute of Mathematical Sciences (939-15-238)

8:30AM
More cyclically-ordered sets. Preliminary report.
Michael I. Aissen, Rutgers University (939-15-745)

8:45AM
Mark A. Mills, Iowa State University (939-15-582)

9:00AM
On the stability of matrices.
Michael Y. Li* and Liancheng Wang, Mississippi State University (939-15-620)

9:15AM
Simple contractions of invariant operators.
Xiaorang Shen, Merrimack College (939-15-667)

9:30AM
Classes of Schur D-stable matrices.
Sivaram K. Narayan, Central Michigan University (939-15-713)

9:45AM
Matrix completions over principal ideal rings and good matrices. Preliminary report.
William H. Gustafson, Texas Tech University, R. Bruce Richter, Carleton University, Donald W. Robinson, Brigham Young University, and William P. Wardlaw*. U.S. Naval Academy (939-15-855)

10:00AM
Rectangular sets and complex symmetric matrices. Preliminary report.
Dipta S. Choudhury, Loyola College in Maryland (939-15-1021)

10:15AM
A theoretical algorithm for the closest matrices in the space of doubly stochastic matrices.
Raja N. Khoury, Collin County Community College (939-15-19)

AMS Session on Combinatorics, I
8:00AM - 10:40AM
An included-minor result for 3-connected graphs with contractible edges.
Galen Ellsworth Turner III, Louisiana State University (939-05-47)

8:15AM
Thomas Q. Sibley, St. John's University (939-05-67)

8:30AM
Binary De Bruijn cycles under different equivalence relations. Preliminary report.
Stephen G. Hartke, University of Dayton (939-05-182)

8:45AM
α-valuations of disconnected graphs.
Charles Vanden Eynden* and Saad El-Zanati, Illinois State University (939-05-271)

9:00AM
Graph isospectrality and representation equivalence. Preliminary report.
Gregory T. Quenell, Vassar College (939-05-290)

9:15AM
The opposition number of a quadrangulation of the 2-sphere.
Louis P. Zulli, Union College (939-05-316)

9:30AM
What is the correct way to seed a knockout tournament?
Allen J. Schwenk, Western Michigan University (939-05-331)

9:45AM
Maximal sets of Hamilton cycles in complete multipartite graphs. Preliminary report.
Mike Daven* and C.A. Rodger, Auburn University (939-05-335)

10:00AM
Inclusion-exclusion formulas used in lottery drawings. Preliminary report.
Joseph E. Chance, University of Texas-Pan American (939-05-377)

January 1999
Notices of the AMS
159
AMS Session on Applications, I

8:00 AM - 10:10 AM

8:00AM On a nonlinear functional differential equation for an age structured population with non constant delay. Preliminary report.
Sanjay Rai, Texas A&M International University (939-92-197)

8:15AM On the asymmetric May-Leonard model of three competing species.
Chia-Wei Chi, Tsing Hua University, Hsin-Chu, Taiwan, and Li-Iing Wu*, Purdue University, West Lafayette (939-92-247)

8:30AM The discrete Frenet frames and the study of protein structure, Part I: Theoretical aspects. Preliminary report.
Jeffrey K. Denny and John R. Quine*, Florida State University (939-92-522)

8:45AM The discrete Frenet Frame and Protein Structure, Part II: Applications to coiled proteins. Preliminary report.
Jeffrey K. Denny* and John R. Quine, Florida State University (939-92-523)

9:00AM Multiple time scales in ventricular fibrillation.
Omer Hotomaroglou, Harold M. Hastings*, Flavio H. Fenton, Hofstra University, Steven J. Evans, Long Island Jewish Medical Center, Alan Garfinkel, UCLA School of Medicine, Uriel Aivalos, Sabrina G. Novick, John Nilson, Hofstra University, and Fred J. Winter, Hofstra University and Suffolk Community College (939-92-1044)

Okan Gurel*, IBM, and Demet Gurel, Touro College (939-58-1089)

William G. Collier Jr, George Washington University (939-73-800)

9:45AM Equilibrium solutions of a nonlinear beam equation.
William G. Newman, Creighton University (939-73-1130)

10:00AM Mathematical modeling of fabrics, including explicit static deflection solution. Preliminary report.
James D. Walker, Southwest Research Institute (939-73-1196)

MAA Session on Quantitative Literacy, II

8:00 AM - 10:55 AM

Organizers: Barbara A. Jur, Macomb Community College
Richard A. Gillman, Valparaiso University
Jimmy L. Solomon, Georgia Southern University
Allen L. Pulsion, College of Science and Technology
Linda R. Sons, Northern Illinois University

7:40AM Moving beyond the first stage: Developing links to other academic disciplines.
Judith F. Moran* and Helen S. Lang, Trinity College (939-B1-1209)

8:00AM Quantitative literacy through "Math across the curriculum". Preliminary report.
Jerry A. Johnson, University of Nevada, Reno (939-B1-402)

8:20AM Discussion.

8:40AM Introducing quantitative literacy at Dominican University.
Paul R. Coe, Dominican University (939-B1-1199)

9:00AM Learning communities and computer based assignments for improving quantitative literacy among college freshmen.
Lyle Hallowell* and Arnold R. Silverman, Nassau Community College (939-B1-1193)

9:20AM An integrated introductory mathematics and computer science course.
Mark L. Kiespis* and Peter A. Cooper, Sam Houston State University (939-B1-642)

9:40AM Moving beyond the first stage: Developing links to other QL programs and other academic disciplines.
Judith F. Moran*, Trinity College, and Gove W. Effinger, Skidmore (939-B1-1208)

10:00AM An appropriate culminating mathematics course.
William E. Haver, Virginia Commonwealth University (939-B1-605)

10:20AM Web-based intermediate algebra minicourse.
Harris S. Shultz, California State University, Fullerton (939-B1-425)

10:40AM Precalculus preparation for college mathematics: A survey of South Carolina faculty.
J. Christopher Tisdale III, Danny W. Turner* and Gary T. Brooks, Winthrop University (939-B1-392)

MAA Session on Teaching Statistics: Teaching the Reasoning and New Technological Tools, I

8:00 AM - 10:55 AM

Organizers: Dexter C. Whittinghill, Rowan University
Franklin A. Wattenberg, National Science Foundation
Mary R. Parker, Austin Community College
Donald L. Bentley, Pomona College

8:00AM Introduction by Frank Wattenberg.

8:10AM Distance learning courses in statistics.
John D. McKenzie Jr., Babson College (939-C1-1001)

8:25AM Integration of multiple technologies in introductory statistics.
Gina F. Reed, Gainesville College (939-C1-332)

8:45AM Teaching statistics in a hi-tech classroom.
Brian E. Smith, McGill University (939-C1-482)

9:00AM Statistical thinking: A course in statistical reasoning using a laboratory approach. Preliminary report.
Barbara A. Wainwright* and Robert M. Tardiff, Salisbury State University (939-C1-339)

9:15AM Learning statistics through the use of interactive Web tools.
Sue B. Schou*, Idaho State University, and Teri S. Peterson, Idaho State University (939-C1-1161)

9:30AM A statistics teaching and resource library (STAR library) on the WWW.
Deborah J. Rumsey, Kansas State University (939-C1-221)
San Antonio, TX, Friday, January 15 – Program of the Sessions

9:50 AM  An internet database for teaching statistics.
    ▶ (626) Thomas W. Judson* and Lori J. Peterson,
    University of Portland (939-C1-323)

10:05 AM  Teaching the practice of statistics through student research and the use of popular media.
    ▶ (627) Nkechi M. Agwu, Borough of Manhattan Community College (939-C1-240)

10:20 AM  Statistical sampling over the Web for classroom examples.
    ▶ (628) Daniel H. Steinberg, Oberlin College (939-C1-1085)

10:35 AM  Using Web applets to assist statistics instruction.
    ▶ (629) Robin H. Lock, St. Lawrence University (939-C1-856)

MAA CUPM Subcommittee on Calculus Reform and the First Two Years-NSF Panel Discussion

8:00 AM - 9:20 AM

Forming the crystal ball for calculus.
Moderator: Chris Arney, U. S. Military Academy
Organizer: Donald B. Small, U. S. Military Academy
Panelists: Paul Zorn, St. Olaf College
David A. Smith, Duke University
Franklin A. Wattenberg, NSF
Donald B. Small

MAA Committee on Two-Year Colleges Panel Discussion

8:00 AM - 9:20 AM

Dual credit for mathematics courses taken in high school.
Moderator: Wade Ellis, West Valley College
Organizer: Mary Robinson, University of New Mexico-Valencia Campus Branch
Panelists: Gary L. Britton, University of Wisconsin-Washington County
Philip M. Cheifetz, Nassau Community College
Ann Davidian, McArthur High School, Levittown, NY
Kathleen K. Berver, New Mexico State University
Raymond J. Cannon Jr., Baylor University

MAA Panel Discussion

8:00 AM - 10:50 AM

Innovations in teaching assistant training.
Organizers: Teri Jo Murphy, University of Oklahoma
Suzanne M. Lenhart, University of Tennessee
Panelists: Patricia Shure, University of Michigan
James Epperson, Texas Tech University
Evelyn Wheland, University of Akron
Iris B. Fetta, Clemson University

Project NeXT-Young Mathematicians Network Poster Session

8:00 AM - 10:00 AM

Organizers: Kenneth A. Ross, University of Oregon

Kevin E. Charlwood, Washburn University

PME Council

8:00 AM - 11:00 AM

Mathematical Sciences Employment Register

8:15 AM - 7:30 PM

Interviews only.

AMS-MAA Special Session on The History of Mathematics, I

8:30 AM - 10:50 AM

Organizers: Karen H. Parshall, University of Virginia
Victor J. Katz, University of the District of Columbia

8:30 AM  G. H. Hardy's Oxford Years (1920-1931).
    ▶ (630) Robin J. Wilson, The Open University (939-01-187)

    ▶ (631) Bruce C. Berndt*, Youn-So Choi and Soon-Yi Kang, University of Illinois at Urbana-Champaign (939-11-231)

9:30 AM  Foundation issues in the 19th century British school: negative and complex numbers.
    ▶ (632) Patricia R. Allaire, Queensborough Community College, The City University of New York (939-01-202)

10:00 AM  On the development of certain numerical methods.
    ▶ (633) E. Kreyszig, Carleton University (939-01-375)

10:30 AM  The role and development of analysis and synthesis in ancient Greece and Medieval Islam.
    ▶ (634) Glen R. Van Brummelen, The King's University College (939-01-553)

AMS Special Session on Bergman Spaces and Related Topics, I

8:30 AM - 10:50 AM

Organizers: Peter L. Duren, University of Michigan, Ann Arbor
Michael Stessin, SUNY at Albany

8:30 AM  Aspects of the Friedrichs operator. Preliminary report.
    ▶ (635) Harold S. Shapiro, Royal Institute of Technology, Stockholm (939-30-86)

9:00 AM  Weights and majorants of Hilbert spaces of entire functions.
    ▶ (636) Yuri I. Lyubarskii and Kristian Seip*, Norwegian University of Science and Technology (939-30-575)

9:30 AM  Best approximation in the mean by analytic and harmonic functions. Preliminary report.
    ▶ (637) Dmitry Khavinson*, University of Arkansas, John E. McCarthy, Washington University, and Harold S. Shapiro, Royal Institute of Technology (939-41-21)

10:00 AM  Interpolating sequences in Bergman spaces and an example of non-corona for operators.
    ▶ (638) Eric M. Amar* and Chantal M. Menini, University of Bordeaux I (939-32-244)

10:30 AM  Multipliers for entire functions and an interpolation problem of Beurling.
    ▶ (639) Joaquin Ortega, Cerda*, University of Barcelona, and Kristian Seip, Norwegian University of Science and Technology, Trondheim (939-30-138)
AMS Special Session on Operator Algebras and Applications, I

8:30 AM - 10:50 AM
Organizers: Allan P. Donsig, University of Nebraska-Lincoln
Nick Weaver, Washington University

8:30 AM Finite rank approximation and semidiscreteness for linear operators. Preliminary report.
Christian G. Le Merdy, University of Houston (939-46-321)

9:00 AM Wavelets in Banach algebras, harmonic analysis of operators, and non-commutative geometry.
Vladimir V. Kisil, IMEM of Odessa Univ. (Ukraine) (939-46-87)

Gelu Pandian, Univ. Texas San Antonio (939-46-134)

10:00 AM Von Neumann inequalities.
Jim Agler, UC San Diego and John E. McCarthy*, Washington University (939-47-115)

10:30 AM A survey of Effros-Marechal topology.
Cark Winslow, Royal Dan. School of Ed. St. (939-46-142)

AMS Session on The Integral Role of the Two-Year College in the Preservice Preparation of Elementary School Teachers, I

8:30 AM - 10:55 AM
Organizers: Mercedes A. McGowen, William Rainey Harper College
Joanne V. Peeples, El Paso Community College
William E. Haver, Virginia Collaborative for Excellence in the Preparation of Teachers

8:30 AM A collaborative model for a teacher preparation institution and two year community colleges. Preliminary report.
Cheryl A. Lubinski* and Albert D. Otto, Illinois State University, Normal, Illinois (939-N1-1146)

8:50 AM Coalition for the Mathematical Preparation of Elementary Teachers (CoMPET).
Mark L. Klespis*, Sam Houston State University, Margaret R. Crider, Tomball College, James Polito, North Harris College, and Patricia M. Stone, Tomball College (939-N1-649)

9:10 AM The building of a seamless transition from Henry Ford Community College to the University of Michigan - Dearborn for preservice elementary school teachers.
Deborah Zopp*, Henry Ford Community College, and Roger Verhey, University of Michigan - Dearborn (939-N1-999)

9:30 AM The mathematics preparation of prospective elementary teachers: A summary of 13 case studies.
Denisse R. Thompson, University of South Florida (939-N1-1016)

Barbara J. Pence and Randall Charles*, San Jose State University (939-N1-558)

10:10 AM Collaborating to improve mathematics for prospective teachers.
Julie M. DePree*, University of New Mexico-Valencia, and Michele K. Diel, University of New Mexico-Valencia (939-N1-767)

10:30 AM Report from the National Science Foundation.
James H. Lighthorne, National Science Foundation (939-N1-927)

AMS Presentation

8:30 AM - 9:30 AM
Organizers: Ralph E. Youngen, AMS
Wendy A. Bucci, AMS

AMS Invited Address

9:00 AM - 9:50 AM
Combinatorics and analysis in the theory of subfactors.
Sorin Popa, University of California Los Angeles (939-05-02)

AMS Special Session on Dynamical, Spectral, and Arithmetic Zeta-Functions, I

9:00 AM - 10:50 AM
Organizers: Michel L. Lapidus, University of California, Riverside
Michiel van Frankenhuyzen, Institut des Hautes Etudes Scientifiques

9:00 AM A residue product for algebraic function fields over a number field. Preliminary report.
Xian-Jin Li, American Institute of Mathematics (939-11-128)

9:30 AM Complements to Li’s criterion for the Riemann hypothesis. Preliminary report.
Enrico Bombieri, Institute for Advanced Study, and Jeffrey C. Lagarias*, AT&T Labs (939-11-177)

10:00 AM Fast computation of the Riemann zeta function to arbitrary accuracy. Preliminary report.
William F. Galway, University of Illinois at Urbana-Champaign (939-11-129)

Andrew Odlyzko, AT&T Labs - Research (939-11-675)

MAA Special Presentation on the Legacy of R. L. Moore

9:00 AM - 9:00 PM
Organizers: Albert C. Lewis, Indiana University-Purdue University Indianapolis
Ben G. Fitzpatrick, North Carolina State University
Donald J. Albers, MAA

Book Sales and Exhibits

9:30 AM - 5:30 PM
MAA Committee on Calculus Reform and the First Two Years Panel Discussion

9:35 AM - 10:55 AM

The effect of calculus reform on student performance in subsequent courses.

Organizers: Jack Bookman, Duke University
Susan L. Gantner, Worcester Polytechnic University and AAHE
Herbert E. Kasube, Bradley University

Panelists: Susan L. Gantner
Jack Bookman
Judith Lee Baxter, University of Illinois at Chicago
John C. Polking, Rice University
Norman L. Webb, Wisconsin Center for Educational Research
Herbert E. Kasube

MAA Open Forum

9:35 AM - 10:55 AM

Educational Testing Service: Testing with technology—Sharing ideas to meet the challenges that lie ahead.

Organizer: Gloria S. Dion, Educational Testing Service

Presenters: Carol Jackson, ETS
Chancey O. Jones, ETS
Patricia Klag, ETS
Craig L. Wright, ETS

MAA-AMS-NCTM Panel Discussion

9:35 AM - 10:55 AM

The draft of the updated NCTM standards for school mathematics: An opportunity for your feedback.

Organizer: Joan Ferrini-Mundy, National Research Council

Panelists: Kathleen Heid, Pennsylvania State University
Judith Roitman, University of Kansas
Alan Schoenfeld, University of California-Berkeley

AMS Presentation

10:00 AM - 10:55 AM

Math e-journals and beyond.

Organizers: Ralph E. Youngen, AMS
Wendy A. Bucci, AMS

AMS Invited Address

10:00 AM - 10:55 AM

(657) Geometric physics.
Cumrun Vafa, Harvard University (939-00-130)

AMS-MAA Invited Address

11:10 AM - NOON

Joan Feigenbaum, AT&T Labs (939-00-01)

AMS Colloquium Lectures: Lecture III

1:00 PM - 2:00 PM

(659) Symplectic geometry from a dynamical systems point of view: III.
Helmut H. Hofer, Courant Institute (939-58-496)

ASL Invited Address

1:00 PM - 1:50 PM

(660) Title to be announced.
Chris Laskowski, University of Maryland

AMS-MAA Special Session on The History of Mathematics, II

1:00 PM - 4:50 PM

Organizers: Karen H. Parshall, University of Virginia
Victor J. Katz, University of the District of Columbia

1:00 PM

The first undergraduate prize in mathematics?
Robert Smith and his prize competition at Cambridge University.
June E. Barrow-Green, The Open University (939-01-245)

1:30 PM

Wilhelm Blaschke: The mathematician as political academic.
Sanford L. Segal, University of Rochester (939-01-212)

2:00 PM

Della D. Fenster, University of Richmond (939-01-468)

2:30 PM

R. L. Moore and innovations in mathematics education.
Albert C. Lewis, Indiana University, Indianapolis (939-01-417)

3:00 PM

The Gottingen context of Von Neumann’s work on Hilbert space. Preliminary report.
Matthew Frank, University of Chicago (939-01-673)

3:30 PM

Eisso J. Atzema, University of Maine (939-00-73)

4:00 PM

Paul R. Wolfson, West Chester University (939-01-499)

4:30 PM

Augustus De Morgan: The forgotten historian.
Adrian C. Rice, University of Virginia (939-01-169)

AMS-AWM Special Session on Geometry in Dynamics, II

1:00 PM - 5:50 PM

Organizer: Krystyna Kuperberg, Auburn University

1:00 PM

Conformal iterated function systems. Preliminary report.
R. Daniel Mauldin, University of North Texas (939-58-1187)

2:00 PM

Sudden changes in basins of attraction.
James A. Yorke and Helena E. Nusse, University of Maryland (939-00-1027)

2:30 PM

Knotted solutions to the Euler equations. Preliminary report.
John B. Etnyre, Stanford University, and Robert W. Ghrist, Georgia Institute of Technology (939-58-411)
AMS Special Session on Bergman Spaces and Related Topics, II

1:00 PM – 5:20 PM

Organizers: Peter L. Duren, University of Michigan, Ann Arbor
Michael Steissin, SUNY at Albany

1:00 PM
A condition for index two invariant subspaces. Preliminary report.
Alexandru Aleman*, Feruniversitaet Hagen, Stefan Richter*, University of Tennessee, Knoxville, and Carl Sundberg, University of Tennessee (939-47-415)

1:30 PM
Boundary behavior and the division property for invariant subspaces of Bergman spaces. Preliminary report.
Alexandru Aleman*, Feruniversitaet Hagen, Stefan Richter and Carl Sundberg, University of Tennessee, Knoxville (939-30-371)

2:00 PM
Carlson measures on Besov spaces. Preliminary report.
Nicola Arcozzi, University of Bologna, Richard Rochberg*, Washington University, and Eric Sawyer, Indiana Univ-Purdue Univ Indianapolis (939-46-405)

2:30 PM
An extension of the Hardy-Littlewood theorem.
Joseph A. Cima*, UNC, and Alexandru Aleman, Ferun University (939-30-371)

3:00 PM
An Hadamard maximum principle for biharmonic operators with applications to the Bergman spaces. Preliminary report.
Haakan P. Hedenmalm, Lund University (939-35-577)

3:30 PM
Reproducing kernels in weighted Bergman spaces and Dirichlet type spaces.
Serguem M. Shimorin, Lund University (939-46-740)

4:00 PM
Finite interpolation with minimum uniform norm in C. Preliminary report.
Eric Amar, Universite Bordeaux I, and Pascal J. Thomas*, Universite Paul Sabatier (939-32-91)

4:30 PM
The backward shift operator on the Bergman spaces.
William T. Ross, University of Richmond (939-30-162)

5:00 PM
Extremal problems for inclusions into weighted Bergman spaces. Preliminary report.
Dragan Vukotić, Univ. Autonoma de Madrid (939-47-230)

AMS Special Session on Probabilistic Combinatorics, II

1:00 PM – 4:20 PM

Organizers: Béla Bollobás, University of Memphis
Jeong Han Kim, Microsoft

1:00 PM
A first look at multi-type percolation. Preliminary report.
John C. Wierman, Johns Hopkins University (939-05-832)

1:30 PM
Dependent percolation. Preliminary report.
Paul N. Balister, Béla Bollobás*, University of Memphis, and Alan M. Stacey, University of Cambridge (939-60-1157)

2:00 PM
Scaling limits for minimal and random spanning trees in two dimensions.
Michael Aizenman, Princeton University, Almut Burchard, University of Virginia, Charles M. Newman, Courant Institute, and David B. Wilson*, Microsoft (939-60-972)

2:30 PM
Total path length for random recursive trees.
Robert P. Dobrow*, Truman State University, and James A. Fill, The Johns Hopkins University (939-05-88)

3:00 PM
Small complete arcs on finite projective planes.
Jeffrey Fill, Clinton University, and Peter J. Cameron, Queen Mary and Westfield College (939-05-871)

4:00 PM
Random walks on groups: How fast they mix and how to speed them up.
Igor Pak, Yale University (939-60-1148)

AMS Special Session on Commutative Algebra and Algebraic Geometry, II

1:00 PM – 5:50 PM

Organizers: Roger A. Wiegand, University of Nebraska and Purdue University
Susan Elaine Morey, Southwest Texas State University

1:00 PM
The algebraic geometry of a variety over a ring. Preliminary report.
Robert G. Underwood, Auburn University (939-14-447)

1:30 PM
Splitting of module-finite ring extensions and unmixing of group cohomology.
Nandini Ranganathan, University of Michigan (939-13-947)

2:00 PM
The tight integral closure of a set of ideals.
Melvin Hochster, Univ. of Michigan, Ann Arbor (939-13-930)

2:30 PM
Algebraic fundamental group of a curve singularity.
Hema Srinivasan* and Steven D. Cutkosky, University of Missouri (939-13-84)

3:00 PM
Test ideals in diagonal hypersurface rings of small prime characteristic. Preliminary report.
Moira A. McDermott, Gustavus Adolphus College (939-13-828)

3:30 PM
An algebraic approach to reductions of ideals, modules and algebras. Preliminary report.
Wolmer V. Vasconcelos, Rutgers University, New Brunswick (939-13-175)
AMS Special Session on Operator Algebras and Applications, II

1:00 PM – 5:50 PM

Preliminary report.

Organizers: Allan P. Donsig, University of Nebraska-Lincoln

1:00 PM

On the local structure of von Neumann algebraic preduals.

Edward G. Effros*, UCLA, and Zhong-Jin Ruan, University of Illinois (1939-46-779)

1:30 PM

The well-posed matrix completion problem.

Preliminary report.

Don W. Hadwin, University of New Hampshire, David R. Larson*, Texas A&M University, and Dan Timotin, Institute of Mathematics, Romanian Academy of Science (1939-47-1172)

2:00 PM

Meet irreducible ideals and nest representations.

Alan Hopenwasser, University of Alabama (1939-47-291)

2:30 PM

The curvature invariant of multivariable operator theory.

William B. Arveson, UC Berkeley (1939-47-124)

3:15 PM

Break.

4:00 PM

The maximal C*-algebra generated by an operator algebra, and application to modules of operators and Morita equivalence.

Preliminary report.

David P. Blecher, University of Houston (1939-46-273)

4:30 PM

Kernel estimates for generalized Segal-Bargmann spaces.

Preliminary report.

Richard Rochberg, Washington University (1939-47-805)

5:00 PM

Hochschild cohomology for von Neumann algebras with Cartan subalgebras.

Allan M. Sinclair, University of Edinburgh, and Roger R. Smith*, Texas A&M University (1939-46-739)

5:30 PM

Local lifting property for operator spaces.

Seung-Hyeok Kye, Seoul National University, and Zhong-Jin Ruan*, University of Illinois (1939-46-243)

AMS Special Session on Computational Algebraic Geometry for Curves and Surfaces, II

1:00 PM – 5:20 PM

Organizers: Mika K. Seppala, Florida State University

1:00 PM

On the irregularity of polarized surfaces of degree four whose adjoint bundles are not spanned.

Preliminary report.

Gian Mario Besana*, Eastern Michigan University, and Sandra Di Rocco, Royal Institute of Technology (1939-14-117)

1:30 PM

Sequence of valuation ideals associated to simple integrally closed ideals of small order.

Preliminary report.

Sunsook Noh, Ewha Womans University (1939-13-1013)

5:00 PM

The Izuimi-Rees theorem.

Irena Swanson, New Mexico State University (1939-13-993)

5:30 PM

Gorenstein modules and rings of finite Cohen-Macaulay type.

Preliminary report.

Graham J. Leuschke, University of Nebraska (1939-13-1042)

AMS Special Session on the Mathematics of the Navier-Stokes Equations, II

1:00 PM – 4:50 PM

Preliminary report.

Organizers: Peter A. Perry, University of Kentucky

1:00 PM

The normal form of the Navier-Stokes equations and decaying turbulence.

Ciprian Foias, Indiana University (1939-35-167)

2:00 PM

Uniform estimates on 3-D incompressible Navier-Stokes equations.

Preliminary report.

Gang Tian, MIT, and Zhouping Xin*, Courant Institute & CUHK (1939-35-361)

2:30 PM

Long-time behavior of the Stommel-Charney model of the Gulf Stream.

Shandy Hauk*, Chapman University, and Edriss S. Titi, University of California, Irvine (1939-35-503)

3:00 PM

Renormalization group method. Application to a slightly compressible fluid model.

Joana Moise*, Indiana University, and Mohammed Ziane, Texas A&M University (1939-35-356)

3:30 PM

Navier-Stokes equations in non-smooth manifolds.

Preliminary report.

Marius S. Mitrea, University of Missouri (1939-35-515)

4:00 PM

Zero dissipation limits of dissipative PDEs.

Jiahong Wu, University of Texas at Austin (1939-35-184)

4:30 PM

Large-time behavior for solutions of equations modeling the low-speed flow of a highly compressible fluid.

Preliminary report.

Diane L. Denny, James Madison University (1939-35-383)

MAA Minicourse #11: Part A

1:00 PM – 3:00 PM

Creating interactive texts in Mathematica.

Organizer: John R. Wicks, North Park University
MAA Minicourse #12: Part B

1:00 PM - 3:00 PM

Writing and the teaching of mathematics.
Organizers: John E. Meier, Lafayette College
Thomas W. Rishel, Cornell University

MAA Minicourse #6: Part A

1:00 PM - 3:00 PM

Cooperative learning in undergraduate mathematics education.
Organizers: Barbara E. Reynolds, Cardinal Stritch University
William E. Fenton, Bellarmine College

AMS Session on Probability and Statistics

1:00 PM - 5:25 PM

1:00 PM A numerical ODE to DeMoivre/Laplace.
(727) James L. Rulla, Lyon College (939-60-64)
1:15 PM The envelope of an oscillatory harmonizable process.
(728) Randall J. Swift, Western Kentucky University (939-60-113)
1:30 PM Some counterexamples in reproducing kernels.
(729) Milan N. Lukic, University of Wisconsin-Oshkosh (939-60-174)
1:45 PM Heavy traffic limit theorems for the closed Lu-Kumar network. Preliminary report.
(730) J. L. Steichen, University of Illinois at Urbana-Champaign (939-60-303)
2:00 PM Convergence and stability analysis of large scale parabolic systems under Markovian structural perturbations. Preliminary report.
(731) Mahmoud J. Anabtawi*, S. S. Sathananthan, Tennessee State University, and G. S. Ladde, The University of Texas at Arlington (939-60-509)
2:15 PM Stochastic heat equation on Lie groups. Preliminary report.
(732) Frederi G. Viens*, University of North Texas, and Samy Tindel, Universite de Paris XIII (939-60-374)
2:30 PM Waiting times and linear automata. Preliminary report.
(733) Ronald W. Gatterdam, University of Alaska Fairbanks (939-60-948)
2:45 PM Construction of multi-dimensional random probability measures via sequential barycenter arrays. Preliminary report.
(734) Michael G. Monticino*, University of North Texas, and Theodore Hill, Georgia Institute of Technology (939-60-964)
3:00 PM Analytical properties of multi-dimensional random probability measures. Preliminary report.
(735) LeRoy I. Valdes*, Michael G. Monticino, University of North Texas, and Theodore Hill, Georgia Tech (939-60-1003)
3:15 PM Large deviation estimates in ruin theory.
(736) Jinhua Jean Tao, Central Missouri State University (939-60-1103)
(737) German Hernandez* and Fernando Nino, University of Memphis (939-60-1171)

AMS Session on Multi-Education

1:00 PM - 5:55 PM

1:00 PM Helping students solve their own problems:
(745) Teaching the entire process of problem solving and mathematical modeling using student-generated projects in applied mathematics courses.
(746) Bruce Pollack-Johnson* and Audrey F. Borchardt, University of Wisconsin-Madison (939-98-59)
1:15 PM The uses of Maple in teaching abstract algebra.
(747) Kevin E. Charlwood, Washburn University (939-98-345)
1:30 PM Discovering number theory.
(748) Jeffrey J. Holt*, Randolph-Macon College, and John W. Jones, Arizona State University (939-98-385)
1:45 PM The Missouri undergraduate mathematics faculty enhancement project.
(749) Terry A. Goodman* and Rhonda L. McKee, Central Missouri State University (939-98-427)
2:00 PM Retention of concepts and skills in traditional and reformed applied calculus.
(750) Bradley E. Garner*, University of New Mexico, Albuquerque, and Lynn E. Garner, Brigham Young University (939-98-580)
2:15 PM Division algorithms and Taylor polynomials.
(751) M. Sayrafiwadeh, Medgar Evers College/CUNY (939-98-836)
2:30 PM History makes mathematics alive.
(752) Daina Taimina, University of Latvia and Cornell University (939-98-668)
2:45 PM A longitudinal study of the effects of integrating developmental algebra with college algebra.
(753) Timothy W. Flood, Pittsburg State University (939-98-681)
3:00 PM A mathematical structure for the chinese zodiac.
(754) John F. Lamb Jr., University of Mary Hardin-Baylor (939-98-785)
3:15 PM Using financial calculators in a business mathematics course.
(755) William H. Heller* and Monty B. Taylor, University of Texas-Pan American (939-98-804)
AMS Session on Functional Analysis and Approximation Theory

1:00 PM - 4:55 PM

1:00 PM  Some inequalities of double and single exponential type. Preliminary report.
David E. Edmunds, University of Sussex, and Ritva M. Hurri-Syrjanen*, University of Helsinki (939-46-53)

Suren A. Grigoryan, Kazan State University, and Thomas V. Tonev*, The University of Montana - Missoula (939-46-98)

1:30 PM  The product of a composition operator with the adjoint of a composition operator.
John H. Clifford*, Michigan State University, and Dechao Zheng, Vanderbilt University (939-46-255)

1:45 PM  Transformation group C*-algebras with bounded trace. Preliminary report.
Astrid an Huef, Dartmouth College (939-46-270)

2:00 PM  Remarks on Banach-Mazur problem about spaces with transitive group of isometries. Preliminary report.
Beata Randrianantoanina, Miami University (939-46-306)

2:15 PM  Applications of a Schauder decomposition in $X \otimes Y$. Preliminary report.
Elizabeth M. Bator, University of North Texas, and Dawn R. Slavens*, Mount Union College (939-46-319)

AMS Session on Partial Differential Equations

1:00 PM - 5:25 PM

1:00 PM  L^p estimates for the mixed boundary problem on a Lipschitz graph domain. Preliminary report.
Jeffery D. Sykes, University of Kentucky (939-35-60)

1:15 PM  Large amplitude torsional oscillations in the Tacoma Narrows Bridge. Preliminary report.
Kristen S. Moore, University of Connecticut (939-35-75)

1:30 PM  Bounded solutions of a nonlinear $\alpha$-harmonic equation with time delay. Preliminary report.
Joseph Wiener and Hushang Pookkarini*, University of Texas-Pan American (939-35-156)

1:45 PM  Weighted integral inequalities for solutions to the conjugate A-harmonic equation. Preliminary report.
Shusen Ding, University of Minnesota (939-35-183)

2:00 PM  Diffractive nonlinear geometric optics for short pulses. Preliminary report.
Deborah Alterman* and Jeffrey Rauch, University of Michigan (939-35-219)

2:15 PM  Blow-up of solutions of some nonlinear hyperbolic systems. Preliminary report.
Keng Deng, University of Southwestern Louisiana (939-35-251)
MAA Session on Mathematics Competitions, III
1:00 PM - 3:55 PM

Program of the Sessions - San Antonio, TX, Friday, January 15 (cont’d.)

2:30 PM An inverse boundary value problem for a
prestressed polycrystalline aggregate.
Robert L. Robertson, Texas A&M International
University (939-35-308)

2:45 PM An existence result for a class of superlinear
p-laplacian semipositive systems.
Hai Dang, Maya Chhetri* and Ratnasingham
Shivaji, Mississippi State University (939-35-395)

3:00 PM Beyond quenching for singular degenerate
semilinear reaction-diffusion equations.
C. Y. Chan* and Jian Yang, University
of Southwestern Louisiana (939-35-452)

3:15 PM Quenching in infinite time for singular degenerate
semilinear reaction-diffusion equations.
C. Y. Chan and Jian Yang*, University
of Southwestern Louisiana (939-35-453)

3:30 PM A method of lines analysis of pump propagation in
solid state lasers. Preliminary report.
Lila F. Roberts, Georgia Southern University
(939-35-483)

3:45 PM Progress in a two-dimensional inverse spectral
C. Maeve McCarthy, Murray State University
(939-35-650)

4:00 PM Transport equations and velocity averages.
Preliminary report.
Guergana Petrova Petrova, USC, Columbia, SC
(939-35-724)

4:15 PM A note on the positivity of nonnegative solutions for
semipositive problems.
Alfonso Castro, Univ. of Texas at San Antonio,
Maya Chhetri and Ratnasingham Shivaji*,
Mississippi State University (939-35-866)

4:30 PM A priori estimates for a semilinear elliptic partial
differential equation. Preliminary report.
Joseph A. Iaia, University of North Texas
(939-35-1005)

4:45 PM Polynomial motions of partial differential equations.
Preliminary report.
Andrzej W. Kedziersawski*, SUNY Geneseo, and N.
R. Nandakumar, Delaware State University
(939-35-1096)

5:00 PM A phase field model with memory. Preliminary report.
Sergiu Aizicovici, Ohio University, Maurizio
Grasselli, Politecnico di Milano, and Mark
McKibben*, Ohio University (939-35-1218)

5:15 PM A symmetry construction for the singular Yamabe
David L. Finn, Goucher College (939-58-108)

MAA Session on Mathematics Competitions, III
1:00 PM - 3:55 PM

Organizers: Harold B. Reiter, University of North
Carolina at Charlotte
Stephen B. Maurer, Swarthmore
College
William P. Fox, U. S. Military Academy
Susan Schwartz Wildstrom, Walt
Whitman High School, Bethesda, MD

1:00 PM The Virginia Tech Regional Mathematics Contest.
> (797) James E. Shockley, VA Tech (939-D1-552)

1:20 PM The Indiana College Mathematics Competition.
> (800) Elton Graves, Rose-Hulman Institute of Technology
(939-D1-827)

1:40 PM Discussion.

MAA Session on Ethical, Humanistic, and Artistic
Mathematics, II
1:00 PM - 2:50 PM

Organizers: Alvin M. White, Harvey Mudd College
Robert P. Webber, Longwood College
Stefanos P. Gialamas, Illinois Institute of
Art

1:00 PM Mathematics and the four great philosophical
questions.
> (807) Jerry P. King, Lehigh University (939-F1-390)

1:30 PM Senior seminar: Preparing computer and
mathematical sciences students for the future.
Preliminary report.
Ron Barnes* and Ken Oberhoff,
University of Houston-Downtown (939-F1-403)

1:45 PM The ethical dilemma of mathematics teaching.
Preliminary report.
Jerry P. King, Lehigh University (939-F1-301)

2:00 PM Introducing liberal arts students to the beauty of
abstract mathematics via computer graphics,
groups, and Pascal’s triangle (Preliminary Report).
Preliminary report.
Kathleen M. Shannon* and Michael J. Bardzell,
Salisbury State University (939-F1-301)

2:30 PM Teaching ethics in mathematics classes: Why and
how.
Bonnie J. Shulman, Bates College (939-F1-222)

MAA Session on Proofs in Mathematical Education
1:00 PM - 5:55 PM

Organizers: G. Joseph Wimbish, Huntingdon
College
Gary E. Davis, University of
Southampton

1:00 PM Student derivation of standard integral formulas.
> (612) Jerome Dancis, Univ of MD (939-G1-651)

1:15 PM Why should students learn the proof of the mean
value theorem in Calculus I? How should we assess?
Preliminary report.
Theresa L. Friedman, Bronxville Schools,
Bronxville, NY, and Martin Badolato,
Canton High School, Canton, MA (939-D1-875)

1:30 PM Making the transition from algorithm to proof:
What can history tell us? Preliminary report.
Janet Heine Barnett, University of Southern
Colorado (939-G1-176)
### San Antonio, TX, Friday, January 15 - Program of the Sessions

#### MAA Panel Discussion

1:00 PM - 2:30 PM

What math do teachers need to know?

Organizer: W. James Lewis, University of Nebraska

#### MAA CUPM Subcommittee on Calculus Reform and the First Two Years Poster Session

1:00 PM - 3:00 PM

College algebra reform.

Organizers: Donald B. Small, U.S. Military Academy
Sara Bush, Wiley College
Eugene J. Taylor, Grambling State University

#### AMS Special Session on Several Complex Variables, II

1:30 PM - 5:20 PM

Organizers: Emil J. Straube, Texas A&M University
Harold P. Boas, Texas A&M University
Marshall A. Whitley, Texas A&M University

1:30 PM Holomorphc images of $\mathbb{C}^n$.
Berit Stensones, Univ. of Michigan (939-32-837)

2:00 PM Proper holomorphic mappings from domains with $SL^1$-action.
Bernard Coupet, Alexander Sukhov, LATP, Universite de Provence, and Yifei Pan*, Indiana University-Purdue University Fort Wayne (939-32-24)

2:30 PM A general theory of shears.
Dror Varolin, University of Michigan (939-32-573)

3:00 PM Regularity of twisted Laplacians and biholomorphic maps.
Jeffery D. McNeal, Ohio State University, Columbus (939-32-589)

3:30 PM Polynomial approximation on submanifolds of strictly pseudoconvex hypersurfaces.

4:00 PM Analytic structure in fibered polynomial hulls.
Preliminary report.

Marshall A. Whitley, Texas A&M University (939-32-1090)

4:30 PM Teichmüller space of a closed subset of the Riemann sphere.
Sudeb Mitra, Cornell University (939-32-1082)

5:00 PM Cohomological hulls and supports of Dolbeault cohomology classes.
Robert Bakula, SUNY at Stony Brook (939-32-1145)

#### ASL Invited Address

2:00 PM - 2:30 PM
A barely $2_3^2$ degree.
Geoffrey L. LaForte, University of West Florida

#### AMS Special Session on Dynamical, Spectral, and Arithmetic Zeta-Functions, II

2:00 PM - 5:00 PM

Organizers: Michel L. Lapidus, University of California, Riverside
Machiel van Frankenhuysen, Institut des Hautes Etudes Scientifiques

2:00 PM Universality of correlations of zeros of random waves. Preliminary report.
Steve Zelditch, Johns Hopkins (939-81-688)

2:30 PM Artin L-functions of graph coverings. Preliminary report.
Audrey A. Terras* and Harold M. Stark, U.C.S.D. (939-11-568)
### Program of the Sessions – San Antonio, TX, Friday, January 15 (cont’d.)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Organizer/Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>3:00 PM</td>
<td>The Zeta function of an elliptic operator in vector bundle over the circle. Preliminary report.</td>
<td>Dan Burghelea, OSU (939-47-1004)</td>
</tr>
<tr>
<td>3:30 PM</td>
<td>The calculation of mass wave forms. Preliminary report.</td>
<td>Harold M. Stark, UCSD (939-11-1086)</td>
</tr>
<tr>
<td>4:00 PM</td>
<td>Discussion/open problems.</td>
<td></td>
</tr>
<tr>
<td>4:45 PM</td>
<td>Determinants of geometric operators. Preliminary report.</td>
<td>Kate Okikiolu, University of California, San Diego (939-51-1217)</td>
</tr>
</tbody>
</table>

#### MAA Session on Integrating Mathematics and Other Disciplines, I

**2:00 PM - 3:55 PM**

Organizers: William G. McCallum, University of Arizona
Nicholas T. Losito, SUNY at Farmingdale
Yajun Yang, SUNY at Farmingdale

- **2:00 PM** Bridging the gap between business calculus and economics with interactive computer illustrations.
  - Jean Marie McDill*, Cal Poly, and Agnes Rash, St. Joseph’s University (939-M1-929)
- **2:15 PM** Chaos in economics.
  - (845) James A. Walsh, Oberlin College (939-M1-692)
- **2:30 PM** Collaboration with business school colleagues and non-academics to redesign a course on business calculus, matrices, and linear programming. Preliminary report.
  - Bruce Pollack-Johnson* and Audrey F. Borchardt, Villanova University (939-M1-1124)
- **2:45 PM** Linking mathematics and the sciences via in-class experiments.
  - Sheldon P. Gordon*, SUNY at Farmingdale, and Florence S. Gordon, New York Institute of Technology (939-M1-520)
- **3:00 PM** A calculus course for biology students.
  - Charles W. Mullins, University of Central Arkansas (939-M1-765)
- **3:15 PM** Connecting mathematics, computer science and science: A computational science approach.
  - Ignatios E. Vakalis, Capital University (939-M1-541)
- **3:30 PM** Computer programming courses using Maple and Mathematica. Preliminary report.
  - David E. Betounes* and Mylan E. Redfern, University of Southern Mississippi (939-M1-517)
- **3:45 PM** Mathematical methods of image processing - A progress report on course development. Preliminary report.
  - Sean A. Broughton* and Edward R. Doering, Rose-Hulman Institute Of Technology (939-M1-853)

#### MAA Invited Address

**2:15 PM - 3:05 PM**

- (852) The role of research in improving school mathematics.
  - Jeremy Kilpatrick, University of Georgia (939-97-554)

#### NAM Granville-Brown Session of Presentations by Recent Doctoral Recipients in the Mathematical Sciences

**2:15 PM - 5:00 PM**

Moderator: William A. Massey, Lucent Technology, Bell Labs

#### RMMC Board of Directors

**2:15 PM - 4:10 PM**

- (853) What you can and can’t define in a model.
  - Michael Benedikt, Bell Laboratories

#### MAA Minicourse #14: Part A

**3:15 PM - 5:15 PM**

- An introduction to wavelets.
  - Organizer: Colm K. Mulcahy, Spelman College

#### MAA Minicourse #15: Part A

**3:15 PM - 5:15 PM**

- Music and mathematics.
  - Organizer: Leon Harkelroad, Bard College

#### MAA Panel Discussion

**3:15 PM - 4:45 PM**

Models for intervention projects.
Organizers: Robert E. Megginson, University of Michigan
Manuel P. Berriozábal, University of Texas at San Antonio
Panelists: Manuel P. Berriozábal
Florence Fasanelli, College-University Resource Institute, Inc.
William A. Hawkins Jr., SUMMA
Robert E. Megginson
Irvin E. Vance, Michigan State University
Charlene Morrow, Mount Holyoke College

#### MAA Teaching Awards Presentations

**3:20 PM - 5:00 PM**

Presenters: Joel V. Brawley, Clemson University
Robert W. Case, Northeastern University
Joan P. Hutchinson, Macalester College

#### MAA Session on Geometry in the Classroom in the Next Millennium, II

**4:00 PM - 7:00 PM**

- (854) Geometry Problem Solving Activities for Elementary Teachers.
  - Preliminary report.
  - Elizabeth D. Gray, Southeastern Louisiana University (939-H1-262)
Barbara J. Pence, San Jose State University (939-H1-557)

(856) Using dynamic geometry software in courses for the preparation of elementary teachers.
Vincent P. Schielack Jr., Texas A&M University (939-H1-1084)

(857) Students constructing geometry - Teaching without lecturing. Preliminary report.
John E. Wolfe, Oklahoma State University (939-H1-1112)

4:40PM Discussion.
5:00PM Geometry for K-8 Teachers Using History and Symmetry.

(858) Was Pythagoras Chinese?
David E. Zitarelli, Temple University (939-H1-421)

Helen Gerretson, University of Northern Colorado (939-H1-456)

(860) Eratosthenes' measurement of the Earth: A module for classroom use.
Kenneth R. Berg’, University of Maryland, and Karen Z. Benbury, Bowie State University (939-H1-633)

(861) Symmetry as a unifying concept in geometry for middle school teachers. Preliminary report.
David E. Kullman, Miami University (939-H1-679)

5:40PM Discussion.
6:00PM Writing and Investigations in Geometry.

(862) Geometry through constructions.
James A. Nickel, U Texas of the Permian Basin (939-H1-350)

(863) Using journals in college geometry. Preliminary report.
Deborah A. Sherman-Denvir, Marshall University (939-H1-690)

Sarah J. Greenwald, Appalachian State University (939-H1-895)

(865) Encouraging diverse geometric perspectives among in-service teachers.
Kelly Gaddis, SUNY College at Buffalo (939-H1-915)

6:40PM Discussion.

MAA Poster Session
4:00 PM - 7:00 PM
Undergraduate research by students.
Organizers: Aparna W. Higgins, University of Dayton
Mario U. Martelli, California State University-Fullerton

ASL Session for Contributed Papers
4:00 PM - 5:20 PM

ASL Session for Contributed Papers
4:00 PM - 5:20 PM

AMS Committee on Science Policy Government Speaker
4:20 PM - 5:10 PM

(866) The new age of exploration.
Rita Colwell, National Science Foundation

MAA Informal Session
5:00 PM - 7:00 PM
Actuarial education.
Organizers: James W. Daniel, University of Texas
Matthew J. Hassett, Arizona State University

NAM Banquet and Cox-Talbot Address
5:30 PM - 6:20 PM

(867) The end of one era, the dawn of another.
Johnny L. Houston, Elizabeth City State University

AMS Special Event
6:00 PM - 7:00 PM
Mathematical Reviews reception.

MAA-ARUME Special Presentation
7:00 PM - 10:00 PM
Research on undergraduate mathematics education.
Organizer: Thomas P. Dick, Oregon State University

MAA Formal Discussion
7:00 PM - 9:00 PM
Isolated teachers of statistics.
Organizer: Dexter C. Whittinghill, Rowan University

MAA Presentation
7:15 PM - 9:15 PM
An evening of poetry.
Organizer: Alvin M. White, Harvey Mudd College

MAA Student Lecture
7:30 PM - 8:20 PM

(868) Pianos and continued fractions.
Edward G. Dunne, American Mathematical Society (939-00-30)

AMS Special Session on Singularities in Algebraic and Analytic Geometry, VI
7:30 PM - 9:30 PM
Organizers: Caroline Grant Melles, U.S. Naval Academy
Ruth I. Michler, University of North Texas

7:30PM Discussions on and open problems in resolution or uniformization of singularities.
Saturday, January 16

Joint Meetings Registration
7:30 AM - 2:00 PM

MAA Session on Geometry in the Classroom in the Next Millennium, I
7:30 AM - 10:55 AM
Organizers: Colm K. Mulcahy, Spelman College
- (869) Using Dynamic Geometry Software with Majors and Preservice Secondary Teachers, I.
- (870) Using technology to connect the empirical and deductive aspects of the college geometry course.
- (871) Using technology to connect the empirical and deductive aspects of the college geometry course.
- (872) Enhancing "Modern Geometries" with technology.
- (873) Designing a dynamic geometry course.
- (874) Forging a more connected, and scientific geometry curriculum through student investigations of focus problems and geometrical curve drawing devices using the computer software Geometer's Sketchpad.
- (875) Teaching Non-Euclidean Geometry with Technology.
- (876) Exploring hyperbolic geometry with Poincaredraw.
- (877) Exploring geometry through Java-based software.
- (878) High and low technology in the geometry classroom.
- (879) A second geometry course: Discussion-based classes and informal texts.
- (880) Analytic taxicab geometry.
- (881) Geometry of the surface of the sphere for K-12 teachers.
- (882) A course in hyperbolic geometry and the topology and geometry of surfaces.

AMS-AWM Special Session on Geometry in Dynamics, III
8:00 AM - 10:40 AM
Organizer: Krystyna Kuperberg, Auburn University
- (883) Hausdorff measures versus equilibrium states of conformal infinite iterated function systems.
- (884) Semi-invariants of finite reflection groups.
- (885) Continuous sections in the action spectrum and applications.
- (886) The Euler equation and contact structures on solid tori.
- (887) Holomorphic curves and global systems of surfaces of section. Preliminary report.
- (888) Lyapunov exponents for birational maps.
- (889) On the dynamics of $S^1$-actions on Stein manifolds.
- (890) Branching structure of basins of attraction of the complex Henon map.
- (891) Uniformly perfect sets, rational semigroups, Kleinian Groups and iterated functions systems.
- (892) A connection on loop space. Preliminary report.
- (893) Some progress on a conjecture of Lech.
- (894) A course in hyperbolic geometry and the topology and geometry of surfaces.

AMS Special Session on Several Complex Variables, III
8:00 AM - 10:50 AM
Organizers: Emil J. Straube, Texas A&M University
- (895) Lyapunov exponents for birational maps.
- (896) On the dynamics of $S^1$-actions on Stein manifolds.
- (897) Branching structure of basins of attraction of the complex Henon map.
- (898) Uniformly perfect sets, rational semigroups, Kleinian Groups and iterated functions systems.
- (899) A connection on loop space. Preliminary report.
- (900) Some progress on a conjecture of Lech.
AMS Special Session on Computational Algebraic Geometry for Curves and Surfaces, III

8:00 AM - 10:50 AM

Organizers: Mika K. Seppala, Florida State University, and Emil J. Volcheck, National Security Agency

8:00 AM
About the numerical uniformization of real hyperelliptic curves. Preliminary report.
Peter Buser, EPF, Lausanne (939-53-1158)

8:30 AM
Equations for real hyperelliptic hyperbolic surfaces. Preliminary report.
Robert Silhol, Universite de Montpellier II (939-14-1075)

9:00 AM
Break.

9:30 AM
Experiments with polynomials having prescribed branch values. Preliminary report.
Kenneth Stephenson, University of Tennessee, Knoxville (939-30-634)

10:00 AM
Philip L. Bowers*, FSU, and Kenneth Stephenson, UTK (939-14-1109)

10:30 AM
Using circle packings to approximate conformal weldings.
George Brock, Williams, University of Tennessee (939-52-65)

AMS Special Session on the Mathematics of the Navier-Stokes Equations, III

8:00 AM - 10:45 AM

Organizers: Peter A. Perry, University of Kentucky, Zhong-Wei Shen, University of Kentucky

8:00 AM
Determining degrees of freedom for the Navier-Stokes equations.
Don A. Jones, Arizona State University (939-76-508)

8:30 AM
Additive turbulent decomposition of the Navier-Stokes equations: Structure and mathematical questions.
James M. McDonough, University of Kentucky (939-76-264)

9:00 AM
The additive turbulent decomposition method for the incompressible Navier-Stokes equations on thin three-dimensional domains.
Douglas A. Riley, University of Kentucky (939-65-617)

9:30 AM
Strong solutions to the incompressible Navier-Stokes equations in the half-space.
Marco Cannone, Fabrice Planchon, Universite Paris VII, and Maria Elena Schonbek*, University of California Santa Cruz (939-76-430)

10:00 AM
Approximation dynamics and the Navier-Stokes equations.
George R. Sell, University of Minnesota (939-35-263)

MAA Minicourse #11: Part B

8:00 AM - 10:00 AM

Creating interactive texts in Mathematica.
Organizer: John R. Wicks, North Park University

MAA Minicourse #16: Part B

8:00 AM - 10:00 AM

Using hand-held CAS throughout the mathematics curriculum.
Organizers: Wade Ellis, West Valley College, L. Carl Leinbach, Gettysburg College, and Bert K. Waits, Ohio State University

AMS Session on Topological Groups and Lie Groups

8:00 AM - 10:25 AM

8:00 AM
Inductive algebras for SL(2, R).
Murali K. Vemuri*, Colgate University, and Tim Steger, Universita degli studi di Sassari (939-22-178)

8:15 AM
Path-connected topological groups.
Laurie A. Edler, University of Southwestern Louisiana (939-22-608)

8:30 AM
Right simple subsemigroups and right subgroups of compact convergence semigroups.
Shing S. So, Central Missouri State University (939-22-885)

8:45 AM
Efficient bases for adjoint representations of semisimple Lie algebras.
Robert G. Donnelly, Murray State University (939-22-1083)

9:00 AM
Duality for flag domains. Preliminary report.
Joseph A. Wolf, University of California (939-22-1175)

9:15 AM
Wave graph bases of tensor invariants of classical Lie groups and algebras.
Aleksandrs Mikhailovs, SUNY College at Oneonta (939-22-1177)

9:30 AM
LCA groups with splitting subgroup of all compact elements and Pontryagin duality. Preliminary report.
Peter Loth, Sacred Heart University (939-22-52)

9:45 AM
On level two representations of $A_2^\infty$.
Robert T. Harger, High Point University (939-17-78)

10:00 AM
A unification of several results on nilpotent Lie algebras. Preliminary report.
Bill Yanksosky, North Carolina State University (939-17-346)

10:15 AM
Muntz-Szasz theorems for nilpotent Lie groups.
Darwyn C. Cook, Daniel Webster College (939-43-56)
AMS Session on Operator Theory

8:00 AM - 10:55 AM

8:00AM  

The abstract bane method in extension problems for almost periodic matrix functions. Preliminary report.

Leiba Rodman*, Ilya M. Spitkovsky and Hugo J. Woerdeman, College of William and Mary (939-47-33)

8:15AM  

Essential norm estimates of composition operators on the Bloch and Besov spaces.

Robert L. Donaway, University of Virginia (939-47-90)

8:30AM  

Hankel operators between Bergman spaces.

Ruhan Zhao, Kyoto University, Japan (939-47-207)

8:45AM  

Toeplitz operators on the Bergman and Hardy spaces. Preliminary report.

Kathryn M. Lewis, Purdue University (939-47-228)

9:00AM  

Boundary multiplicity and filling a hole in the essential spectrum. Preliminary report.

George R. Exner*, Bucknell University, and Bernard Chevreau, Universite de Bordeaux I (939-47-458)

9:15AM  

Composition operators acting between Hardy spaces.

Thomas E. Goebeler Jr., University of Virginia (939-47-614)

9:30AM  

A degree-theoretic approach for a variational inequality of Von Karmán type.

Dan D. Pascali, Courant Institute, NYU (939-47-749)

9:45AM  

Real C*-algebras, united K-theory, and the Küneth formula. Preliminary report.

Jeffrey L. Boersema, University of Oregon (939-47-802)

10:00AM  

Introversion operators. Preliminary report.

Amir A. Maleki, Howard University (939-47-878)

10:15AM  

Derivations of limit algebras.

Randall Crist*, Creighton University, Allan Donsig, University of Nebraska-Lincoln, Timothy Hudson, and Elias Katsoulis, East Carolina University (939-47-888)

10:30AM  

Semigroups of isometries of the Bergman space. Preliminary report.

William E. Hornor*, University of Southern Mississippi, and James E. Jamison, University of Memphis (939-47-1155)

10:45AM  

Grunsky transformation for the upper half plane.

Subhajit Ghosechowdhury, University of Missouri (939-47-1150)

AMS Session on Combinatorics, II

8:00 AM - 10:40 AM

8:00AM  

Large sets often have large partition regular structures. Preliminary report.

Vitaly Bergelson, Ohio State University, and Neil Hindman*, Howard University (939-05-505)

8:15AM  

Some properties of the conjugacy classes of the hyperoctahedral group. Preliminary report.

Robert V. Gill, Illinois Wesleyan University (939-05-516)

8:30AM  

Construction of partial difference sets using Galois rings. Preliminary report.

John E. Polhill Jr., University of Virginia (939-05-613)

8:45AM  

Permutations enumerated by The Schröder numbers.

Darla J. Kremer, Murray State University (939-05-623)

9:00AM  

O, IO, ICO matroids. Preliminary report.

Vadim Jonomarenko, University of Wisconsin, Madison (939-05-745)

9:15AM  

Turran problems for weighted graphs.

Andre Kundgen* and Zoltan Furedi, University of Illinois (939-05-773)

9:30AM  

Vertex partitions in directed graphs with bounded indegree.

Eric W. Araz, Texas A&M-Commerce (939-05-785)

9:45AM  

Root sets of polynomials modulo prime powers.

Daniel Maulik, Harvard University (939-05-809)

10:00AM  

Extreme problems on weighted graphs. Preliminary report.

John Allen Kuchenbrod, University of Kentucky (939-05-810)

10:15AM  

Complexity of vertex transitive graphs. Preliminary report.

Milan Randić, Drake University (939-05-840)

10:30AM  

Hypergraphical designs.

Cheryl L. Olsen, Shippensburg University (939-05-845)

AMS Session on Applications, II

8:00 AM - 9:40 AM

8:00AM  

An adaptive algorithm version of Kuhn's lone-divider method of fair division.

Bryan Dawson, Union University (939-90-312)

8:15AM  

Potential, recursive definitions and reduction to Shapley value, for values of cooperative T.U. games.

Irinel C. Dragan, University of Texas Arlington (939-90-426)

8:30AM  

A group decision and preference ranking based on fuzzy expert information.

Alexey L. Sadoski, Texas A&M University-Corpus Christi (939-90-596)

8:45AM  

An extremum problem with application to vibration suppression in a beam. Preliminary report.

N. G. Medhim*, Clark Atlanta University, and M. Sambandham, Morehouse College (939-49-664)

9:00AM  

Suppression of coupled parallel structural vibration systems via velocity feedback controllers.

Mahmoud Najafi, Kent State University (939-00-1119)

9:15AM  

Grand Canyon River Trip Simulator Project.

Preliminary report.

Catherine A. Roberts, Northern Arizona University (939-00-919)

9:30AM  

Nonlinear waves of a two layer compressible fluid.

Preliminary report.

Jeongwan Choi, Korea University, Seoul, Korea (939-76-1213)

MAA Session on Discrete Mathematics Revisited, II

8:00 AM - 10:55 AM

Organizers: Richard K. Molnar, Macalester College; Suzanne M. Molnar, College of St. Catherine

8:00AM  

Discrete mathematics: One person's view of the present and the future.

William A. Marion, Valparaiso University (939-11-299)

8:20AM  

Discrete mathematics: Queen and servant of computer science.

Wayne M. Dymacek, Washington and Lee University (939-11-489)
8:40AM Discrete mathematics for mathematics and computer science students.
  Nancy L. Hageljans, Ursinus College (939-J1-337)
9:00AM Introduction to discrete mathematics with ISETL.
  ► (953) Preliminary report.
  William E. Fenton, Bellarmine College (939-J1-250)
9:20AM Teaching and learning discrete mathematics through undergraduate research.
  Preliminary report.
  Anant P. Godbole, Michigan Tech University (939-J1-214)
9:40AM Establishing a summer program in discrete mathematics, Preliminary report.
  Glenn Acree* and Tosha Stanley, Belmont University (939-J1-1126)
10:00AM Constructivist hypertext support materials for post-secondary discrete mathematics courses aimed at retraining secondary teachers.
  Nancy Casey, Institute for Studies in Educational Mathematics and University of Idaho (939-J1-1088)
10:20AM Discrete mathematics: A basis and gateway for learning mathematics.
  Tabitha T. Mingus, Western Michigan University, and Richard M. Grassl*, University of Northern Colorado (939-J1-682)
10:40AM Discussion.

MAA Panel Discussion
8:00 AM – 9:20 AM
Life after retirement.
Organizer: Andrew Sterrett Jr., Denison University

AWM Workshop
8:20 AM – 4:00 PM

AMS-MAA Special Session on Research in Mathematics by Undergraduates, II
8:30 AM – 10:50 AM
Organizers: John E. Meier, Lafayette College
  Leonard A. VanWyk, James Madison University
  ► (958) Chaotic attractors and evolving planar symmetry.
9:00AM Computing homoclinic bifurcations. Preliminary report.
  Suzanne Michelle Shontz, University of Northern Iowa (939-34-294)
9:30AM Lengths of geodesics on Klein's quartic curve.
  Preliminary report.
  Ryan Derby-Talbot, Pomona College (939-14-1174)
10:00AM The geometry for $PSL_2(Z[i])$. Preliminary report.
  ► (961) Mary Elizabeth Cassells, Lafayette College (939-20-744)
10:30AM Investigations in polynomial knots.

AMS-MAA Special Session on The History of Mathematics, III
8:30 AM – 10:50 AM
Organizers: Karen H. Parshall, University of Virginia
  Victor J. Katz, University of the District of Columbia
  ► (963) The least time principle. Preliminary report.
  James J. McCary, Laredo Community College (939-01-524)
9:00AM Charles Hermite and Franco-German relations in mathematics, 1870-1885.
  ► (964) Thomas Archibald, Acadia University (939-01-69)
  ► (965) Daniel S. Alexander, Drake University (939-01-411)
10:00AM Some confusion surrounding early notions of convergence. Preliminary report.
  ► (966) Mark McKinzie*, University of Wisconsin, and Curtis Tuckey, Bell Laboratories (939-01-528)
10:30AM Why do we use 'm' for slope? Preliminary report.
  ► (967) Rickey A. Kolb, and V. Frederick Rickey*, U. S. Military Academy (939-01-911)

AMS Special Session on Bergman Spaces and Related Topics, III
8:30 AM – 10:50 AM
Organizers: Peter L. Duren, University of Michigan, Ann Arbor
  Michael Stessin, SUNY at Albany
  ► (968) Zero-free invariant subspaces in weighted Bergman spaces.
  Alexander Borichev, CNRS, University of Bordeaux I (939-46-329)
9:00AM On a theorem of W.K. Hayman. Preliminary report.
  Boris Korenblum, University at Albany, SUNY (939-30-68)
9:30AM Analytic functions having bounded variations of radial and orthogonal projections. Preliminary report.
  Thomas H. MacGregor, University at Albany, SUNY (939-30-63)
10:00AM Multiple interpolation and extremal functions in Bergman spaces.
  Haakan Hedenmalm, Lund University, Mark Krosky, University of Michigan, and Alexander Schuster*, Washington University (939-30-342)
10:30AM Wandering property in the Bergman space. Preliminary report.
  ► (971) Brent J. Carswell*, SUNY at Albany, Peter L. Duren, University of Michigan, and Michael I. Stessin, SUNY at Albany (939-30-76)

AMS Special Session on Operator Algebras and Applications, III
8:30 AM – 10:50 AM
Organizers: Allan P. Donsig, University of Nebraska-Lincoln
  Nik Weaver, Washington University
  ► (973) Analytic crossed products of Cuntz-Krieger algebras.
  Miron E. Shpigel, University of Waterloo (939-47-341)
9:00AM Epimorphisms of nest algebras.
Kenneth R. Davidson*, University of Waterloo,
Kenneth J. Harrison, Murdoch University, and John L. Orr, University of Nebraska (939-47-1029)

9:30AM Some primitive triangular operator algebras, their structure spaces and their epimorphisms.
Elias G. Katsoulis, East Carolina University (939-47-309)

10:00AM Outer automorphisms of TAF algebras (joint work with Steve Power). Preliminary report.
Justin R. Peters, Iowa State University (939-47-158)

Valentin Deaconu*, Alexander Kumjian, University of Nevada, Reno, and Paul S. Muhly, University of Iowa (939-46-404)

8:30 AM - 10:20 AM

8:30AM Complete sets of orthogonal frequency hypercubes and their connections to affine resolvable designs.
Ilene H. Morgan, University of Missouri-Rolla (978)

9:00AM Unexpectedly linear behavior for the Cahn-Hilliard equation.
Evelyn Sander, George Mason University (979)

9:30AM Subfactors and an algebra of paths on trees.
Bina Bhattacharyya, University of Ottawa/University of Rome (980)

10:00AM Subgroup separability: A blending of number theory, geometry, and topology.
Elizabeth S. Allman, University of North Carolina, Asheville (981)

8:30 AM - 10:00 AM

State standards.
Moderator: Henry Alder, University of California-Davis
Organizers: Kenneth A. Ross, University of Oregon
Joan F. Donahue, NASSMC
Panelists: Alice Gill, American Federation of Teachers
Ralph A. Raimi, University of Rochester
Presenters: Rolf Blank, Council of Chief State School Officers
Joseph Rosenstein, New Jersey Mathematics Coalition

9:00AM - 9:50 AM

Convex polytopes and partially ordered sets.
Rodica Simion, The George Washington University (939-05-1019)

9:00AM - 9:50 AM

Understanding automorphisms using templates.
Robert I. Soare, University of Chicago (983)

AMS Special Session on Dynamical, Spectral, and Arithmetic Zeta-Functions, III

9:00 AM - 10:50 AM

Organizers: Michel L. Lapidus, University of California, Riverside
Machiel van Frankenhuyzen, Institut des Hautes Etudes Scientifiques

9:00AM On zeros of linear combinations of Euler products.
Dennis A. Hejhal, University of Minnesota and Uppsala University (939-11-1202)

9:30AM The transfer operator approach to Selberg's zeta function for subgroups of the modular group. Preliminary report.
Dieter H. Mayer, University of Clausthal (939-58-370)

10:00AM Patterson's conjecture and the divisor of Selberg's zeta function for Kleinian groups.
Samuel J. Patterson, Universit"at Göttingen, and Peter A. Perry*, University of Kentucky (939-58-443)

10:30AM Dynamical zeta functions in Nielsen theory and Reidemeister torsion.
Alexander L Fel'shtyn, E.-M.-Arndt-Universitat Greifswald (939-58-697)

9:00 AM - 11:00 AM

Organizers: Julie Clark
Annie Selden, Tennessee Technological University
John Selden, MERC

9:00 AM - 9:00 PM

Organizers: Albert C. Lewis, Indiana University-Purdue University Indianapolis
Ben G. Fitzpatrick, North Carolina State University
Donald J. Albers, MAA

9:00 AM - 10:00 AM

Effective networking and research dialogue via teleconferences/telecommunication.
Moderator: Leon C. Woodson, Morgan State University
Panelists: James C. Turner, Arizona State University

9:00 AM - NOON

Interviews only.

9:00 AM - NOON

9:00 AM - NOON

176

NOTICES OF THE AMS

VOLUME 46, NUMBER 1
MAA Presentation

9:30 AM - 10:50 AM
Planning for retirement.
Organizer: Carol Shaw, MAA

NAM Business Meeting

10:00 AM - 10:55 AM

ASL Invited Address

10:05 AM - 10:55 AM

(988) Experimental mathematics: Insight from computation.
Jonathan M. Borwein, Simon Fraser University (939-68-81)

ASL Invited Address

10:20 AM - 11:10 AM

(989) Aspects of nonlocal compactness.
Slawomir J. Solecki, University of Indiana

AWM Graduate Student Poster Session

10:30 AM - 11:00 AM

10:30 AM Posters will remain on display all morning:

(990) The gain of regularity for the KP-II equation.
Julie L. Benson, Brown University

(991) Isothermic tori with planar lines of curvature.
Holly E. Bernstein, Washington University in St. Louis

(992) Twisted torsion on compact hyperbolic spaces.
Maria G. Fung, Cornell University

(993) On Artin’s conjecture for icosaedral representations.
Theresa Girardi, Rutgers University

(994) Hecke C*-algebras.
Rachel W. Hall, Pennsylvania State University

(995) Norms of powers and a central limit theorem for complex-valued probabilities.
Natalia A. Humphreys, Ohio State University

(996) Stochastic models of physical systems.
Edna W. James, Iowa State University

(997) Adams operations and the Dennis trace map.
(Miriam) Ruth Kantoravitz, University of Illinois at Urbana-Champaign

(998) The influence of two moving heat sources on blow-up in a reactive-diffusive medium.
Colleen Margarita Kirk, Northwestern University

(999) The behavior of relative entropy in the hydrodynamic scaling limit.
Elena Kosygina, Courant Institute of Mathematical Sciences, NYU

(1000) Another reason why exceptional Weyl groups are exceptional.
Amy E. Ksir, University of Pennsylvania

(1001) The relaxation limit in a biodegradation model.
Regan E. Murray, University of Arizona

(1002) Transport equations and velocity averages.
Guergana Petrova, University of South Carolina

(1003) Positivity preserving numerical schemes for lubrication type equations.
Liya Zhornitskaya, Duke University

MAA Business Meeting

11:10 AM - 11:40 AM

AMS Business Meeting

11:45 AM - 12:15 PM

ASL Invited Address

12:30 PM - 1:20 PM

(1004) Simple theories.
Anand Pillay, University of Illinois at Urbana-Champaign

AWM Workshop Panel Discussion

12:30 PM - 2:00 PM

Launching a career in mathematics.
Moderator: Catherine A. Roberts, Northern Arizona State University
Panelists: Susan C. Geller, Texas A&M University
Deborah Frank Lockhart, National Science Foundation
Elizabeth W. McMahon, Lafayette College

NAM William W.S. Claytor Lecture

1:00 PM - 2:00 PM

(1005) Maximum cliques and minimum colorings in graphs.
Earl R. Barnes, Georgia Institute of Technology (939-05-1030)

AMS-MAA Special Session on Research in Mathematics by Undergraduates, III

1:00 PM - 3:40 PM

Organizers: John E. Meier, Lafayette College
Leonard A. VanWyk, James Madison University

1:00 PM Weight distributions for certain codes. Preliminary report.

(1006) Sukaina Alarakhia*, Mount Holyoke College, Paul Lambert, Furman University, Tom Wexler, Amherst College, and Liangyi Zhao, Rutgers University (939-11-718)

2:00 PM Minimal volume maximal cusps.

(1007) Colin C. Adams, Williams College, David P. Biddle*, SUNY Binghamton, Carol A. Gwosdz, University of Dallas, Katherine A. Paur, MIT, and Scott B. Reynolds, Williams College (939-57-928)

3:00 PM The topological fundamental group and generalized covering spaces.

(1008) Daniel Biss, Harvard University (939-22-1206)

AMS-AWM Special Session on Geometry in Dynamics, IV

1:00 PM - 5:50 PM

Organizer: Krystyna Kuperberg, Auburn University

1:00 PM Fixed-point problems in continuum theory.

(1009) Charles L. Hagopian, California State University, Sacramento (939-54-450)

2:00 PM Some problems on 0-dimensional subsets of hyperspaces.

Alejandro Illanes, Universidad Nacional Autónoma de México (939-54-974)

2:30 PM Induced Maps on Knaster Continua. Preliminary report.

(1011) Piotr Minc, Auburn University (939-54-838)
Program of the Sessions – San Antonio, TX, Saturday, January 16 (cont’d.)

AMS Special Session on Operator Algebras and Applications, IV

1:00 PM – 4:20 PM

Organizers: Allan P. Donsig, University of Nebraska-Lincoln

Nik Weaver, Washington University

1:00 PM
Operator algebras, interpolation and computability. Preliminary report.

(1031) Vern Ival Paulsen, University of Houston (939-47-841)

2:00 PM
Regularity revisited. Preliminary report.

(1032) Charles A. Akemann*, UC Santa Barbara, and Soren Eilers, Copenhagen University (939-46-348)

3:00 PM
Structure theory of higher order Hankel forms. Preliminary report.

(1033) Sarah H. Ferguson*, Wayne State University, and Richard Rochberg, Washington University (939-47-942)

3:00 PM
Continuous maps between ideals spaces of C*-algebras. Preliminary report.

(1034) May M. Nilsen, University of Nebraska-Lincoln (939-46-938)

3:30 PM
Hochschild cohomology of operator algebras and duality. Preliminary report.

(1035) Corran Webster, Texas A&M University (939-47-1038)

4:00 PM
Problems and progress in non-self adjoint operator algebras. Preliminary report.

(1036) David R. Pitts, University of Nebraska (939-47-1144)

AMS Special Session on Commutative Algebra and Algebraic Geometry, IV

1:00 PM – 4:50 PM

Organizers: Roger A. Wiegand, University of Nebraska and Purdue University

Susan Elaine Morey, Southwest Texas State University

1:00 PM
A variation of a theorem off Vasconcelos.

(1023) Daniel A. Smith, University of Illinois (939-13-73)

1:30 PM
On the equations of the edge cone of a graph and some applications.

(1024) Rafael H. Villarreal, CINVESTAV-IPN (939-13-198)

2:00 PM
Asymptotic behaviour of Castelnuovo-Mumford regularity.

(1025) Steven Dale Cutkosky*, University of Missouri, Juergen Herzog, University of Essen, Germany, and N. V. Trung, University of Hanoi, Vietnam (939-13-702)

AMS Special Session on Computational Algebraic Geometry for Curves and Surfaces, IV

1:00 PM – 3:00 PM

Organizers: Mika K. Seppala, Florida State University

Emil J. Volcheck, National Security Agency

1:00 PM
Discussion and software demonstrations.

AMS Special Session on The Mathematics of the Navier-Stokes Equations, IV

1:00 PM – 3:20 PM

Organizers: Peter A. Perry, University of Kentucky

Zhong-Wei Shen, University of Kentucky
AMS Session on Topology

1:00 PM - 4:25 PM

1:00 PM A Lefschetz-type coincidence theorem.
Organizer: Leon Harkelroad, Bard College

1:15 PM Coincidences of maps into homogeneous spaces.
Peter Saveliev, University of Illinois at Urbana-Champaign (939-55-121)

1:30 PM On the RO(G)-graded equivariant ordinary cohomology of generalized G-cell complexes for G = Z/p.
Kevin K. Ferland, Virginia Tech (939-57-861)

1:45 PM The Hopf ring for the spectrum BO.
Dena S. Cowen, John Carroll University (939-55-716)

2:00 PM Duals of stable summands of BZ/p.
David J. Hunter, North Central College (939-55-741)

2:15 PM Positionings of essential tori in link complements.
Val Pinciu, Southern Connecticut State University (939-55-1134)

2:30 PM Visualizing space-filling curves with fractals and web publishing.
Mark D. Meyerson, U.S. Naval Academy (939-55-137)

2:45 PM On Sorgenfrey's half-open square convergence.
Jama P. Ambasht, Benedict College (939-54-756)

3:00 PM Some contractible manifolds with disjoint spines.
Manuel J. Sanders III, University of Tennessee (939-57-583)

3:15 PM Group-categories and their field theories.
Frank Quinn, Virginia Tech (939-57-861)

3:30 PM Applications of the disjoint homotopies property to products of generalized manifolds with the line.
Denise M. Halverson, University of Tennessee at Knoxville (939-57-880)

3:45 PM Generating expressions for finite type invariants from oriented trivalent graphs.
Daylene Zielinski, Bellarmine College (939-57-1113)
AMS Session on Combinatorics, III

1:00 PM - 3:25 PM

1:00 PM The average connectivity of a graph. Preliminary report.
Lowell W. Beineke*, Indiana University Purdue University Fort Wayne, Ortrud R. Oellermann, The University of Winnipeg, and Raymond E. Pippert, Indiana University Purdue University Fort Wayne (939-05-857)

1:15 PM Chromatic polynomials and their extreme graphs. Preliminary report.
Italo Simonelli, Texas A&M University-Commerce (939-05-382)

1:30 PM Asymptotic comparisons of forbidden patterns. Preliminary report.
Alexander Burstein, University of Rhode Island (939-05-949)

1:45 PM Avoidable sets in groups, and another special property of the Fibonacci sequence.
Michael L. Develin, Harvard University (939-05-1036)

2:00 PM Rectangle-visibility layouts of unions and products of trees. Preliminary report.
Alice M. Dean*, Skidmore College, and Joan P. Hutchinson, Macalester College (939-05-1049)

Norman J. Finizio and Adele J. Merritt*, University of Rhode Island (939-05-1067)

2:30 PM Some specializations of pitch tournament designs. Preliminary report.
Norman J. Finizio and Scott J. Lewis*, University of Rhode Island (939-05-1115)

2:45 PM Candies and dollars. Preliminary report.
Saad M. Adnan, MVSU, Itta Bena, MS (939-05-1205)

3:00 PM Limiting distributions for characteristics of random interval graphs and random coincidence graphs. Preliminary report.
Bernard Harris, University of Wisconsin, Madison (939-05-1205)

3:15 PM Vertex-neighbor-integrity of expanders, magnifiers, and hypercubes. Preliminary report.
March J. Gambrell, University of Chicago (939-05-289)

AMS Session on Convex Geometry

1:00 PM - 1:40 PM

1:00 PM On the geometry of locally nonconical convex sets. Preliminary report.
Glenn C. Shell, Lincoln University of Missouri (939-52-29)

1:15 PM Secondary polytopes of two-dimensional point sets with few interior points. Preliminary report.
Wendy A. Weber, University of Kentucky (939-52-684)

1:30 PM The Moon, the Sun, and convexity. Preliminary report.
Noah S. Brannen, Samford University (939-52-237)

MAA Session on Innovative Use of Distance Learning Techniques to Teach Post-Secondary Mathematics, II

1:00 PM - 5:05 PM

Organizers: Brian E. Smith, McGill University
Marcelle Bessman, Jacksonville University

1:00 PM An experience to share: A hard beginning but worth it. Preliminary report.
Jose H. Giraldo, Texas A&M University-Corpus Christi (939-05-1287)

1:00 PM Applications projects as course threads. Preliminary report.
(1079) Dick Jardine, U.S. Military Academy (939-K1-819)

1:30 PM Quaking mathematics. Preliminary report.
(1080) Richard J. Marchand, U.S. Military Academy (939-K1-671)

2:00 PM A mathematical investigation in physics: PDEs and the hydrogen atom. Preliminary report.
Terry T. Crow, Kelley B. Mohrman* and Joseph D. Myers, U.S. Military Academy (939-K1-232)

2:30 PM Interdisciplinary projects in numerical analysis. Preliminary report.
Richard D. West, U.S. Military Academy (939-K1-419)

3:00 PM Data rich projects from geo-, aero- and biosciences. Preliminary report.
Bruce N. Lundberg, University of Southern Colorado (939-K1-148)

3:15 PM Losing your head in linear algebra—Using computer graphics to enjoy linear transformations. Preliminary report.
Elsa J. Newman, Marymount University (939-K1-272)

3:30 PM Helping students solve their own problems: Teaching the entire process of problem solving and mathematical modeling using student-generated projects in applied mathematics courses. Preliminary report.
Audrey F. Borodzick* and Bruce Pollack-Johnson, Villanova University (939-K1-1132)

3:45 PM Real-data projects in elementary and intermediate algebra. Preliminary report.
Elaine M. Hubbard, Kennesaw State University (939-K1-239)

4:00 PM Calculus and blood hematocrit. Preliminary report.
(1087) Phil Gustafson, Mesa State College (939-K1-952)

4:15 PM Using hotel, restaurant, tourism administration applications to increase interest in calculus. Preliminary report.
Ronald J. Harshbarger and Jane T. Upshaw*, University of South Carolina Beaufort (939-K1-797)

4:30 PM Project based teaching and learning mathematics for nonmathematics majors. Preliminary report.
Paul Kochanowski* and Mortesza Shafi-Mousavi, Indiana University South Bend (939-K1-252)

4:45 PM Interdisciplinary undergraduate research projects. Preliminary report.
Elias Deeba, Andre deKorvin, and Xie Shishen*, University of Houston-Downtown (939-K1-1192)

5:00 PM Special topics in applied mathematics. Preliminary report.
Alexandra Kurepa, North Carolina A&T State University (939-K1-586)
MAA Session on Integrating Mathematics and Other Disciplines, III

1:00 PM - 5:25 PM

Organizers: William G. McCallum, University of Arizona
Nicholas T. Losito, SUNY at Farmingdale
Yajun Yang, SUNY at Farmingdale

1:00PM (1106) Partnerships: Interdisciplinary workshops for faculty in mathematics and partner disciplines. Preliminary report.
Tina H. Straley, Kennesaw State University, and Brian J. Winkel*, U.S. Military Academy (939-M1-1116)

David R. Burns, West Virginia Wesleyan College (939-M1-1046)

1:30PM S.C. ATE - pre engineering technology curriculum - an integrated approach.
Elizabeth T. Higgins* and Michael H. Farmer, Greenville Technical College (939-M1-903)

1:45PM An integrated pre-engineering curriculum.
> (1109) Preliminary report.
Phillip L. Zener* and Thomas Shumpert, Auburn University (939-M1-901)

2:00PM Integrating mathematics and environmental engineering.
Dick J. Jardine, U.S. Military Academy (939-M1-818)

2:15PM The integrated engineering curriculum at Louisiana Tech University.
Bernd Siegfried Walter Schröder* and Jenna Price Carpenter, Louisiana Tech University, Ruston, LA (939-M1-454)

2:30PM A math, science, and technology interdisciplinary program: the application of mathematics at the United States Military Academy.

2:45PM Integrated math/physics at Union College.
> (1113) Preliminary report.
Julius B. Barbanel, Union College (939-M1-511)

3:00PM Moving beyond moving beyond myths.
> (1114) George T. Rublein, College of William and Mary (939-M1-1033)

3:15PM Incorporation of industry applications with classroom instruction.
Patty G. Monroe* and Elizabeth T. Higgins, Greenville Technical College (939-M1-890)

3:30PM Formal demography in the classroom.
> (1116) Lyn H. Geisler III, Randolph-Macon College (939-M1-825)

3:45PM Joint projects in a general education program.
> (1117) Philip S. Blau, College of General Studies, Boston University (939-M1-793)

4:00PM Physics does not equal math, but talking helps.
> (1118) Jon L. Johnson* and Marie Baehr, Elmhurst College (939-M1-801)

4:15PM A truly interdisciplinary mathematics/s science course. Preliminary report.
Philip E. McNeill, Norfolk State University (939-M1-549)

4:30PM An interdisciplinary science course for the non-science major.
Linda C. Thiell, Ursinus College (939-M1-527)

4:45PM Linking mathematics and business.
> (1121) Florence S. Gordon*, Sharon Petrushka and Anna Silverstein, New York Institute of Technology (939-M1-518)

5:00PM Integrating mathematics and electrical engineering technology: Workshops for students in electric circuits I.
Yajun Yang*, Arlene Kleinstein, Yellshpur Dathati and Marjanee Issapour, SUNY-Farmingdale (939-M1-662)

5:15PM Symbolic dynamics for Math, CS, and EE.
> (1123) Brian P. Hopkins, Seattle University (939-M1-946)

MAA Session on The Integral Role of the Two-Year College in the Preservice Preparation of Elementary School Teachers, II

1:00 PM - 5:05 PM

Organizers: Mercedes A. McGowen, William Rainey Harper College
Joanne V. Peeples, El Paso Community College
Program of the Sessions - San Antonio, TX, Saturday, January 16 (cont’d.)

MAA Committee on the Teaching of Undergraduate Mathematics Panel Discussion
1:00 PM – 2:20 PM

Teaching collaborations between graduate departments, in mathematics at four-year institutions, and community colleges.
Organizer: Pamela E. Matthews, American University
Panelists: Paul Latlal, Portland State University
Janet P. Ray, Seattle Central Community College
Ginger Warfield, University of Washington

MAA Committee on the Mathematical Education of Teachers Panel Discussion
1:00 PM – 2:20 PM

Improved teacher preparation: What mathematics departments can do.
Organizer: James Loats, Metropolitan State College of Denver

SUMMA Special Presentation
1:00 PM – 2:20 PM

Intervention programs for minority precollege students.
Organizer: William A. Hawkins Jr., SUMMA
Presenters: Manuel Berrioza, University of Texas-San Antonio
Claudette Bradley-Kawagley, University of Alaska-Fairbanks
Max Warshauer, Southwest Texas State University

MAA Workshop
1:00 PM – 3:00 PM

Integrating active learning techniques into lectures.
Organizer: Sandra L. Rhoades, Keene State College

ASL Invited Address
1:30 PM – 2:20 PM

Computable aspects of ordered groups.
Reed Solomon, University of Wisconsin

AMS Special Session on Several Complex Variables, IV
1:30 PM – 4:20 PM

Organizers: Emil J. Straube, Texas A&M University
Harold P. Boas, Texas A&M University
Marshall A. Whittlesey, Texas A&M University

1:30 PM
The holomorphic extension of \( H^p \) - CR functions on tube submanifolds.
Albert Boggess, Texas A&M University
(939-32-706)

2:00 PM
Loredana Lanzani, University of Arkansas at Fayetteville (939-31-268)
2:30PM  Sobolev estimates for the d-bar Neumann problem on some domains in $C^2$ where the infinite type points form a regularly closed set in the boundary. Preliminary report.
Marcel K. Sucheston, Texas A&M University (939-32-1011)

3:00PM  The Bergman kernel on monomial polyhedra.
Chieh-Hsien Tiao, Purdue University (939-32-285)

3:30PM  Sobolev estimates for the d-bar Neumann problem on pseudoconvex Lipschitz domains.
Mei-Chi Shaw, Univ. of Notre Dame (939-32-712)

4:00PM  A Riemann zeta function associated to sub-Laplacian on the unit sphere in $C^n$. Preliminary report.
Der-Chen E. Chang*, University of Maryland, College Park, and Song-Ying Li, University of California, Irvine (939-32-466)

**Special Poster Session**
1:30 PM - 3:30 PM

Guided student exploration as a means of learning mathematics.
Organizer: Harriet Pollatsek, Mount Holyoke College

**AMS Special Session on Dynamical, Spectral, and Arithmetic Zeta-Functions, IV**
2:00 PM - 5:00 PM

Organizers: Michel L. Lapidus, University of California, Riverside
Machiel van Frankenhuysen, Institut des Hautes Etudes Scientifiques

2:00PM  Complex dimensions of self-similar fractal strings.
Michel L. Lapidus and Machiel van Frankenhuysen*, University of California, Riverside (939-58-84)

2:30PM  Zeros of the Riemann zeta-function, complex dimensions of fractal strings, and geometric and spectral oscillations.
Michel L. Lapidus* and Machiel van Frankenhuysen, University of California, Riverside (939-58-85)

3:00PM  Approximately self-similar measures and their zeta-functions. Preliminary report.
Gabor Elek*, Mathematical Institute of the Hungarian Academy of Sciences, and Michel L. Lapidus, University of California at Riverside (939-28-154)

3:30PM  Small eigenvalues and Hausdorff dimension of sequences of hyperbolic 3-manifolds.
Carol E. Fan*, Pepperdine University, and Jay Jorgenson, Oklahoma State University (939-58-343)

4:00PM  Discussion/open problems.

**AWM Presentations by Recent Women Ph.D.s, II**
2:00 PM - 3:50 PM

2:00PM  Hecke structure of spaces of modular forms.
Sharon M. Frechette, Wellesley College (1147)

2:30PM  Curves over finite fields and applications in modern technology.
Kristin Lauter, University of Michigan (1148)

3:00PM  Test ideals and computations in tight closure.
Moira McDermott, Gustavus Adolphus College (1149)

3:30PM  Gauss maps of minimal hypersurfaces with finite total scalar curvature.
Helen Moore, Stanford University/Bowdoin College (1150)

**AMS Invited Address**
2:15 PM - 3:05 PM

1151  Undercompressive shocks in thin film flow.
Andrea L. Bertozzi, Duke University (939-35-42)

**MAA Special Presentation**
2:30 PM - 4:10 PM

Mobilization to support higher achievement in mathematics.
Organizer: Linda P. Rosen, U.S. Department of Education

**ASL Invited Address**
2:40 PM - 3:30 PM

1152  Club sets and large cardinals.
William J. Mitchell, University of Florida

**ASL Session for Contributed Papers**
4:00 PM - 5:20 PM

**ASL Session for Contributed Papers**
4:00 PM - 5:50 PM

**AMS Banquet**
6:30 PM - 10:00 PM

Susan J. Friedlander
AMS Associate Secretary
Chicago, Illinois

James J. Tattersall
MAA Associate Secretary
Providence, Rhode Island
Meetings and Conferences of the AMS

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 is available on the World Wide Web at www.ams.org/meetings/.

Meetings:

1998

November 14-15 Tucson, Arizona p. 107

1999

January 13-16 San Antonio, Texas p. 107

March 12-13 Gainesville, Florida p. 109

March 18-21 Urbana, Illinois p. 111

April 10-11 Las Vegas, Nevada p. 113

April 24-25 Buffalo, New York p. 114

May 19-22 Denton, Texas p. 114

July 12-16 Melbourne, Australia p. 115

September 25-26 Salt Lake City, Utah p. 116

October 2-3 Providence, Rhode Island p. 116

October 8-10 Austin, Texas p. 116

October 15-17 Charlotte, North Carolina p. 117

2000

January 19-22 Washington, DC p. 117

April 1-2 Lowell, Massachusetts p. 117

April 7-9 Notre Dame, Indiana p. 118

April 14-16 Lafayette, Louisiana p. 118

June 12-15 Odense, Denmark p. 118

August 7-12 Los Angeles, California p. 118

Important Information Regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 150 in the January 1998 issue of the Notices for general information regarding participation in AMS meetings and conferences.

Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of TeX is necessary to submit an electronic form, although those who use LaTeX or AMS-LaTeX may submit abstracts with TeX coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html or send mail to abs-submit@ams.org, typing help as the subject line, and descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Meetings & Conferences Department, AMS, P.O. Box 6887, Providence, RI 02940. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

Conferences: (See http://www.ams.org/meetings/ for the most up-to-date information on these conferences.)

1999:


Cosponsored Conference:

Methods and Applications of Mathematics

Treats that part of Analysis with direct or potential applications to biological and physical sciences.

Table of Contents

* Uniform L1 boundedness of solutions of hyperbolic conservation laws
  Tai-Ping Liu and Tong Yang

* Asymptotic solutions of linear ordinary differential equations at an irregular singularity of rank unity,
  F. W. J. Olver

* Best Constants in one-sided weak-type inequalities,
  A. B. J. Kuijlaars

* Multinomial Ratio (Paul Erdos solves a problem)
  K. L. Chung

* Periodicity in diffractive age-structured SEIR models.
  W. Fitzgibbon, J. Morgan, and M. Parrott

Mathematical Research Letters

Mathematical Research Letters is dedicated to rapid publication of high quality research announcements, complete papers, and expository articles in all areas of mathematics.

Table of contents

* Nonabelian integrable systems, quasideterminants, and Mochizuki lemmas,
  Pavel Etingof, Israel Gelfand, and Vladimir Retakh

* Principal G-invariant curves over elliptic curves
  Robert Friedman, John W. Morgan, and Edward Sitten

* The longest increasing subsequence in a random permutation and a unitary random matrix model,
  Kurt Johansson

* Contact geometry and the index of Fourier integral operators
  Charles Epstein and Richard Melrose

Journal of Combinatorics

The print version of the Electronic Journal of Combinatorics, a pioneering electronic journal since 1994.

Table of Contents

* Perfect matchings in epilongraphs, G. Alon, V. Rödl, and A. Rucinski

* Combinatorial Aspects of Multiple Zeta Values,
  J. M. Borwein, D. M. Bradley, J. D. Broadhurst, and P. Lisonek

* Multi-strict enumeration of two-stack sortable permutations,
  M. Bousquet-Mézou

* Random walks on generating sets for finite groups
  F. P. K. Chung and R. L. Graham

* Overlapping pfaffians, Donald E. Knuth

Journal of Differential Geometry

The journal founded by C.C. Hsiung. Now in its 33rd year as the leading journal in its field. Subscription includes free Surveys in Differential Geometry volume.

Table of Contents

* Symplectic submanifolds and almost-complex geometry,
  S. K. Donaldson

* Twistor Spaces, Einstein Metrics, and Isomonodromic deformations,
  N. J. Hitchin

* Eternal Solutions to the Ricci flow,
  R. S. Hamilton

* The existence of anti-self-dual conormal structures, C.H. Taubes

Asian Journal of Mathematics

Promoting the exchange of mathematics between the countries of Asia and the remainder of the world.

Table of Contents

* Short Time Behavior of Logarithmic Derivatives of the Heat Kernel
  Daniel W. Stroock and James Terskay

* Mirror Principle I. Dong H. Liu, Kefeng Liu, and Shing-Tung Yau

* The 14-dimensional Kervaire Invariant and the Sporadic Group
  M. R. James Milgram

* Rigidity for Asymptotically Manifolds with pi1=SLn(R)
  E. T. Farrell and L.E. Jones

Advances in Theoretical and Mathematical Physics

This new journal furthers the cross fertilization of mathematics and physics.

Table of Contents

* Integration over the u-Plane in Donaldson Theory
  G. Moore, E. Witten

* Categorical Mirror Symmetry: The Elliptic Curve, A. Polishchuk

* Black Holes and Calabi-Yau Threefolds C. Vafa

* Rank 2 Integral Systems of Prym Varieties, J.C. Hartshorne

Communications in Analysis and Geometry

Publishing on classical analysis, partial differential equations, algebraic geometry, differential geometry, and topology.

Table of Contents

* Sobolev Spaces and Harmonic Maps for Metric Space Targets,
  N. J. Korevaar and Richard M. Schoen

* Flips of Moduli Spaces and Transition Formulas for Donaldson Polynomial Invariants of Rational Surfaces.
  Robert Friedman and Zhubo Qin

* Four-Manifolds with Positive Isotropic Curvature
  Richard Hamilton

IP Series

35% OFF STANDING ORDERS FOR SERIES
NEW 1999 INTERNATIONAL PRESS CATALOGUE
IS NOW AVAILABLE! WE HAVE MUCH MORE TO OFFER!
Fax: (617) 491-6779, Call: (617) 491-0329 or Visit http://www.intlpress.com