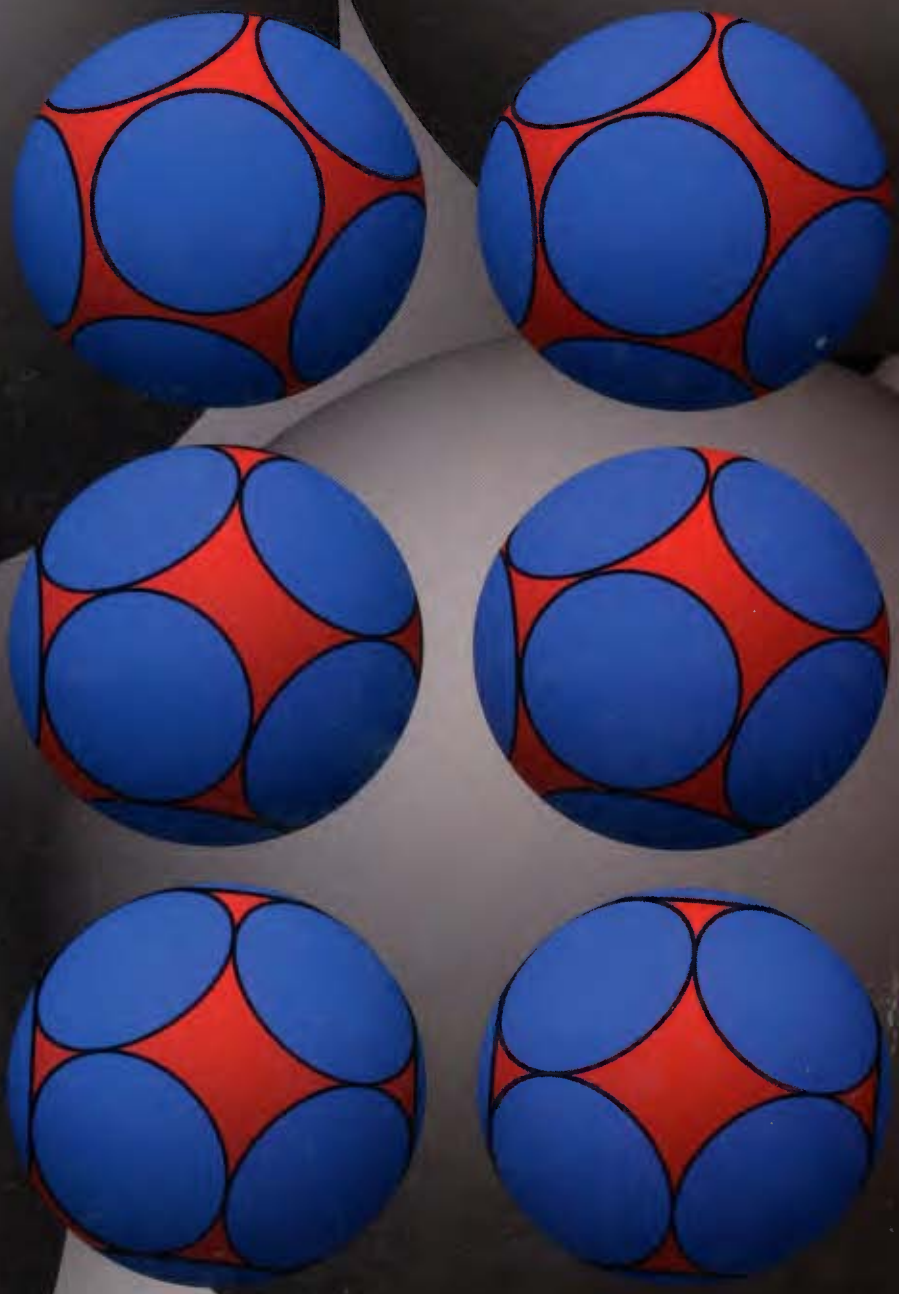
# Notices

of the American Mathematical Society

September 2004 Volume 51, Number 8





*Kissing in Motion (see page 883)*

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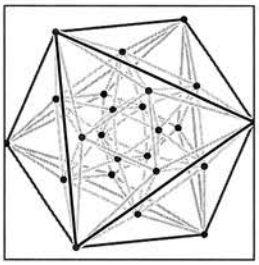
## Feature Articles







## Communications



## Commentary

# Notices

of the American Mathematical Society

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**SUBSCRIPTION INFORMATION:** Subscription prices for Volume 51 (2004) are $401 list; $321 institutional member; $241 individual member. (The subscription price for members is included in the annual dues.) A late charge of 10% of the subscription price will be imposed upon orders received from nonmembers after January 1 of the subscription year. Add for postage: Surface delivery outside the United States and India—$20; in India—$40; expedited delivery to destinations in North America—$35; elsewhere—$87. Subscriptions and orders for AMS publications should be addressed to the American Mathematical Society, P.O. Box 845904, Boston, MA 02284-5904 USA. All orders must be prepaid.

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[*Notices of the American Mathematical Society* is published monthly except bimonthly in June/July by the American Mathematical Society at 201 Charles Street, Providence, RI 02904-2294 USA, GST No. 12189 2046 RT****. Periodicals postage paid at Providence, RI, and additional mailing offices. POSTMASTER: Send address change notices to *Notices of the American Mathematical Society*, P.O. Box 6248, Providence, RI 02940-6248 USA.] Publication here of the Society's street address and the other information in brackets above is a technical requirement of the U.S. Postal Service. Tel: 401-455-4000, email: `notices@ams.org`.





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# Departments



# From the AMS Secretary

# How Mathematicians Can Contribute to K–12 Education

As the so-called "Math Wars" calm down, many mathematicians and mathematics educators are now working together in order to, if you will, "win the peace". But as our political leaders have discovered in Afghanistan and Iraq, this is not as easy as one might wish it were. On the ground one finds complications that are often not noticed from a distance. These include state-adopted standards for K–12 education, pressure from the new federal law known as "No Child Left Behind" (NCLB), and high-stakes tests on which students' graduation and teachers' jobs depend.

Over the last several years I have reviewed many of the new state standards for school mathematics and have participated in numerous discussions about the changing landscape of standards and high-stakes testing. Based on this experience, I offer four suggestions for how mathematicians can constructively contribute to the improvement of K–12 mathematics education.

• Notwithstanding serious problems of clarity in many state standards—problems that are being addressed in most states—the variation in mathematics expectations among state standards is far less than the variation in mathematical preparation of teachers (or subsequently in the mathematical proficiency of their students). Not surprisingly, the mathematical proficiency of teachers is more important than the wording of standards in determining what students learn. *Thus, mathematicians should focus first on the mathematical preparation of teachers (which is, after all, one of higher education's most important obligations).*

• Increasingly, high-stakes exams conflict with high performance standards. When teachers' jobs or students' graduation are on the line as the result of scores on a single test, it becomes very difficult to maintain political consensus on the value of high performance standards. One state after another is postponing, reducing, or evading the consequences of students' failure (or sometimes merely the prediction of failure) to meet the ideals of high standards. *To preserve momentum for high standards, mathematicians should advocate policies that judge students, teachers, and schools using multiple criteria rather than single high-stakes tests.*

• Overly specific standards obscure the rich internal connections of mathematics and lead to an atomized "check-off" approach to pedagogy and assessment. In sharp contrast, the 2001 National Research Council study *Adding It Up* stresses that mathematical proficiency consists of several "interwoven and interdependent" strands: namely, conceptual understanding, adaptive reasoning, procedural fluency, productive disposition, and strategic competence. These same five elements (albeit in different words) anchor the discussion of mathematical understanding in *Standards for Success*, a recent consensus report on what students need to know and be able to do to succeed in entry level university courses. *Thus in any discussion of K–12 standards and assessment, mathematicians should advocate balance not only of content but also among these interwoven strands of mathematical proficiency.*

• Many state mathematics standards have been rightly criticized for including statements that are unclear, incorrect, or meaningless. But without well-chosen sample problems, even carefully crafted standards cannot accurately convey the degree of cognitive sophistication desired to achieve appropriate mathematical proficiency. Rhetoric alone, even when clear and correct, cannot communicate mathematical understanding. For example, "solve systems of 2 x 2 linear equations" is perfectly clear but omits any sense of complexity concerning the nature of variables or coefficients. Adding restrictions such as "integer coefficients" adds clarity but, by limiting expectations, contributes to the atomization of learning. *To help students experience the power of mathematical thinking, mathematicians should create and contribute exemplary problems that convey important aspects of mathematical thinking.*

During the last two decades the standards movement has achieved many good results, not least public recognition of the increasing breadth and utility of mathematics, the importance of mathematics in the education of all students, and the value of striving for high aspirations. But the thin, repetitive, and disconnected rhetoric of standards too often undercuts their potential; they become just a list of bullets arranged in some partially arbitrary linear order. By its very nature—its *essential* nature—mathematics is interconnected and multidimensional, where distant parts link through logic and common structure. Rich problems can convey the distinctive cohesiveness of mathematics in a way that narrative standards never can.

In short, mathematicians can best contribute to the K–12 standards movement by offering problems—problems that provoke, problems that surprise, problems that expand minds. What problems would attract and stretch fifth-grade students? What problems would entice eighth-grade students to continued study of mathematics? What problems must a high-school graduate be able to do in order to succeed in today's high-performance workplace? What problems will make teachers (or prospective teachers) into better teachers?

These are not the problems normally found on standardized tests or college placement exams. Neither are they examples designed to illustrate one or another standard, nor are they the template questions favored by test item writers. We really do not need more of these kinds of problems. Both to prepare teachers to think mathematically and to broaden students' mathematical experience, we need a rich collection of thought-provoking problems that will exercise the interconnected skills of conceptual understanding, adaptive reasoning, procedural fluency, productive disposition, and strategic competence. To adapt a trite expression, one problem that makes students think mathematically is worth a hundred standards that just tell students what they should think.

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*This article is adapted from remarks from a panel discussion at the January 2004 Joint Mathematics Meetings in Phoenix sponsored by the AMS Committee on Education on the topic "The evaluation of state mathematics standards: How can mathematicians contribute?".*

# Letters to the Editor

## Alternative Freshman Mathematics

I would like to offer a suggestion for improving mathematics education at colleges in the U.S. I wish that freshman mathematics education did not always begin with calculus. For many people (particularly, I think, those of a philosophical or poetic turn of mind), calculus is a terrible place to start.

I took calculus in high school and found it so unsatisfactory that I quit studying math for ten years. (Mathematics is important to me, and I was severely depressed during this decade without mathematics.) I made very good grades, so no one listened to me when I complained that calculus made no sense to me. When I returned to the study of mathematics, I learned real analysis. After this, calculus made sense.

I recently read a book (*Everything and More: A Compact History of Infinity*, by David Foster Wallace) which recalled to me all my frustrations with calculus. The author, Mr. Wallace, states that he has hated and done badly in every mathematics class he has ever taken. Both this book and the novel *Infinite Jest* make clear that Mr. Wallace is fascinated by the theorems of calculus but sometimes misinterprets them. I do not think that he has ever taken a course in pure mathematics. *Everything and More* contains many errors and misleading statements. But what I notice most is that Mr. Wallace, a very intelligent person, has sought mathematical knowledge in several college math classes and has been shamefully shortchanged. I fear that this happens to many students who are not majoring in engineering or physics.

I propose that there be two standard mathematical curricula in college rather than just one. One track would begin with calculus in what is now the usual way. The other would begin with pure mathematics. Calculus would follow real analysis, not the other way around.

Currently I teach a course called Discrete Mathematics, which is actually an introduction to set theory, logic, and mathematical proof. The official prerequisite for this course is two semesters of calculus. I really don't think this makes sense. Some freshman have no trouble with calculus. For others, the standard calculus class is profoundly unsatisfying. Some people need to learn analysis before they can be comfortable with calculus. If we could offer two standard tracks—one that begins with calculus and one that begins with pure mathematics—I think that more people in this country would be able to understand and enjoy mathematics.

It would be easy to make this change. Please, let's try it.

—*Amy Babich*
*Austin, Texas*

(Received March 14, 2004)

## Role of Mathematics, As They Think of It

PISA (Programme for International Student Assessment) is a major international programme for investigation of the quality of school education. It estimates knowledge and skills of 15-year-old school students in three domains: reading literacy, mathematical literacy, and scientific literacy. Its main proclaimed aim is to test how well the students are prepared for solving problems of everyday adult life. So, looking at the mathematical part of its tests, we have a chance to learn finally how our science can be used in this life.

I quote in italics PISA's program document available via `www.pisa.oecd.org/Docs/Download/PISAFrameworkEng.pdf`. *Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded mathematical judgements and to engage in mathematics, in ways that meet the needs of that individual's current and future life as a constructive, concerned and reflective citizen.*

In testing mathematical literacy, *questions are organised in terms of three "competency classes" defining the type of thinking skill needed. Class 1: reproduction, definitions, and computations. Class 2: connections and integration for problem solving.* (Well, I use connections and integration to solve mathematical problems, so probably I am in the second class.) *Class 3: mathematical thinking, generalisation and insight.*

Example of problems from Class 1: *Solve the equation* $7x - 3 = 13x + 15$. From Class 2: *Mary lives two kilometers from school, Martin five. How far do Mary and Martin live from each other?* (No, I am not in this class...)

And finally Class 3, the top level of mathematics applications in the adult life of a "constructive, concerned and reflective citizen".

*In a certain country, the national defense budget is $30 million for 1980. The total budget for that year is $500 million. The following year the budget is $35 million, while the total budget is $605 million. Inflation during the period covered by the two budgets amounted to 10 per cent.*

*a) You are invited to give a lecture for a pacifist society. You intend to explain that the defense budget decreased over this period. Explain how you would do it.*

*b) You are invited to lecture to a military academy. You intend to explain that the defense budget increased over this period. Explain how you would do this.*

In this problem, mathematics is considered just as a tool for political prostitution and dirty manipulation with data and uncertain notions. To get a maximal mark for it, one should have no idea that in solving a problem, one should first decide *for himself* what is the truth in this problem, after which the suggestion that in one case he "intends to explain" something opposite is absolutely insulting. (A soft discussion of ethic aspects is given in the book where this problem occurred first, but no trace of it is reproduced in this fundamental document.)

This document was issued in 1999 and is acknowledged by national educational organizations of thirty-two countries conducting this assessment. All these years, nobody cried out with horror, as I do now; doesn't it mean that all its readers and implementors (mainly school teachers and other educators) agree with its "identification and understanding of the role that mathematics plays in the world"? What have we done to deserve this shame?

The same document quotes a list of mathematical "big ideas", including chance, change and growth, space and shape, etc. However, it misses (and undermines) the basic idea of science: that of Objective Truth, which roughly is as follows. Everybody solving a problem should

(1) acknowledge the existence of objective truth, independent of our desires, presumptions, or abilities to describe it;

(2) try to discover it, being ready to accept it in any shape and form in which it will occur to us; and

(3) be ready to defend it after that in all legal ways, respecting one's right to have a different opinion—but not two at the same time!

A fundamental role of science is the dissemination and strengthening of this boring truism in our quite deceitful world.

And the last question: How should one rely on this investigation? What is *its* subtask b)?

*—V. A. Vassiliev*
*Steklov Mathematical Institute*

(Received April 19, 2004)

## Alternative Journal Pricing

Gerard van der Geer's article on *Compositio* in the May issue of the *Notices* shows a line of action which editors can take if they own the name of a journal and are worried about the price. In most cases, however, the publishers own the title.

The editors of *Topology*, in discussion with the publishers, came up with another route a few years ago. There is now an alternative subscription which offers immediate electronic access to the journal with paper copies at the end of the year for half the price of the standard subscription (which incidentally gives a figure less than *Compositio*'s new price). Since the driver for much of the current discussion on open access is the immediate availability of online versions, this in principle offers what many consumers want.

What the future holds is anybody's guess, but we are nowadays used to the fact that there is no single price for an airline ticket or a cellular phone contract. Everything depends on a balance of delivery methods, forward planning, and volume. Maybe that is what we should expect in scientific publishing.

*—Nigel Hitchin*
*Editor,* Topology

(Received May 20, 2004)

## Coding Theory and the Genetic Code

It might be said that the mathematical community today has three wishes: a wish for greater public recognition, a wish to attract talented men and women into the field, and a wish to increase funding levels. What can be done to make these wishes come true? No single achievement would do as much to improve the public image of mathematics as a forceful application of the theory of codes to the structure of DNA sequences. Imagine the result if a single child's life could be saved in this way: mathematicians would appear on the cover of *Time*.

An open mind about possible models will be crucial to any attempt to apply coding theory to the genetic code. To hint at the possibilities, I will sketch a newly noticed parallel between DNA sequences which code for proteins and arguments in Aristotelian logic.

For logical purposes Aristotle classified sentences into four types: A (universal affirmative), I (particular affirmative), E (universal negative), and O (particular negative). For Aristotle, the basic kind of argument is the syllogism. A syllogism is a sequence of three sentences and so is coded by a triplet in the AEIO code. For example "All men are mortal; Socrates is a man; Socrates is mortal" has the code AAA. A proof in Aristotelian logic is a sequence of syllogisms and so has a sequence of triplets in the AEIO code as its code.

Proteins are coded for by a sequence of triplets in the TAGC code, each of which codes for an amino acid, where T = Thymine, A = Adenine, G = Guanine, and C = Cytosine. For example, the triplet GCA codes for Alanine, and CAACAC codes for Glutamine, followed by Histidine. Chargaff's Rules $T \leftrightarrow A$ and $G \leftrightarrow C$ are analogous to the Medieval Square of Opposition $A \leftrightarrow O$ and $E \leftrightarrow I$. There are twenty-one amino acids and three stop codons, for a total of twenty-four. There are fifteen universally valid forms of the syllogism and nine conditionally valid forms, for a total of twenty-four.

When will coding theory be applied to the genetic code?

*—Sherwood Washburn*
*Seton Hall University*

(Received May 26, 2004)

## Wu's Comment on Roitman Letter

Professor Roitman's remarks about the fostering of geometric intuition are well taken. I was at fault for not being sufficiently precise: one must spend time to build up prospective teachers' geometric intuition, but most of the class time must still be devoted to the mathematics of the school classroom. I sincerely hope that the lonely reference to the work by B. Braxton and myself would be interpreted more as an implicit criticism of the vacuum that at present exists in the literature than as an attempt at self-advertisement, Professor Roitman's recommendations notwithstanding.

*—H. Wu*
*University of California, Berkeley*

(Received June 16, 2004)

## Correction

The August 2004 issue of the *Notices* carried my article "Has the Women-in-Mathematics Problem Been Solved?". On page 778, the text of the article says that 46 of the Ph.D.'s granted between 1995 and 2003 in the Department of Computational and Applied Mathematics at Rice University were granted to women. A percent sign was inadvertently dropped; the correct figure is 46%, not 46.

*—Allyn Jackson*

# Kissing Numbers, Sphere Packings, and Some Unexpected Proofs

*Florian Pfender and Günter M. Ziegler*

The "kissing number problem" asks for the maximal number of blue spheres that can touch a red sphere of the same size in $n$-dimensional space. The answers in dimensions one, two, and three are classical, but the answers in dimensions eight and twenty-four were a big surprise in 1979, based on an extremely elegant method initiated by Philippe Delsarte in the early seventies which concerns inequalities for the distance distributions of kissing configurations.

Delsarte's approach led to especially striking results in cases where there are exceptionally symmetric, dense, and unique configurations of spheres: In dimensions eight and twenty-four these are given by the shortest vectors in two remarkable lattices, known as the $E_8$ and the Leech lattice.

However, despite the fact that in dimension four there is a special configuration which is conjectured to be optimal and unique—the shortest vectors in the $D_4$ lattice, which are also the vertices of a regular 24-cell—it was *proved* that the bounds given by Delsarte's method are not good enough to solve the problem in dimension four. This may explain the astonishment even to experts when in the fall of 2003 Oleg Musin announced a solution of the problem, based on a clever modification of Delsarte's method [22], [23].

Independently, Delsarte's by now classical approach has also recently been adapted by Henry Cohn and Noam Elkies [5] to deal with optimal sphere packings more directly and more effectively than had been possible before. Based on this, Henry Cohn and Abhinav Kumar [6] [7] have now proved that the sphere packings in dimensions eight and twenty-four given by the $E_8$ and Leech lattices are optimal lattice packings (for dimension eight this had been shown before) and that they are optimal sphere packings, up to an error of not more than $10^{-28}$ percent.

Here we try to sketch the setting, to explain some of the ideas, and to tell the story. For this

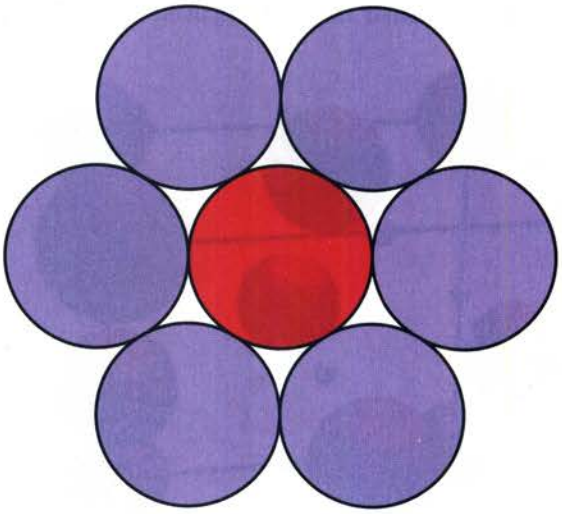

**Figure 1. The perfect kissing arrangement for $n = 2$.**

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*The first author was supported by the DFG Research Center "Mathematics in the Key Technologies" (FZT86). The second author was partially supported by Deutsche Forschungs-Gemeinschaft (DFG), via the DFG Research Center "Mathematics in the Key Technologies" (FZT86), the Research Group "Algorithms, Structure, Randomness" (Project ZI 475/3), and a Leibniz grant.*

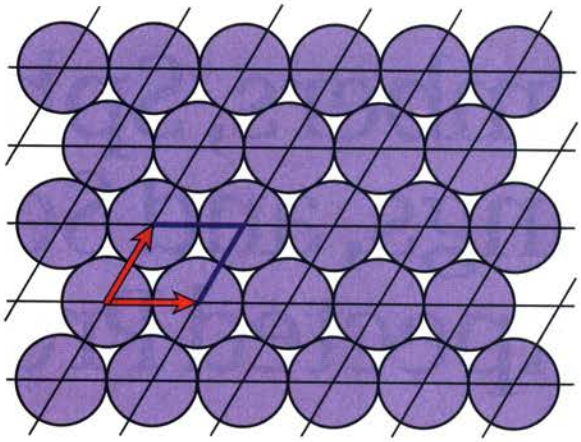
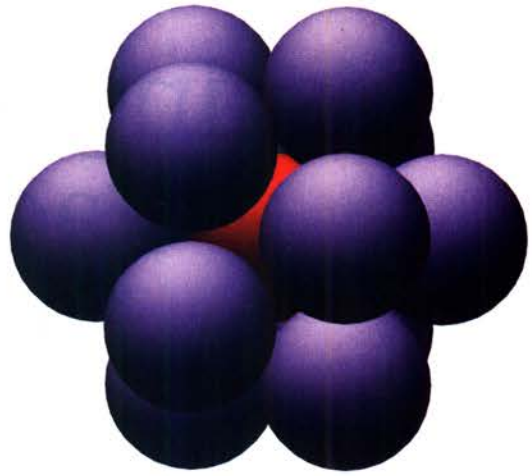


**Figure 2. The hexagonal lattice packing in the plane.**



(Graphics: Detlev Stalling, ZIB Berlin)

**Figure 3. The icosahedron configuration.**

we start with a brief review of the sphere packing and kissing number problems. Then we look at the remarkable kissing configurations in dimensions four, eight, and twenty-four. We give a sketch of Delsarte's method and how it was applied for the kissing number problem in dimensions eight and twenty-four. Then Musin's ideas kick in, which leads us to look at some nonlinear optimization problems as they occur as subproblems in his approach. Finally, we sketch an elegant construction of the Leech lattice in dimension twenty-four, which starts from the graph of the icosahedron and uses only simple linear algebra. This is the lattice which Cohn and Kumar have now proved to be optimal in dimension twenty-four by another extremely elegant and puzzling adaption of Delsarte's method. A sketch for this will end our tour.

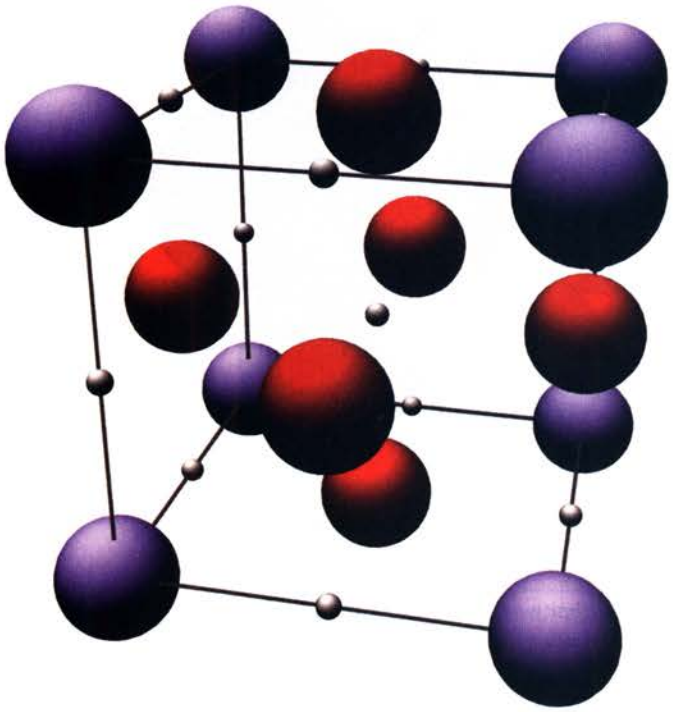


**Figure 4. The fcc sphere packing.**

## Three Classical Problems

The **"kissing number problem"** is a basic geometric problem that got its name from billiards: two balls "kiss" if they touch. The kissing number problem asks how many blue balls can touch one given red ball at the same time if all the balls have the same size. If you arrange the balls on a pool table, it is easy to see that the answer is exactly six: six balls just perfectly surround a given ball.

The **sphere packing problem** is to determine the maximal density of a packing of balls (all of them of the same size) in Euclidean $n$-space.

One class of packings to consider are *lattice* packings, which are invariant under any translation that takes one ball of the packing to the other.

It is a simple exercise (recommended) to prove, for dimension two, that the "obvious" hexagonal packing of equal-sized disks (two-dimensional balls) in the plane—a lattice packing in which each disk touches $\kappa(2) = 6$ others—is the optimal lattice packing and to compute its density.

It is not so easy to prove that the hexagonal packing is indeed an optimal sphere packing for dimension two. (Experts disagree whether the first proof for this, given by Thue 1892/1910, was indeed complete; if there was a gap, it was closed by Mahler and by Segre in 1940. See e.g. [14] for a proof.)

Thus the hexagonal planar lattice packing yields optimal solutions for the two-dimensional cases of the kissing number problem, the lattice packing problem, and the sphere packing problem. However, there are various indications that solutions of these three problems in higher dimensions are not so simple, they are not just given by "one perfect lattice packing", and things are much more complicated than in dimension two. This starts to show already in dimension three.

**Geometry Is Difficult ...**

... as soon as you reach dimension three. The **kissing number problem** in dimension three asks, "How many balls can touch a given ball at the same time?" This problem is indeed very interesting and surprisingly hard. Isaac Newton and David Gregory had a famous controversy about it in 1694: Newton said that 12 should be the correct answer, while Gregory thought that 13 balls could fit. The regular icosahedron yields a configuration of 12 touching balls that has great beauty and symmetry and leaves considerable gaps between the balls, which are clearly visible in our figure.

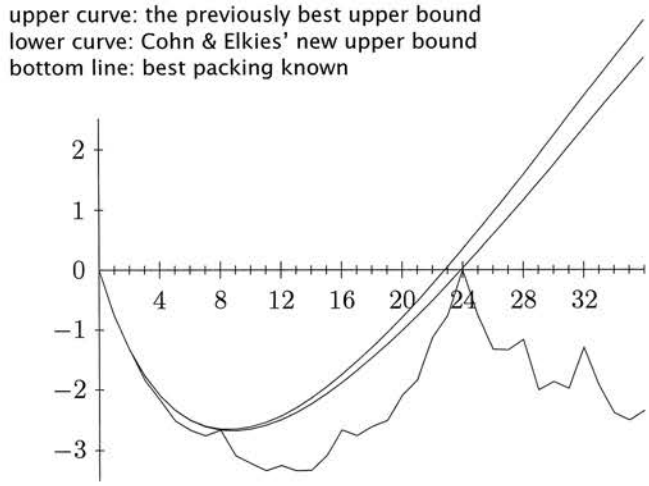
So perhaps if you moved all of them to one side, a 13th ball would possibly fit in? It is a close call, but the answer is no; 12 is the correct answer. To *prove* this is a hard problem, which was finally solved by Schütte and van der Waerden [27] in 1953. A short sketch of an elegant proof was given by Leech [18] in 1956, but it is a substantial challenge to derive a complete proof from this.

The **lattice packing problem** for dimension three was solved by Gauß in 1831, in an *Anzeige* (what today we would call a book review) of a book by Ludwig August Seeber. Indeed, Gauß proved a result about ternary quadratic forms which he even interpreted geometrically and which easily implies that the so-called "face-centered cubic (fcc)" packing is the unique densest lattice sphere packing for dimension three.

The centers for this sphere packing are all the integral points in $\mathbb{Z}^3$ with exactly one or exactly three even coordinates. Again, it is a nice exercise to prove that this does indeed give a lattice packing and that we can pack spheres of radius $\frac{1}{2}\sqrt{2}$ with their centers in the lattice points, to compute the density of the resulting sphere packing, and to recognize that in this packing each sphere is "kissed" by exactly 12 other spheres whose touching points do *not* give a regular icosahedron.

Just recall that the general **sphere packing** problem for dimension 3, known as the "Kepler conjecture", was only recently solved by Thomas C. Hales. The controversial story about that case has been told elsewhere (see for instance [14], [15], and [28]) and may even continue after the publication of Hales's papers (which are expected to appear in the *Annals* and *Discrete & Computational Geometry*).

So the **lattice packing problem** is different from the general sphere packing problem, and it seems to be considerably simpler. This starts with the fact that lattice packings are easy to describe (by a basis matrix). The density of a lattice packing is easily derived from the length of a shortest nonzero lattice vector and the determinant of a basis matrix. Also, the subtleties in the definition of "density" of a sphere packing disappear in the lattice case.




(From Cohn and Elkies [5])

**Figure 5. Plot of $\log_2 \delta + n(24-n)/96$ vs. dimension $n$, where $\delta$ is the "center density".**

**... and in High Dimensions**

It is likely that for most dimensions the optimal kissing arrangement is not unique and not rigid, the optimal sphere packing is not a lattice packing, and thus the methods discussed in this paper will not be able to give optimal results—but they do give the best *known* results in virtually the whole range of dimensions, from $n = 1$ to very large.

Here are three indications that the final answers in high dimensions will not be extremely simple:

- The optimal lattice packings $E_7$, $E_8$, and $\Lambda_9$ (conjectured) in dimensions 7, 8, and 9 have approximate densities 0.29530, 0.25367, and 0.14577 respectively, so there is a "sudden drop" beyond $n = 8$ it seems. A similar effect happens at $n = 24$. (See Figure 5, taken from Cohn and Elkies [5] with their kind permission.) This nonmonotone behaviour indicates that there are "special effects" happening in special dimensions.
- In dimension $n = 9$ the nonlattice packing known as "P9a" contains spheres that kiss 306 others, while it is *known* that in each lattice packing the kissing number (which is the same for all spheres) cannot exceed 272. So in general the optimal kissing configuration is not given by a lattice.
- In dimension $n = 10$ the packing "P10c" has a greater density than the best known lattice packing, "$\Lambda_{10}$".
- In most dimensions, there is not even a plausible conjecture for a best sphere packing. Also, every dimension seems to have its own characteristics, with remarkable phenomena occurring in dimensions 4, 8, and 24, which is, however, not reflected in the upper bounds we have.

### Three Kissing Configurations

The theory of lattices and sphere packings features some of the most beautiful objects in mathematics, including some remarkable kissing configurations in special dimensions. In the following, we describe optimal kissing configurations of spheres in dimensions 4, 8, and 24. In each of them the vectors are the shortest vectors of a lattice of high symmetry, and there are special binary codes, large simple groups, and a lot of other miracles attached to them. Thompson's little book [29] is a nice historical account of the discoveries; Conway and Sloane's book [8] is the classical technical account, which includes a number of the key research papers in the subject; and Elkies's prize-winning *Notices* papers [12] explain a lot of the connections to other mathematical fields, such as theta functions and modular forms.

$n = 4$: There are 24 vectors with two zero components and two components equal to $\pm 1$; they all have length $\sqrt{2}$ and a minimum distance of $\sqrt{2}$. Properly rescaled (that is, multiplied by $\sqrt{2}$), they yield the centers for a kissing configuration of unit spheres and imply that $\kappa(4) \geq 24$. The convex hull of the 24 points yields a famous 4-dimensional polytope, the "24-cell", discovered in 1852 by Ludwig Schäfli. Its facets are 24 regular octahedra.

$n = 8$: Again we present a configuration with simple integer coordinates which then can be rescaled. Our configuration includes the $\binom{8}{2}4 = 112$ vectors of type "$(0^6, \pm 2^2)$," that is, with two nonzero coordinates, which are $\pm 2$, as well as the $2^7 = 128$ vectors of type "$(\pm 1^8)$" with an even number of negative components. All the $112 + 128 = 240$ vectors have length $\sqrt{8} = 2\sqrt{2}$, which is also the minimum distance between the points.

At the same time, the vectors above are the shortest nonzero vectors of the exceptional root lattice $E_8$, which appears, for example, in the classification of simple Lie algebras. It consists of all integral vectors in $\mathbb{R}^8$ whose coordinates are all odd or all even, and for which the sum of all coordinates is divisible by 4.

$n = 24$: The configuration consists of the shortest (nonzero) vectors in a remarkable lattice, the Leech lattice, for which we will later outline a simple construction.

The vectors have three different types: The vectors of type "$(0^{16}, \pm 2^8)$" have 16 zero coordinates and eight coordinates that are $\pm 2$, with an even number of minus signs. The Leech lattice contains $759 \cdot 2^7 = 97152$ such vectors, all of them of length $\sqrt{32} = 4\sqrt{2}$. The second type of vector is "$(0^{22}, \pm 4^2)$", with two nonzero components, $\pm 4$, of arbitrary sign. There are $\binom{24}{2}4 = 1104$ such vectors, again of length $\sqrt{32}$, and we take them all. The third type is vector of the form "$(\pm 1^{23}, \pm(-3))$", obtained from a vector with one entry $-3$ and all entries $+1$ by reversing the sign on a number of coordinates which are divisible by 4. Exactly $3 \cdot 2^{15} = 98304$ of these are contained in the Leech lattice, again of length $\sqrt{32}$. Miraculously, all the resulting $97152 + 1104 + 98304 = 196560$ vectors have the same length, and the minimum distance between them is again $\sqrt{32}$ — and this minimum distance is achieved *very often*.

### The Delsarte Method

Philippe Delsarte (Phillips Research Labs) started in the early seventies [9] to develop an approach that via linear programming yields upper bounds for cardinalities of binary codes where Krawtchouk polynomials appear at the core of the method. (See Best [4] for a beautiful exposition.) However, Delsarte's approach was much more general, yielding cardinality bounds for "association schemes" [10]. An important case is the situation for spherical codes in the Delsarte-Goethals-Seidel method [11], where Gegenbauer polynomials play the decisive role.

Here is our sketch: If $N$ unit spheres kiss the unit sphere in $\mathbb{R}^n$, then the set of kissing points is a rather special configuration of unit vectors, namely $N$ vectors $x_1, \ldots, x_N \in \mathbb{R}^n$ that satisfy $\langle x_i, x_j \rangle \leq \frac{1}{2}$ for $i \neq j$, while $\langle x_i, x_i \rangle = 1$ for all $i$. If we write the $x_i$ as the columns of a matrix $X \in \mathbb{R}^{n \times N}$, then the special properties amount to a matrix

$$(x_{ij}) \;:=\; X^T X \;\in\; \mathbb{R}^{N \times N}$$

with the following properties:

(i) it has ones on the diagonal,
(ii) all off-diagonal entries are at most $\frac{1}{2}$,
(iii) it has rank (at most) $n$, and
(iv) it is positive semidefinite.

Now we use a result that may be traced to a paper by Schoenberg [26]. He characterized the functions $f$ one may apply to the entries of matrices with properties (i), (iii), and (iv) such that the resulting matrix

$$(f(x_{ij}))$$

is guaranteed to be still positive semidefinite. If we restrict $f$ to be a polynomial of degree at most $d$, then Schoenberg's answer is that $f$ can be an arbitrary nonnegative linear combination of the *Gegenbauer polynomials* $G_k^{(n)}$ of degree $k \leq d$. These polynomials (also known as the *spherical* or the *ultra spherical* polynomials) may be defined in a variety of ways. One compact description is that for any $n \geq 2$ and $k \geq 0$, $G_k^{(n)}(t)$ is a polynomial of degree $k$, normalized such that $G_k^{(n)}(1) = 1$, and such that $G_0^{(n)}(t) = 1$, $G_1^{(n)}(t) = t$, $G_2^{(n)}(t) = \frac{nt^2-1}{n-1}, \ldots$ are orthogonal with respect to the scalar product

$$\langle\, g(t), h(t) \,\rangle \;:=\; \int_{-1}^{+1} g(t)h(t)(1-t^2)^{\frac{n-3}{2}}\, dt$$

on the vector space $\mathbb{R}[t]$ of polynomials, which arises naturally in integration over $S^{n-1}$. This is just

one of many possible descriptions and definitions of these remarkable polynomials. For example, readers are invited to derive a recursion from this description by applying Gram-Schmidt orthogonalization. For $n = 3$ one obtains the Legendre polynomials; for $n = 4$, the Chebychev polynomials of the second kind (but with a different normalization than usual). Perhaps one more useful fact to know about Gegenbauer polynomials is that computer algebra systems such as Maple and Mathematica "know them".

The key property of the Gegenbauer polynomials that we need, Schoenberg's lemma, is a simple consequence of the classical addition theorem for spherical harmonics, beautifully explained and derived in the book by Andrews, Askey and Roy [2, Chap. 9], who credit Müller [21], who in turn says that this goes back to Gustav Herglotz (1881–1925).

***Lemma 1*** (**Addition Theorem** [2, Thm. 9.6.3]). *The Gegenbauer polynomial $G_k^{(n)}(t)$ can be written as*

$$G_k^{(n)}(\langle x, y\rangle) \;=\; \frac{\omega_n}{m}\sum_{\ell=1}^{m} S_{k,\ell}(x)S_{k,\ell}(y),$$

*where $\omega_n$ is the $(n-1)$-dimensional area of $S^{n-1}$ and the functions $S_{k,1}, S_{k,2}, \ldots, S_{k,m}$ form an orthonormal basis for the space of "spherical harmonics of degree $k$", which has dimension* $m = m(k,n) = \binom{k+n-2}{k} + \binom{k+n-3}{k-1}$.

This easily yields Schoenberg's result:

***Lemma 2*** (Schoenberg [26]). *If $(x_{i,j}) \in \mathbb{R}^{N\times N}$ is a positive semidefinite matrix of rank at most $n$ with ones on the diagonal, then the matrix $(G_k^{(n)}(x_{i,j}))$ is positive semidefinite as well. In particular, the sum of all its entries is nonnegative.*

***Proof.*** We can write the matrix $(x_{i,j})$ as $X^TX$; that is, $x_{i,j} = \langle x_i, x_j\rangle$ for vectors $x_i, x_j \in S^{n-1}$. Here we prove only that the sum of all entries of $(G_k^{(n)}(x_{i,j}))$ is nonnegative: For this we plainly compute

$$\begin{aligned}
&\sum_{i,j=1}^{N} G_k^{(n)}(\langle x_i, x_j\rangle)\\
&\quad= \frac{\omega_n}{m}\sum_{i,j=1}^{N}\sum_{\ell=1}^{m} S_{k,\ell}(x_i)S_{k,\ell}(x_j)\\
&\quad= \frac{\omega_n}{m}\sum_{\ell=1}^{m}\Big(\sum_{i=1}^{N} S_{k,\ell}(x_i)\Big)\Big(\sum_{j=1}^{N} S_{k,\ell}(x_j)\Big)\\
&\quad= \frac{\omega_n}{m}\sum_{\ell=1}^{m}\Big(\sum_{i=1}^{N} S_{k,\ell}(x_i)\Big)^2 \;\geq\; 0.
\end{aligned}$$

To get a feel for "what this means", let $(x_{ij})$ be a positive semidefinite matrix of rank $n \geq 2$ with ones on the diagonal, and let us look at the polynomials $f(t)$ such that $(f(x_{ij}))$ has a nonnegative sum of entries. Clearly $f(t) = 1$ has this property, and $f(t) = t$ as well. It starts to be interesting if we apply $f(t) = t^2 + \alpha$, since then the set of admissible $\alpha$s depends on the rank $n$. The claim of Schoenberg's lemma is that we can take any $\alpha \geq -\frac{1}{n}$, since $t^2 + \alpha = \frac{n-1}{n}G_2^{(n)}(t) + (\frac{1}{n} + \alpha)$.

***Theorem 3*** (Delsarte, Goethals and Seidel [11]). *If*

$$f(t) \;=\; \sum_{k=0}^{d} c_k G_k^{(n)}(t)$$

*is a nonnegative combination of Gegenbauer polynomials, with $c_0 > 0$ and $c_k \geq 0$ otherwise, and if $f(t) \leq 0$ holds for all $t \in [-1, \frac{1}{2}]$, then the kissing number for $\mathbb{R}^n$ is bounded by*

$$\kappa(n) \;\leq\; \frac{f(1)}{c_0}.$$

***Proof.*** We estimate the sum of all entries of the matrix $(f(x_{ij}))$ in two ways. The first one is the simple computation

$$\begin{aligned}
\sum_{i,j=1}^{N} f(x_{ij}) \;&=\; \sum_{k=0}^{d} c_k \sum_{i,j=1}^{N} G_k^{(n)}(x_{ij})\\
&\geq\; c_0 \sum_{i,j=1}^{N} G_0^{(n)}(x_{ij}) \;=\; c_0N^2,
\end{aligned}$$

which rests on the fact that by Schoenberg's lemma the sum of all entries of the matrix $(G_k^{(n)}(x_{ij}))$ is nonnegative.

The second, equally simple, computation

$$(1)\qquad \sum_{i,j=1}^{N} f(x_{ij}) \;=\; Nf(1) + \sum_{i\neq j} f(x_{ij}) \;\leq\; Nf(1)$$

depends on the fact that all the off-diagonal entries of the matrix $(f(x_{ij}))$ are nonpositive, due to our assumption on the function $f(t)$ in the range where the scalar products $x_{ij} = \langle x_i, x_j\rangle$ lie.

Now the two estimates yield $c_0N^2 \leq Nf(1)$.

### $n = 8$ and $n = 24$

The kissing number problems in dimensions eight and twenty-four were solved in the late seventies by matching the Delsarte-Goethals-Seidel bound with the very special $E_8$ and Leech configurations: Andrew Odlyzko and Neil Sloane at AT&T Bell Labs [24], [7, Chap. 13], and independently Vladimir I. Levenšteĭn in Russia [19] proved that the correct, exact maximal numbers for the kissing number problem are $\kappa(8) = 240$ and $\kappa(24) = 196560$.

In dimensions with a candidate for a unique optimal configuration for the kissing number problem, one has a quite straightforward guess for the

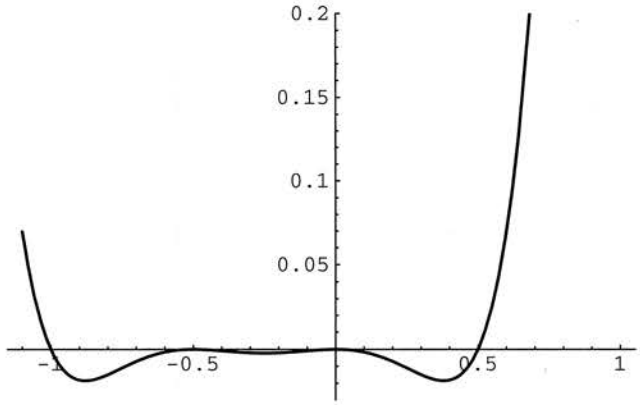



**Figure 6.** $f_8(t)$.

polynomial to be used in Delsarte's method. Namely, for the estimate (1) to be tight, we must have $f(x_{ij}) = 0$ for all scalar products $x_{ij}$ that actually occur for $i \neq j$ in our candidate solution.

Thus, in dimension $n = 8$ the configuration given by the roots of the $E_8$ lattice seems so nice and dense and rigid that it might be unique. It is also very symmetric, and the only scalar products that occur (if the roots are normalized to length 1) are $\pm 1$, $\pm\frac{1}{2}$, and 0. Thus the "obvious" function to write down is

$$f_8(t) := (t - \frac{1}{2})t^2(t + \frac{1}{2})^2(t + 1).$$

You (or your computer algebra system) have to expand this polynomial in terms of Gegenbauer polynomials, check that all coefficients in the expansion are nonnegative, compute $f_8(1)/c_0$, and get 240.

One can proceed similarly for $n = 24$ and the shortest roots of the Leech lattice, which have the additional scalar products $\pm\frac{1}{4}$. Thus one uses

$$f_{24}(t) := (t - \frac{1}{2})(t + \frac{1}{4})^2 t^2 (t + \frac{1}{4})^2 (t + \frac{1}{2})^2 (t + 1).$$

It works!

The same approach *cannot* work for dimension $n = 3$, where the optimal configuration is far from unique, so the function $f$ would have to be equal to zero in a whole range of possible scalar products to get a tight estimate $N \leq 12$, or would have to be close to zero to get the estimate $N < 12.9999$, say, which would be good enough to prove $\kappa(3) = 12$.

**Musin's Trick**

To determine the kissing number for $n = 4$ has been a challenge for quite a while now. There is a claim by Wu-Yi Hsiang that dates back to 1993 but that apparently has not been backed up by a detailed proof. It may be surprising that for $n = 4$ the Delsarte method does not work: After all, we have a conjectured unique optimal configuration of unit vectors, given by the 24-cell (the $D_4$ lattice), with only very few scalar products between distinct points ($\pm\frac{1}{2}$, 0, and $-1$). However, from the "obvious" polynomial

$$f_4(t) = (t - \frac{1}{2})t^2(t + \frac{1}{2})^2(t + 1),$$

which is the same polynomial as for $n = 8$ and the $E_8$ lattice, we get only $\kappa(4) \leq f_4(1)/c_0 = 28.8$.

Once we look a little bit harder for a suitable function, Delsarte's bound yields that $\kappa(4) \leq 25$, but nothing better than that. Arestov and Babenko [3] have analyzed this case in detail and *proved* that even with an optimally chosen Delsarte function, the bound obtained will not be smaller than 25.

So it came as a great surprise that now the Russian mathematician Oleg Musin, who lives in Los Angeles, has indeed found a method to modify Delsarte's method in a very beautiful and clever way which yields better bounds. In particular he improves the upper bound from 25 to 24.

**Oleg R. Musin.** (Photo: private)

In the meantime, an announcement [23] has appeared in print; the long version [22] is submitted and being refereed. So let us assume that the details and computations work out right (which are technical and for some of which alternative routes are outlined in the preprint) and will be confirmed in the reviewing process. Then, indeed, $\kappa(4) = 24$ is the answer! However, Musin makes no claim to have proved that the special configuration of the 24-cell is unique.

Here we want only to sketch Musin's beautiful idea. He allows the function $f(t)$ to get positive

**Status 2004: Kissing Numbers**

The only exact values of kissing numbers known:

| $n$ | | | lattice | regular polytope |
|---|---|---|---|---|
| $\kappa(1)$ | = | 2 | $A_1$ | |
| $\kappa(2)$ | = | 6 | $A_2$ | hexagon |
| $\kappa(3)$ | = | 12 | $H_3$ | icosahedron |
| $\kappa(4)$ | = | 24 | $D_4$ | 24-cell |
| $\kappa(8)$ | = | 240 | $E_8$ | |
| $\kappa(24)$ | = | 196560 | $\Lambda_{24}$ | |

"opposite to the given sphere", that is, close to $t = -1$. Here is the result in a nutshell.

***Theorem 4*** (Musin's theorem). *Fix a parameter $t_0$ in the range $-1 \le t_0 < -\frac{1}{2}$. If*

$$f(t) = \sum_{k \ge 0} c_k G_k^{(n)}(t)$$

*is a nonnegative combination of Gegenbauer polynomials ($c_k \ge 0$ for all $k$, with $c_0 > 0$) and if $f(t) \le 0$ holds for all $t \in [t_0, \frac{1}{2}]$, while $f'(t) < 0$ for $t \in [-1, t_0]$, then the kissing number for $\mathbb{R}^n$ is bounded by*

$$\kappa(n) \le \frac{1}{c_0} \max\{h_0, h_1, \ldots, h_\mu\},$$

*where $h_m$ is the maximum of*

$$f(1) + \sum_{j=1}^{m} f(\langle e_1, y_j \rangle)$$

*over all configurations of $m \le \mu$ unit vectors $y_j$ in the spherical cap given by $\langle e_1, y_j \rangle \le t_0$ whose pairwise scalar products are at most $\frac{1}{2}$. Here $\mu$ denotes the maximal number of points that fit into the spherical cap.*

***Proof.*** We argue just as in the proof of Delsarte's theorem, except that in (1) we cannot drop all nondiagonal terms: We now get only that

$$(2) \qquad \sum_{i,j=1}^{N} f(x_{ij}) \le \sum_{i=1}^{N} \Big( f(1) + \sum_{j:\langle x_i, x_j \rangle \le t_0} f(x_{ij}) \Big).$$

Letting $m$ denote the number of points that could appear in the last sum ($0 \le m \le \mu$) yields the estimate in Musin's theorem.

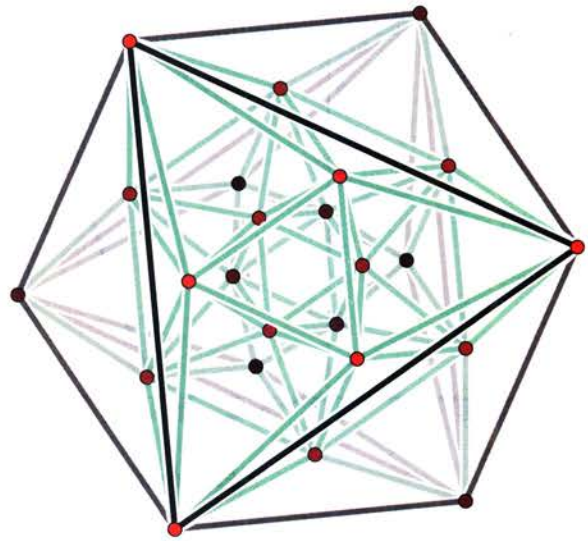
**Nonlinear Optimization Problems**

*The bad news* about Musin's approach is that it forces him to compute, at least approximately, the numbers $h_0, \ldots, h_\mu$, and this leads to nonconvex optimization problems.

*Almost everything* can be written as a nonlinear, nonconvex, constrained optimization problem. For example, the question whether 25 spheres can kiss a given sphere is immediately answered if we solve the problem

$$(3) \qquad \min_{x_1, \ldots, x_{25} \in S^3} \max_{1 \le i < j \le 25} \langle x_i, x_j \rangle.$$

Indeed, if the answer is $\frac{1}{2}$ or smaller, then the 25 points $x_i$ that achieve the minimum give a kissing configuration. If the answer is larger than $\frac{1}{2}$, then a kissing configuration with 25 spheres doesn't exist. *However*, high-dimensional, nonlinear, nonconvex, constrained optimization problems are extremely hard to solve. We may interpret (3) as a problem in 100 variables, the coordinates of $x_1, \ldots, x_{25} \in \mathbb{R}^4$, constrained by the restrictions $x_i \in S^3$. Or we may eliminate the constraints, say, by introducing polar coordinates, and thus have an unconstrained problem in 75 variables. Eliminating the symmetry of the 3-sphere will reduce the number of variables by 10 but not significantly simplify the problem. This problem is nonconvex, since it has lots of minima: indeed, any asymmetric optimal configuration will yield 25! minima, and we may assume that there are lots of "combinatorially different" optimal solutions. Numerical methods for nonlinear optimization, such as local descent methods, might find some feasible point, and they should even find a stationary point, say, a local maximum or minimum of the function to be optimized. Such methods exist and are widely used, the most popular ([25], Matlab) and the most questionable (see [17], [20]) one probably being the Nelder-Mead simplex method. However, a local improvement method cannot guarantee finding a global optimum.



(Graphics: Michael Joswig/polymake [13])

**Figure 7. A "Schlegel diagram" of the 24-cell.**

**Dimension Reduction**

However, *the good news* for Musin's approach is that if parameters are chosen carefully, if $t_0$ is small enough (that is, close to $-1$), and if the monotonicity assumption is exploited carefully, then one gets low-dimensional problems of a type that can be treated numerically.

So, it is already a remarkable achievement that Musin's improvement of the Delsarte method yields a clean and simple proof for the Newton-Gregory problem, $\kappa(3) < 13$. Indeed, choosing $t_0 = -0.5907$ and a suitable polynomial $f_3(t)$ of degree 9, Musin gets $\mu = 4$ and the parameters $h_0 = f_3(1) = 10.11$, $h_1 = f_3(1) + f_3(-1) = 12.88$, while all other $h_i$'s are smaller.

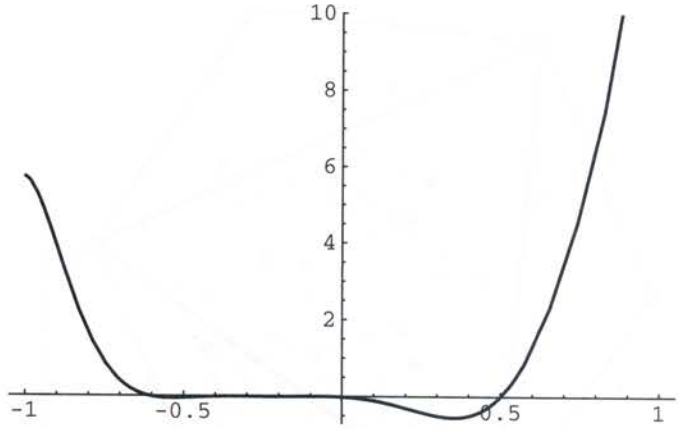



**Figure 8. Musin's *f(t)*.**

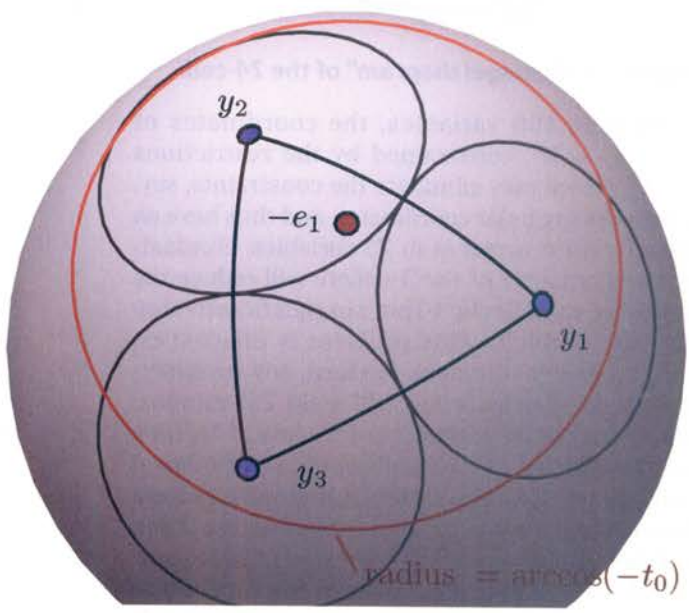



**Figure 9. An $h_3$-configuration.**

**A Sketch of Musin's Proof for $\kappa(4) < 25$.**
Musin produced a polynomial of degree 9 satisfying the assumptions of his theorem with $t_0 \approx -0.608$:

$$\begin{aligned} f(t) &= G_0^{(4)}(t) + 2G_1^{(4)}(t) + 6.12G_2^{(4)}(t) \\ &\quad + 3.484G_3^{(4)}(t) + 5.12G_4^{(4)}(t) + 1.05G_5^{(4)}(t) \\ &= 53.76t^9 - 107.52t^7 + 70.56t^5 \\ &\quad +16.384t^4 - 9.832t^3 - 4.128t^2 \\ &\quad -0.434t - 0.016. \end{aligned}$$

This was found via discretization and linear programming; such methods had been employed already by Odlyzko and Sloane for the same purpose.

To evaluate $h_m$, we have to consider arrangements of $m$ points $y_1, \ldots, y_m$ in the spherical cap $C_0 := \{y \in S^3 : \langle e_1, y\rangle \le t_0\}$. The points have a minimum distance of $60^\circ = \pi/3 = \arccos(\frac{1}{2})$ given by $\langle y_i, y_j\rangle \le \frac{1}{2}$, and this distance is larger than the radius $\arccos(-t_0)$ of the spherical cap. We know that in an *optimal* arrangement for a given $m$ we cannot move one or several of the points towards the center of the cap while maintaining the "minimum distance" requirement, because of the monotonicity assumption on $f(t)$. From this Musin [22, Lemma 1] derives strong conditions on the combinatorics of optimal configurations. For example, for $m \ge 1$ the center $-e_1$ of the spherical cap is contained in the (spherical) convex hull of the $m$ points $y_i$; for $m \ge 2$ each point has at least one other point at distance exactly $\pi/3$ (for $m \ge 2$), etc. This already yields that $h_0 = f(1) = 18.774$ and $h_1 = f(1) + f(-1) = 24.48$. Also,

$$h_2 = \max_{\varphi \le \pi/3} f(1) + f(-\cos(\varphi)) + f(-\cos\frac{\pi}{3} - \varphi)),$$

which yields $h_2 \approx 24.8644$. The computations of $h_m$ for $m = 3, 4, 5$ amount to rather well-behaved optimization problems in $m-1$ variables that can be solved numerically and yield $h_m < h_2$; for the case $m = 6$ Musin shows that $h_6 < h_2$ by a separate argument.

Clearly there is potential for other applications of Musin's insight: in the whole range of sphere packing and coding theory problems where Delsarte's method was used in the last thirty years, with tremendous success.

**Sphere Packings**

Surprisingly, Musin's breakthrough is not the only remarkable recent piece of progress related to the packing of spheres in high-dimensional space. Namely, by again extending and improving upon Delsarte's method, Henry Cohn (Microsoft Research) in joint papers with Noam Elkies (Harvard University) and with Abhinav Kumar (a mathematics graduate student at Harvard) has obtained new upper bounds on the density of sphere packings in $n$-space, for $n \le 36$.

Once you know bounds for spherical codes (the kissing number is a special case of this, and these more general bounds can be derived in a similar fashion), you can bound the density of a sphere packing in this dimension. This is the classical way of using Delsarte's method in the context of sphere packings, by Kabatjanskiĭ and Levenšteĭn [16], which gives the best-known upper bounds for the density of very-high-dimensional sphere packings.

Cohn and Elkies found a more direct approach to the problem. Instead of using functions defined only on the interval $[-1, 1]$, they use functions defined on all of $\mathbb{R}^n$ to get good bounds, as follows.

Let $f : \mathbb{R}^n \to \mathbb{R}$ be an $L^1$ function, and let its Fourier transform $\hat{f}$ be defined as

$$\hat{f}(t) := \int_{\mathbb{R}^n} f(x) e^{2\pi i \langle x,t \rangle} dx.$$

The function $f(t)$ is called *admissible* if there is a constant $\varepsilon > 0$ such that $|f(x)|$ and $|\hat{f}(x)|$ are bounded above by a constant times $(1 + |x|)^{-n-\varepsilon}$. One crucial property of these functions is the Poisson summation formula

$$\sum_{x \in \Lambda} f(x + v) = \frac{1}{|\Lambda|} \sum_{t \in \Lambda^*} e^{-2\pi i \langle v,t \rangle} \hat{f}(t),$$

for every vector $v \in \mathbb{R}^n$ and every lattice $\Lambda \subset \mathbb{R}^n$, where $\Lambda^* = \{y \in \mathbb{R}^n : \langle x, y \rangle \in \mathbb{Z} \text{ for all } x \in \Lambda\}$ is its dual lattice.

***Theorem 5*** (Cohn and Elkies [5]). *Suppose that $f : \mathbb{R}^n \to \mathbb{R}$ is an admissible function, not identically zero, which satisfies the following two conditions:*

1. $f(x) \le 0$ for $|x| \ge 1$, and
2. $\hat{f}(t) \ge 0$ for all $t$.

Then the density of $n$-dimensional sphere packings is bounded above by

$$\Delta_n \le \frac{\omega_n}{n 2^n} \frac{f(0)}{\hat{f}(0)}.$$

***Proof.*** A *periodic packing* is given by vectors $v_1, \ldots, v_N$ and a lattice $\Lambda$ such that the packing consists of all spheres centered at translates of $v_1, \ldots, v_N$ by elements of $\Lambda$, and such that $v_i - v_j \in \Lambda$ implies that $i = j$. It is easy to see that periodic packings come arbitrarily close in density to the densest possible sphere packing, so it is sufficient to consider packings of this type. Rescale the packing so that all spheres have radius $1/2$. The density of such a packing is $\frac{\omega_n}{n 2^n} \frac{N}{|\Lambda|}$, since $\frac{1}{n}\omega_n$ is the volume of a unit $n$-ball.

Now we bound the quantity

$$\sum_{j,k=1}^{N} \sum_{x \in \Lambda} f(x + v_j - v_k).$$

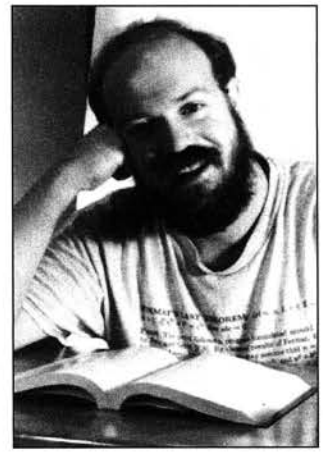
From below, the Poisson summation formula yields a lower estimate of $N^2 \hat{f}(0)/|\Lambda|$. To get an upper bound, observe that $x + v_j$ and $v_k$ are two centers of the packing. Thus, $|x + v_j - v_k| < 1$ if and only if $x + v_j = v_k$, i.e. $x = 0$ and $j = k$. We have $f(x + v_j - v_k) \le 0$ whenever $|x + v_j - v_k| \ge 1$, and thus $Nf(0)$ is an upper bound for the sum. This yields

$$Nf(0) \ge \frac{N^2 \hat{f}(0)}{|\Lambda|},$$

and thus the theorem.

## The Golay Code and the Leech Lattice

Since the most spectacular applications of the setup by Cohn and Elkies concern the Leech lattice, we describe it here. For this we start with a construction of the (extended binary) Golay code, a remarkable binary linear code of length 24, dimension 12, and minimal distance 8: that is, a linear 12-dimensional subspace of $(\mathbb{Z}_2)^{24}$ consisting of $2^{12} = 4096$ code words (vectors), all of which except for the zero vector have weight (number of ones) at least 8. There is a myriad of ways in the literature to describe this code, the most compact one being just a list of twelve basis vectors. Here, we choose not just any basis but one based on the adjacency matrix of the graph $X$ of the icosahedron to make use of some symmetries later, following lecture notes by Aigner [1].



(Photo courtesy of Valerie Samn)

**Henry Cohn.**

Consider the binary $12 \times 24$ matrix

$$G := (I \mid B) \in \mathbb{Z}^{12 \times 24},$$

where $I$ is the identity matrix of order 12 and $B = J - A$ is the all-one matrix of that order minus the adjacency matrix $A$ of the icosahedron. Thus $B$ is a symmetric $0/1$-matrix with seven ones in each row and each column, corresponding to the seven nonneighbors for each vertex of the icosahedron (counting the vertex itself). We will see in a minute that the code

$$C := \text{rowspan}(G) \subset (\mathbb{Z}_2)^{24}$$

is a $(24, 12, 8)$-code. It has been proved that there is a unique such code, the famous Golay code.

Consider $B^2$. We have

$$(B^2)_{ij} = 12 - |N(v_i) \cup N(v_j)|$$

for every pair of vertices $v_i, v_j \in V(X)$, where we write $N(v)$ for the set of vertices adjacent to a vertex $v$. Therefore,

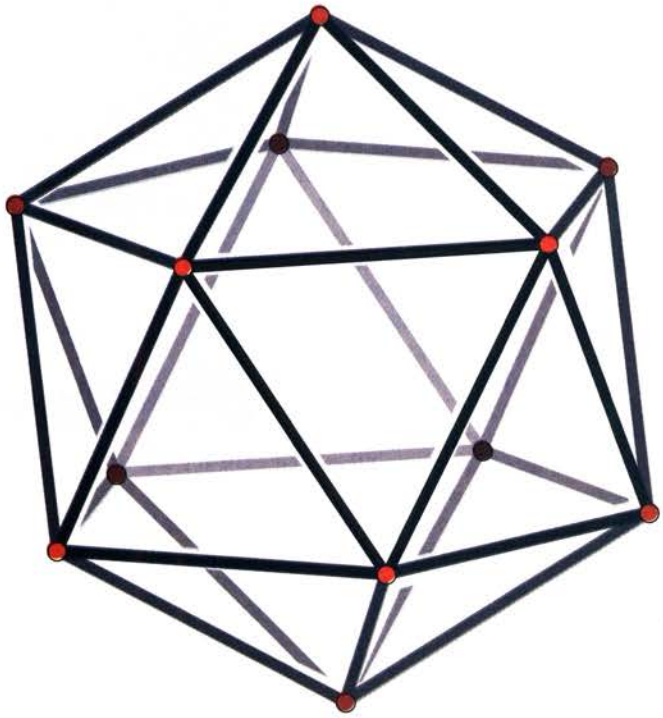
$$(B^2)_{ij} = \begin{cases} 7 & \text{if } \operatorname{dist}(v_i, v_j) = 0, \\ 4 & \text{if } \operatorname{dist}(v_i, v_j) = 1, \\ 4 & \text{if } \operatorname{dist}(v_i, v_j) = 2, \\ 2 & \text{if } \operatorname{dist}(v_i, v_j) = 3. \end{cases}$$

Thus all entries of $I - B^2$ are even, which we write as $I - B^2 \equiv O \pmod 2$, and it follows that

$$GG^T = I + B^2 \equiv O \pmod 2.$$

This implies that $C \subseteq C^\perp$, and thus $C = C^\perp$, since $\dim(C) + \dim(C^\perp) = 24$. From this, together with the fact that all rows of $G$ have Hamming weight 8, we conclude that for each $c \in C$ the Hamming weight is divisible by 4.

All that is left to show is that there are no code words of weight 4. Note that



(Graphic: Michael Joswig/polymake [12])

**Figure 10. The icosahedron graph.**

$$BG = B(I \mid B) = (B \mid B^2) \equiv (B \mid I) \pmod 2.$$

This implies that for each code word $c = (c_L \mid c_R)$, $(c_R \mid c_L)$ is a code word too. If $c$ has weight 4, then one of $c_L$ and $c_R$ has weight at most 2. All one has to do to exclude code words of weight 4 therefore is to check sums of up to two rows of $G$, and we have already seen that a sum of two different rows has weight at least $16 - 8 = 8$.

In order to construct the Leech lattice from the Golay code, consider the lattice

$$\Gamma_{24} = \{x \in \mathbb{Z}^{24} : x \bmod 2 \in C\}.$$

Then $\Gamma_{24} = \Gamma_1 \cup \Gamma_2$, where

$$\Gamma_1 = \{x \in \Gamma_{24} : \textstyle\sum x_i \equiv 0 \pmod 4\},$$
$$\Gamma_2 = \{x \in \Gamma_{24} : \textstyle\sum x_i \equiv 2 \pmod 4\}.$$

Finally, let $\Lambda_{24} = 2\Gamma_1 \cup (\mathbf{1} + 2\Gamma_2)$. One can show that this is a lattice with minimum distance $\sqrt{32}$, the Leech lattice.

### Optimality of the Leech Lattice

Cohn and Elkies have conducted a systematic computer search for suitable admissible functions. In this context, the role of the Gegenbauer polynomials is played by Bessel functions (times some power of $|x|$). These are the functions whose Fourier transform is a delta function on a sphere centered at the origin, so a function with nonnegative Fourier transform is like a nonnegative linear combination of them (but with an integral instead of a sum). The best currently known function was found by Cohn and Kumar [6], a radial function that consists of a polynomial of degree 803 (evaluated at $|x|^2$, so technically it is a polynomial of degree 1606) multiplied by $e^{-\pi|x|^2}$. It yields a density bound that is above the density of the Leech lattice by a factor of less than $1 + 10^{-29}$. Similarly, they found a function that provides a density bound that is above the density of the $E_8$-lattice by a factor of less than $1 + 10^{-14}$. Functions which show that these lattices are in fact densest possible sphere packings are yet to be found.

But what about the easier quest of finding the densest *lattice* packing? In dimension 8 the question was settled, while in dimension 24 it was still open. This case was now answered by Cohn and Kumar [6]. Since it is known that the Leech lattice is a local optimum for the density of lattice packings, it is enough to show that every denser lattice has to be very close to the Leech lattice. This required finding the above-mentioned admissible function and then quite a bit of work involving linear programming and association scheme theory.

The reader may have arrived at this point and said, "What a shame they don't explain this in more detail". Well, we feel the same—and refer you to the original papers/preprints, which are fascinating mathematics and a pleasure to read!


### Acknowledgements

We are grateful to Eiichi Bannai, Henry Cohn, Noam Elkies, and Oleg Musin for discussions, helpful remarks, and many insightful comments related to this paper.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## About the Cover

### Kissing in Motion

The cover accompanies the article by Florian Pfender and Günter Ziegler in this issue (see also my short article, "The Difficulties of Kissing in Three Dimensions", pp. 884–885). It shows the motion of the "shadows" of kissing spheres in a deformation pointed out by Conway and Sloane, following an observation of Coxeter. The sequence is left-right, right-left, left-right (sometimes called boustrophedon).

*—Bill Casselman*
*Covers/Graphics Editor*
(`notices-covers@ams.org`)

# The Difficulties of Kissing in Three Dimensions

*Bill Casselman*

As the article by Florian Pfender and Günter Ziegler in this issue explains, the kissing number in four dimensions has apparently been shown by Oleg Musin to be 24, after several years of speculation that this was so. The same problem in three dimensions continues to be of considerable interest, even though it was shown as long ago as 1953, by Schütte and van der Waerden, that in three dimensions no more than 12 spheres could be placed in contact with a central thirteenth, all of the same size.

The history of the problem is obscure. It is commonly said that in a discussion that took place in Cambridge the Scottish astronomer and mathematician David Gregory asserted that 13 spheres could be placed in contact with a central sphere, while Isaac Newton claimed that only 12 were possible. Evidence for exactly what was said in this discussion is murky. The first published reference to it that I know of is in the third volume of Newton's correspondence, edited by H. W. Turnbull, which came out in 1961. There is an entry for May 4, 1694, one of several Latin memoranda written about that day by Gregory, summarizing a conversation with Newton on the distribution of stars of various magnitudes. On the question of 12 *versus* 13, the entry does not support what is commonly said. Two distinct possibilities are not mentioned, and the most plausible reading is that Newton himself thought that 13 spheres surrounding a fourteenth was a possibility! More likely, some would think, is that Gregory didn't understand what Newton had said in an apparently rather rapid discourse. Turnbull refers to a more elaborate entry in a notebook of Gregory kept at Christ Church, Oxford, but at least one person's attempt to locate that entry where Turnbull said it should be was unsuccessful. In any event, Turnbull's paraphrase suggests that there is nothing important there not already mentioned in the published memorandum. Other puzzling features of this story are that the 1953 paper by Schütte and van der Waerden refers to a Newton-Gregory discussion, and in 1956 John Leech referred in more detail to the Christ Church notebook. These both appeared several years before the correspondence of Newton appeared in print. What was the source of their information? To paraphrase a familiar dictum of the Mattel Toy Company, history is hard.

R. Hoppe thought he had solved the problem in 1874. Although the first proof now accepted as valid appeared in 1953, Coxeter in 1963 refers to Hoppe's proof as if it were correct. Schütte and van der Waerden make no reference to nineteenth century work, and the first published analysis of Hoppe's mistake that I know of is that by Hales in his 1994 *Intelligencer* article. There are several historical puzzles here, too, about the track of mathematical ideas.

As far as I know, no really simple proof of the result of Schütte and van der Waerden has been found. The one probably most admired is that presented by Leech in a cryptic two-page note, but although his reasoning has been accepted as correct, there are gaps in his exposition, many involving spherical trigonometry no longer generally familiar (for example, Lexell's circle), and I am not aware that anyone has ever written a complete account. To illustrate that as Tom Hales has written, "The subject is littered with faulty arguments and abandoned methods," I can point out that the first edition of the well known book by Ziegler and Martin Aigner included an expansion of Leech's argument that, although usefully filling in many gaps in Leech's exposition, turned out to be erroneous. Rather than patch it up for the second edition, the authors simply removed this chapter, feeling presumably that they didn't want to include so much spherical trigonometry in what they hoped would be a "perfect proof." It would be valuable if someone were to publish an account of Leech's proof that

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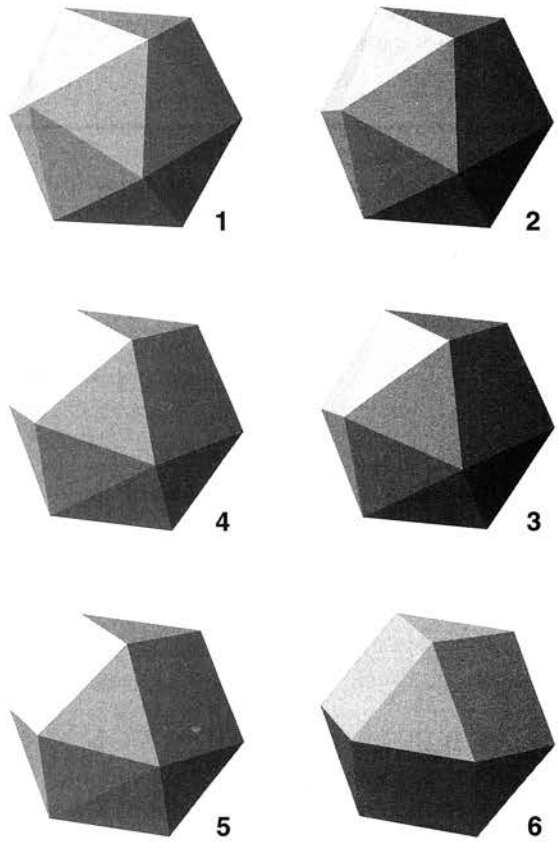
made it accessible to an elementary undergraduate course.

In connection with other problems involving the distribution of spheres in three and four dimensions, new proofs that the kissing number in 3D is 12 have been proposed in recent publications by Wu-Yi Hsiang, Károly Böröczky, Kurt Anstreicher, and finally Oleg Musin. The last of these is particularly interesting, since the 3D case offers an instructive warm-up exercise for the more difficult one in 4D.

If the three-dimensional problem continues to be of interest, one reason is presumably that here is a part of the mathematical universe where the borderline between essential rigour and mere detail in proofs is particularly difficult to perceive. There is a great deal of room in the geometry of three-dimensional configurations in which to dispute over what's necessary and what's tedious.

There are real mathematical difficulties present, however, in addition to psychological ones. In contrast to other dimensions where the exact kissing number is known, in dimension three optimal solutions form a continuum. Interesting things take place in this space of all acceptable configurations. In one configuration the centres of the exterior spheres are positioned loosely at the vertices of a regular icosahedron, and in another they are positioned at the vertices of a regular cuboctahedron. Coxeter mentioned in §3.7 of *Regular Polytopes* that the vertices of an icosahedron can be obtained by dividing the edges of an octahedron according to the golden section, and describes a continuous family of shapes running from the octahedron through a regular icosahedron to a cuboctahedron.

In SPLAG, Conway and Sloane point out that this leads to a path among kissing configurations, and go on in a remarkable discussion to relate this construction to properties of the Mathieu group. There are a number of interesting open questions implicit here, as John Baez has mentioned in one of his web notes—the space of all allowable configurations is at once intriguing and not well understood. There are several indisputable proofs that the kissing number is 12, but it would be very pleasant to see this more clearly than we do now.




**Coxeter's deformation of the icosahedron into the cuboctahedron. The cover of this issue shows the corresponding deformation of kissing circles on the sphere.**

## Further reading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See also the reference list in the article by Pfender and Ziegler. I would like to thank Tom Hales, George Szpiro, and Günter Ziegler for their help. —*B.C.*

# The Bowl Championship Series: A Mathematical Review

*Thomas Callaghan, Peter J. Mucha, and Mason A. Porter*

## Introduction

On February 29, 2004, the college football Bowl Championship Series (BCS) announced a proposal to add a fifth game to the "BCS bowls" to improve access for midmajor teams ordinarily denied invitations to these lucrative postseason games. Although still subject to final approval, this agreement is expected to be instituted with the new BCS contract just prior to the 2006 season.

There aren't too many ways that things could have gone worse this past college football season with the BCS Standings governing which teams play in the coveted BCS bowls. The controversy over USC's absence from the BCS National Championship game, despite being #1 in both polls, garnered most of the media attention [12], but it is the yearly treatment received by the "non-BCS" midmajor schools that appears to have finally generated changes in the BCS system [15].

Created from an abstruse combination of polls, computer rankings, schedule strength, and quality wins, the BCS Standings befuddle most fans and sportswriters, as we repeatedly get "national championship" games between purported "#1" and "#2" teams in disagreement with the polls' consensus. Meanwhile, the top non-BCS squads have never been invited to a BCS bowl. Predictably, some have placed blame for such predicaments squarely on the "computer nerds" whose ranking algorithms form part of the BCS formula [7], [14]. Although we have no part in the BCS system and the moniker may be accurate in our personal cases, we provide here a mathematically inclined review of the BCS. We briefly discuss its individual components, compare it with a simple algorithm defined by random walks on a biased graph, attempt to predict whether the proposed changes will truly lead to increased BCS bowl access for non-BCS schools, and conclude by arguing that the true problem with the BCS Standings lies not in the computer algorithms but rather in misguided addition.

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## Motivation for the BCS

The National Collegiate Athletic Association (NCAA) neither conducts a national championship in Division I-A football nor is directly involved in the current selection process. For decades, teams were selected for major bowl games according to traditional conference pairings. For example, the Rose Bowl featured the conference champions from the Big Ten and Pac-10. Consequently, a match between the #1 and #2 teams in the nation rarely occurred. This frequently left multiple undefeated teams and cochampions—most recently Michigan and Nebraska in 1997. It was also possible for a team with an easier schedule to go undefeated without having played a truly "major" opponent and be declared champion by the polls, though the last two schools outside the current BCS agreement to do so were BYU in 1984 and Army in 1945.

The BCS agreement, forged between the six major "BCS" conferences (the Pac-10, Big 12, Big

Ten, ACC, SEC, and Big East, plus Notre Dame as an independent), was instituted in 1998 in an attempt to fix such problems by matching the top two NCAA Division I-A teams in an end-of-season BCS National Championship game. The BCS Standings, tabulated by The National Football Foundation [18], selects the champions of the BCS conferences plus two at-large teams to play in four end-of-season "BCS bowl games", with the top two teams playing in a National Championship game that rotates among those bowls. Those four bowl games—Fiesta, Orange, Rose, and Sugar—generate more than $100 million annually for the six BCS conferences, but less than 10 percent of this windfall trickles down to the other five (non-BCS) Division I-A conferences [13]. With the current system guaranteeing a BCS bowl bid to a non-BCS school only if that school finishes in the top 6 in the Standings, those conferences have complained that their barrier to appearing in a BCS bowl is unfairly high [20]. Moreover, the money directly generated by the BCS bowls is only one piece of the proverbial pie, as the schools that appear in such high-profile games receive marked increases in both donations and applications.

Born from a desire to avoid controversy, the short history of the BCS has been anything but uncontroversial. In 2002 precisely two major teams (Miami and Ohio State) went undefeated during the regular season, so it was natural for them to play each other for the championship. In 2000, 2001, and 2003, however, three or four teams each year were arguably worthy of claiming one of the two invites to the championship game. Meanwhile, none of the non-BCS schools have ever been invited to play in a BCS bowl. Tulane went undefeated in 1998 but finished 10th in the BCS Standings. Similarly, Marshall went undefeated in 1999 but finished 12th in the BCS. In 2003, with no undefeated teams and six one-loss teams, the three BCS one-loss teams (Oklahoma, LSU, and USC) finished 1st through 3rd (respectively) in the BCS Standings, whereas the three non-BCS one-loss teams finished 11th (Miami of Ohio), 17th (Boise State), and 18th (TCU).

The fundamental difficulty in accurately ranking or even agreeing on a system of ranking the Division I-A college football teams lies in two factors: the paucity of games played by each team and the large disparities in the strength of individual schedules. With 117 Division I-A football teams, the 10–13 regular season games (including conference tournaments) played by each team severely limits the quantity of information relative to, for example, college and professional basketball and baseball schedules. While the 32 teams in the professional National Football League (NFL) each play 16 regular season games against 13 distinct opponents, the NFL subsequently uses regular season outcomes to seed a 12-team playoff. Indeed, Division I-A college football is one of the only levels of any sport that does not currently determine its champion via a multigame playoff format.[1] Ranking teams is further complicated by the Division I-A conference structure, as teams play most of their games within their own conferences, which vary significantly in their level of play. To make matters worse, even the notion of "top 2" teams is woefully nebulous: Should these be the two teams who had the best aggregate season or those playing best at the end of the season?

## The BCS Formula and Its Components

In the past, national champions were selected by polls, which have been absorbed as one component of the BCS formula. However, they have been accused of bias towards the traditional football powers and of making only conservative changes among teams that repeatedly win. In attempts to provide unbiased rankings, many different systems have been promoted by mathematically and statistically inclined fans. A subset of these algorithms comprise the second component of the official BCS Standings. Many of these schemes are sufficiently complicated mathematically that it is virtually impossible for lay sports enthusiasts to understand them. Worse still, the essential ingredients of some of the algorithms currently used by the BCS are not publicly declared. This state of affairs has inspired the creation of software to develop one's own rankings using a collection of polls and algorithms [21] and comical commentary on "faking" one's own mathematical algorithm [11].

Let's break down the cause of all this confusion. The BCS Standings are created from a sum of four numbers: polls, computer rankings, a strength of schedule multiplier, and the number of losses by each team. Bonus points for "quality wins" are also awarded for victories against highly ranked teams. The smaller the resulting sum for a given team, the higher that team will be ranked in the BCS Standings.

The first number in the sum is the mean ranking earned by a team in the AP Sportswriters Poll and the *USA Today*/ESPN Coaches Poll.

The second factor is an average of computer rankings. Seven sources currently provide the algorithms selected by the BCS. The lowest computer ranking of each team is removed, and the remaining six are averaged. The sources of the participating ranking systems have changed over the short history of the system, most recently when the BCS mandated that the official computer ranking

[1] *The absence of a Division I-A playoff is itself quite controversial, but we do not intend to address this issue here. Rather, we are more immediately interested in possible solutions under the constraint of the NCAA mandate against playoffs.*

## Simple Random Walker Rankings

Consider independent random walkers who each cast a single vote for the team they believe is the best. Each walker occasionally considers changing its vote by examining the outcome of a single game selected randomly from those played by their favorite team, recasting its vote for the winner of that game with probability $p$ (and for the loser with probability $1-p$). In selecting $p \in (1/2, 1)$ to be the only parameter of this simple ranking system, we explicitly ignore margin of victory (currently forbidden in official BCS systems) and other potentially pertinent pieces of information (including the dates that games are played).

We denote the number of games team $i$ played by $n_i$, the number it won by $w_i$, and the number it lost by $l_i$. A tie (not possible with the current NCAA overtime format) is counted as both half a win and half a loss, so that $n_i = w_i + l_i$. We denote the number of random walkers casting their single vote for team $i$ as $v_i$.

To avoid rewarding teams for the number of games played, we set the rate at which a walker voting for team $i$ decides to recast its vote to be proportional to $n_i$ (with those games then selected uniformly). In other words, the rate that a single game played by team $i$ is considered by a walker at site $i$ (e.g., by a Poisson process) is independent of the other games played by team $i$. Both because of this rate definition and to circumvent cycles that can arise in discrete-time transition problems, we find it convenient to consider the statistics of the random walkers in terms of differential equations for the expected populations.

For a game in which team $i$ beats team $j$, the average rate at which a walker voting for $j$ changes to $i$ is proportional to $p > \frac{1}{2}$ (as it is more likely that the winning team is actually the better team), and the rate at which a walker already voting for $i$ switches to $j$ is proportional to $(1-p)$. The expected rates of change of the populations at each site are thus described by a homogeneous system of linear differential equations,

$$\bar{\mathbf{v}}' = \mathbf{D} \cdot \bar{\mathbf{v}}, \tag{1}$$

where $\bar{\mathbf{v}}$ is the $T$-vector of the expected number $\bar{v}_i$ of votes cast for each of the $T$ teams, and $\mathbf{D}$ is the square matrix with components

$$\begin{aligned} D_{ii} &= -pl_i - (1-p)w_i, \\ D_{ij} &= \frac{1}{2}N_{ij} + \frac{(2p-1)}{2}A_{ij}, \quad i \neq j, \end{aligned} \tag{2}$$

where $N_{ij} = N_{ji}$ is the number of head-to-head games played between teams $i$ and $j$, and $A_{ij} = -A_{ji}$ is the number of times team $i$ beat team $j$ minus the number of times team $i$ lost to team $j$ in those $N_{ij}$ games. In particular, if $i$ and $j$ played no more than a single head-to-head game,

$$\begin{aligned} A_{ij} &= +1, \quad \text{if team } i \text{ beat team } j, \\ A_{ij} &= -1, \quad \text{if team } i \text{ lost to team } j, \\ A_{ij} &= \phantom{+}0, \quad \text{if team } i \text{ tied or did not play team } j. \end{aligned} \tag{3}$$

If two teams play each other multiple times (which can occur because of conference championships), we sum the contribution to $A_{ij}$ from each game. This multiplicity also occurred in the calculations we performed, because we treated all non-Division I-A teams as a single team (which is, naturally, ranked lower than almost all of the 117 Division I-A teams).

The matrix $\mathbf{D}$ encompasses all the win-loss outcomes between teams. The off-diagonal elements $D_{ij}$ are nonnegative, vanishing only for teams $i$ and $j$ that did not play directly against one another (because $p < 1$). The steady-state equilibrium $\bar{\mathbf{v}}^*$ of (1) and (2) satisfies

$$\mathbf{D} \cdot \bar{\mathbf{v}}^* = \mathbf{0}, \tag{4}$$

lying in the null-space of $\mathbf{D}$; that is, $\bar{\mathbf{v}}^*$ is an eigenvector associated with a zero eigenvalue. As long as the graph of teams connected by their games played comprises a single connected component, then the matrix must have codimension one for $p < 1$ and $\bar{\mathbf{v}}^*$ is unique up to a scalar multiple. We therefore restrict the probability $p$ of voting for the winner to the interval $(\frac{1}{2}, 1)$; the winning team is rewarded for winning, but some uncertainty in voter behavior is maintained. The distribution of $\mathbf{v}$ is then joint binomial with expectation $\bar{\mathbf{v}}^*$, and the expected populations of each site yield a rank ordering of the teams.

Although this random walker ranking system is grossly simplistic, we have found [3], [4] that this algorithm does a remarkably good job of ranking college football teams, or at least arguably as good as the other available systems. In the absence of sufficient detail to reproduce the official BCS computer rankings, we use this simple random walker ranking scheme here to analyze the effects of possible changes to the BCS.

algorithms were not allowed to use margin of victory starting with the 2002 season. In the two seasons since that change, the seven official systems have been provided by Anderson & Hester, Billingsley, Colley, Massey, *The New York Times*, Sagarin, and Wolfe. None of these sources receive any compensation for their time and effort; indeed, many of them appear to be motivated purely out of a combined love of football and mathematics. Nevertheless, the creators of most of these systems guard their intellectual property closely. An exception is Colley's ranking, which is completely defined on his website [5]. Billingsley [1], Massey [17], and Wolfe [23] provide significant information about the ingredients for their rankings, but it is insufficient to reproduce their analysis. Additional information about the BCS computer ranking algorithms (and numerous other ranking systems) can be found on David Wilson's website [22].

The third component of the BCS formula is a measurement of each team's schedule strength. Specifically, the BCS uses a variation of what is commonly known in sports as the Ratings Percentage Index (RPI), which is employed in college basketball and college hockey to help seed their end-of-season playoffs. In the BCS, the average winning percentage of each team's opponents is multiplied by 2/3 and added to 1/3 times the winning percentage of its opponents' opponents. This schedule strength is used to assign a rank to each team, with 1 assigned to that deemed most difficult. That rank ordering is then divided by 25 to give the "Schedule Rank", the third additive component of the BCS formula.

The fourth additive factor of the BCS sum is the total number of losses by each team.

Once these four numbers (polls, computers, schedule strength, and losses) are summed, a final quantity for "quality wins" is subtracted to account for victories against top teams. The current reward is -1.0 points for beating the #1 team, decreasing in magnitude in steps of 0.1, down to -0.1 points for beating the #10 team.

It is not difficult to imagine that small changes in any of the above weightings have the potential to alter the BCS Standings dramatically. However, because of the large number of parameters, including unknown "hidden parameters" in the minds of poll voters and the algorithms of computers, any attempt to exhaustively survey possible changes to the rankings is hopeless. Instead, to demonstrate how weighting different factors can influence the rankings, we discuss a simple ranking algorithm in terms of random walkers on a biased network.

## Ranking Football Teams with Random Walkers

Before introducing yet another ranking algorithm, we emphasize that numerous schemes are available for ranking teams in all sports. See, for example, [6], [10], and [16] for reviews of different ranking methodologies and the listing and bibliography maintained online by David Wilson [22].

Instead of attempting to incorporate every conceivable factor that might determine a team's quality, we took a minimalist approach, questioning whether an exceptionally naive algorithm can provide reasonable rankings. We consider a collection of random walkers who each cast a single vote for the team they believe is the best. Their behavior is defined so simplistically (see sidebar) that it is reasonable to think of them as a collection of trained monkeys. Because the most natural arguments concerning the relative ranking of two teams arise from the outcome of head-to-head competition, each monkey routinely examines the outcome of a single game played by their favorite team—selected at random from that team's schedule—and determines its new vote based entirely on the outcome of that game, preferring but not absolutely certain to go with the winner.

In the simplest definition of this process, the probability $p$ of choosing the winner is the same for all voters and games played, with $p > 1/2$, because on average the winner should be the better team, and $p < 1$ to allow a simulated monkey to argue that the losing team is still the better team (due perhaps to weather, officiating, injuries, luck, or the phase of the moon). The behavior of each virtual monkey is driven by a simplified version of the "but my team beat your team" arguments one commonly hears. For example, much of the 2001 BCS controversy centered on the fact that BCS #2 Nebraska lost to BCS #3 Colorado, and the 2000 BCS controversy was driven by BCS #4 Washington's defeat of BCS #3 Miami and Miami's win over BCS #2 Florida State.

The synthetic monkeys act as independent random walkers on a graph with biased edges between teams that played head-to-head games, changing teams along an edge based on the win-loss outcome of that game. The random behavior of these individual voters is, of course, grossly simplistic. Indeed, under the specified range of $p$, a given voter will never reach a certain conclusion about which team is the best; rather, it will forever change its allegiance from one team to another, ultimately traversing the entire graph. In practice, however, the macroscopic total of votes cast for each team by an aggregate of random-walking voters quickly reaches a statistically steady ranking of the top teams according to the quality of their seasons.

We propose this model on the strength of its simple interpretation of random walkers as a reasonable way to rank the top college football teams (or at least as reasonable as other available methods, given the scarcity of games played relative to

the number of teams—but we warn that this naive random walker ranking does a poor job ranking college basketball, where the margin of victory and established home-court advantage are significant [19]). This simple scheme has the advantage of having only one explicit, precisely defined parameter with a meaningful interpretation easily understood at the level of single-voter behavior. We have investigated the historical performance and mathematical properties of this ranking system elsewhere [3], [4]. At $p$ close to $1/2$, the ranking is dominated by an RPI-like ranking in terms of a team's record, opponent's records, etc., with little regard for individual game outcomes. For $p$ near 1, on the other hand, the ranking depends strongly on which teams won and lost against which other teams.

Our initial questions can now be rephrased playfully as follows: Can a bunch of monkeys rank football teams as well as the systems currently in use? Now that we have crossed over into the Year of the Monkey in the Chinese calender and the BCS has recently proposed changes to their non-BCS rules, it seems reasonable to ask whether the monkeys can clarify the effects of these planned changes.

## Impact of Proposed Changes on Non-BCS Schools

The complete details of the new agreement have not yet been released, but indications are that the proposed rules would have given four at-large BCS bids to non-BCS schools over the past six years [13]. Based on the BCS Standings, the best guesses at those four teams are 1998 Tulane (11-0, BCS #10, poll average 10), 1999 Marshall (12-0, BCS #12, poll average 11), 2000 TCU (10-1, BCS #14, poll average 14.5), and 2003 Miami of Ohio (12-1, BCS #11, poll average 14.5). However, there are also indications that only non-BCS teams finishing in the BCS top 12 would automatically get bids [15], and each of the four schools above would have had to be given one of the at-large bids over at least one team ahead of them in the BCS Standings [8].

Given the perception that the polls unfairly favor BCS schools, it is worth noting the contrary evidence from six seasons of BCS Standings. In addition to the four schools listed above, other notable non-BCS campaigns were conducted this past season by Boise State (12-1, BCS #17, poll average 17) and TCU (11-1, BCS #18, poll average 19). Five of these six schools earned roughly the same ranking in the BCS standings and the polls. The only significant exception was 2003 Miami of Ohio, averaging 6th in the official BCS computer algorithms but only 14.5 in the polls.

While the new rules might indeed give BCS bowl bids to all non-BCS schools who finish in the top 12, it is worth inquiring how close non-BCS schools

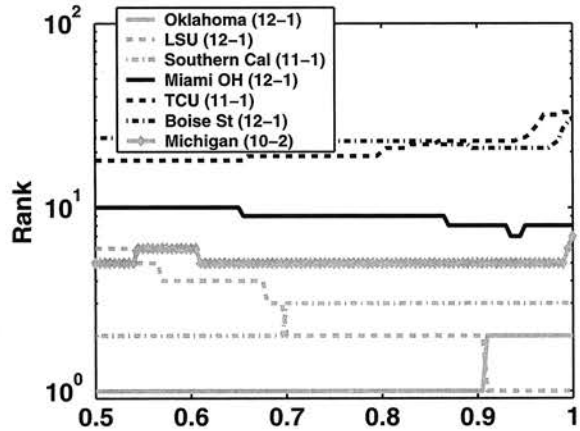


**Figure 1. Random-walking monkey rankings of selected teams for 2003.**

may have come to this or to a top 6 ranking that would have guaranteed them a bid during the past six years. In particular, 2003 was the first time in the BCS era that there were no undefeated teams remaining prior to the bowl games. Given that there were six one-loss teams and no undefeateds, what would have happened if one or more of the three non-BCS teams had instead gone undefeated? While it is impossible to guess how the polls would have behaved and we are unable to reproduce most of the official computer rankings, we can instead compute the resulting "random-walking monkey" rankings for different values of the bias parameter $p$. As a baseline, Figure 1 plots the end-of-season, pre-bowl-game rankings of each of the six one-loss teams, plus Michigan, from the true 2003 season (scaled logarithmically so that the top 2, top 6, and top 12 teams are clearly designated).

Now consider what would have transpired had Miami of Ohio, TCU, and Boise State all gone undefeated. Figure 2 shows the resulting rankings of the same teams as Figure 1 under these alternative outcomes. In the limit $p \to 1$, going undefeated trumps any of the one-loss teams, so each of these mythically undefeated schools ranks in the top 3 in this limit. For TCU and Boise State, however, their range of $p$ in the top 6 is quite narrow. If the new rules require only a top 12 finish for a non-BCS team, then the situation looks much brighter for an undefeated TCU, which earned monkey rankings in the top 11 at all $p$ values. However, according to the scenario plotted in Figure 2, an undefeated Boise State's claim on a BCS bid remains tenuous even under the proposed changes. Indeed, even had Boise State been the only undefeated team last season (not shown), the monkeys would have left them out of the top 10 and behind Miami of Ohio for $p \lesssim 0.86$.

At the other extreme, one-loss Miami of Ohio already has a legitimate claim to the top 12 according to both the monkeys *and* the real BCS Standings. Note, in particular, the exalted ranking

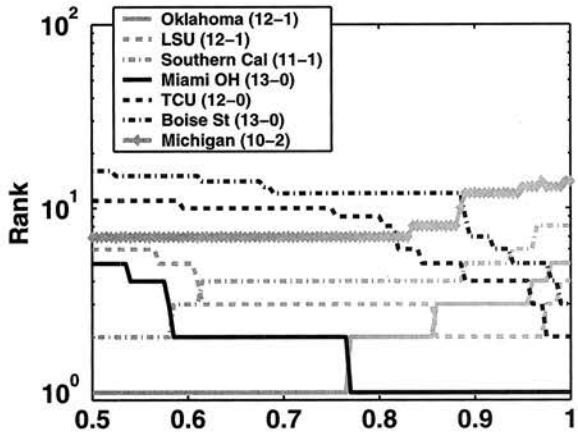


**Figure 2. Random-walking monkey rankings of selected teams for an "alternate universe" 2003 in which the three non-BCS, one-loss teams instead went undefeated.**

the monkeys would have given Miami of Ohio had they won their season opener against Iowa (their only loss in the actual 2003 season). According to the monkeys, they may have even had a reasonable argument to be placed in the championship game had they gone undefeated. It was bad enough not being able to fit three teams onto the field for the BCS National Championship game, but we might have been one Miami of Ohio victory over Iowa away from wanting to crowd four squads into the mix!

As an example of how the effects of games propagate into the rankings of other teams, we also include Michigan's ranking in both figures, even though their outcomes were not changed in the calculations that produced the two plots. Nevertheless, because Michigan is a next-nearest neighbor of Miami of Ohio in the network (both teams lost to Iowa in 2003), changing the outcome of the Iowa v. Miami of Ohio game unsurprisingly affects Michigan's ranking detrimentally.

To conclude this section, we stress that the above discussion is purely hypothetical, as the monkeys provide only a stand-in for our inability to compute true BCS Standings under alternative outcomes.

## The Problem at the Top, and a Possible Solution

While we focused above on non-BCS schools and the recent changes that improve their chances of playing in a BCS bowl game, the larger BCS controversy for many fans is the recurring inability of the BCS to generate a championship game between conclusive "top 2" teams. Each of the past four seasons, the two polls agreed on the top two teams prior to the bowl games. In three of those seasons, however, the top two spots in the BCS Standings included only one of the teams selected by the polls. In 2000 and 2001, the #2 team in the polls ended up on the short end of the BCS stick, whereas in 2003 it was USC (the #1 team in both polls) on the outside looking in.

Although it is easy to blame this situation on the computer rankings, the true problem as we see it lies in the BCS formula of polls, computers, schedule strength, losses, and quality wins. Simply, the polls and computers already account for schedule strength and "quality wins", or else the three non-BCS one-loss teams (Miami of Ohio, TCU, and Boise State) would have placed in the top 6 in the 2003 BCS Standings. Adding these factors *again* after the polls and computer rankings are determined disastrously double-counts these effects, adversely degrading confidence in the BCS selections for the National Championship and the other BCS bowls.

One of the presumed motivations for including separate factors for schedule strength and quality wins was to reduce the assumed bias of the polls towards traditional football powers. However, as discussed above, the top non-BCS teams over the past six years were ranked similarly in the polls and computers. Therefore, one might rightly worry that the quality wins and schedule strength factors are making it harder for non-BCS schools to do well in the standings, as their schedules are typically ranked significantly lower and they have few opportunities for so-called "quality wins".

USC was on the losing end of this double-counting in 2003, having finished the regular season #1 in both polls and averaged #2.67 on the computers. LSU was #2 in both polls and averaged #1.93 on the computers, and Oklahoma was #3 in both polls and averaged #1.17 on the computers. One of the official computer systems even ranked non-BCS Miami of Ohio ahead of USC. However, although the computers ranked Oklahoma ahead of the other teams, it was Oklahoma's 11th place schedule strength and −0.5 "quality win" bonus for beating Texas that combined to give it an additional 1.55 BCS-points edge compared to USC's 37th place schedule (standings available from [18]). With six one-loss teams in Division I-A, the ranking algorithms predominantly favored Oklahoma *because* of its relatively difficult schedule and its victory over Texas. Without those effects being included *again* in separate quality wins and schedule strength factors, a straight-up averaging of the polls and the computers would rank USC first (1+2.67=3.67), LSU second (2+1.93=3.93), and Oklahoma third (3+1.17=4.17).

A reasonable knee-jerk reaction to this proposal would be to reassert that schedule strength, number of losses, and so-called quality wins should matter. Our point is that they are *already* incorporated in such a simple averaging scheme, as the polls and the computers (necessarily) consider such factors to produce reasonable rankings. To explicitly add further BCS points for each of these considerations gives them

more weight than the collective wisdom of the polls and computer rankings believe they should have.

Whatever solution is ultimately adopted, we strongly advocate that modifications to the BCS remove such double-counting and, ideally, provide a system that is more open to the community. That the double-counting problem is not widely appreciated further supports our opinion that the BCS system needs to be more transparent. The recently announced addition of a fifth BCS bowl does not address this problem.[2]

College football fans should not have to accept computer rankings without a minimal explanation of their determining ingredients, not only so that they have more confidence in these algorithms, but also to open debate about what factors should be included and how much they should be weighted. For example, there is certainly a need to discuss how much losing a game late in the season or in a conference championship game (as Oklahoma did in 2003) should matter compared to an earlier loss.

Even before the end-of-season controversy in 2003, a survey conducted by New Media Strategies indicated that 75 percent of college football fans thought that the BCS system should be scrapped entirely [9]. That number presumably increased after the new round of controversy. Changes that lead to greater transparency and a simplified weighted averaging of the polls and computers are the only way anything resembling the current BCS system can maintain popular support.

## Epilogue

New information appearing after the original writing of this review claims that the double-counting factors in the BCS formula may be scrapped in favor of an average of polls and computer rankings [2]. We submitted advance copies of this article to BCS decision makers, but we have no knowledge that any changes resulted directly from our input. It was announced on July 15th that the new BCS Standings wil be determined by equally weighting the AP poll, the *USA Today*/ESPN Coaches poll, and an average over the computer systems (that is, 2/3 polls, 1/3 computers). One might worry that this weighting effectively relegates the computers to tie breaking, a posteriori yielding National Championship pairings in agreement with the polls over each of the past six seasons and placing any possibility of a midmajor school getting a BCS bid almost wholly in the hands of poll voters. Nevertheless, such a change clearly simplifies the BCS Standings, which we view as positive.

[2]*However, it appears that even more recent changes may simplify the BCS formula by removing the double counting; see the Epilogue.*

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# a Grope?

*Peter Teichner*

The mathematical term *grope* first appeared in print in Jim Cannon's 1978 *Bulletin* exposition [1]. He credited the term to his Madison colleague Russ McMillan, a geometric topologist. Cannon explained that the object in question was called a grope "because of its multitudinous fingers." He went on to warn that "this terminology suggests any number of bad puns," some of which he failed to resist. Over the years research articles have even been rejected because they used the term *grope*.

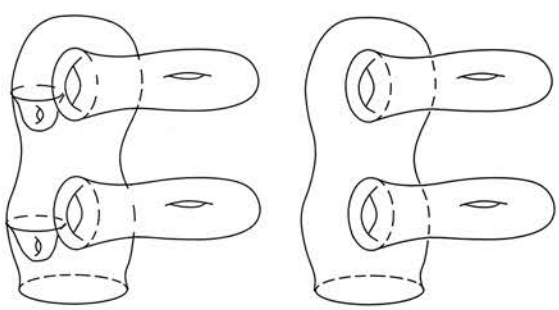

**Figure 1. Gropes of height 2 (L) and class 3 (R).**

Mathematically, *gropes* are certain 2-dimensional complexes (with one boundary circle) which are unions of *surfaces* (here taken to be compact, connected, oriented 2-manifolds with a single boundary circle). To organize the gluing of these surfaces, we introduce a complexity, the *height* of the grope. For height $h = 1$, a grope is just a surface $\Sigma$.

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For $i = 1, \ldots, 2 \cdot \mathrm{genus}(\Sigma)$, let $\alpha_i$ be a full symplectic basis of circles in $\Sigma$. Then a grope of height $(h+1)$ is formed by attaching gropes of height $h$ to each $\alpha_i$ along the boundary circles.

Gropes, therefore, are not quite manifolds, but the singularities that arise are of a very simple type, so that these 2-complexes are in some sense the next easiest thing after surfaces. To motivate the definition of gropes and their complexity, let us next explain a relation to group theory.

**Group Commutators and Gropes.** A continuous map $S^1 \to X$ (from the circle to any space $X$) represents an element in the fundamental group $\pi_1 X$. The map extends to a map of a surface (a grope of height 1) to $X$ if and only if it represents a commutator in $\pi_1 X$. This is most easily seen by thinking of a surface $\Sigma$ of genus $g$ as a (punctured) $4g$-gon with sides identified in pairs. The pattern of these identifications is given by reading the following word along the boundary of the $4g$-gon:

$$\prod_{i=1}^{g} a_i b_i a_i^{-1} b_i^{-1}.$$

Since the boundary circle of $\Sigma$ is in the middle of the $4g$-gon, it must equal this commutator. Iterated commutators can similarly be expressed by continuous maps of gropes to $X$: A map $S^1 \to X$ represents an element in the $h$-th term of the *derived series* of $\pi_1 X$ if and only if it extends to a continuous map of a grope of height $h$. Recall that the derived series of a group $G = G^{(0)}$ is defined by iterated commutators $G^{(h+1)} := [G^{(h)}, G^{(h)}]$. A group is *solvable* if this series terminates at 1. There is a

close cousin of the derived series, namely the *lower central series* of a group $G = G_1$, defined by $G_{c+1} = [G, G_c]$. A group is *nilpotent* if this series terminates at 1. The reader might imagine how to define certain 2-complexes (with one boundary circle), called *gropes of class c*, such that a map $S^1 \to X$ represents an element in the $c$-th term of the lower central series of $\pi_1 X$ if and only if it extends to a continuous map of a grope of class $c$. In fact, such gropes are more general than the ones previously defined, and the terminology has shifted over the years as follows: gropes that have a height $h$ are now also called *symmetric gropes.* Group theory tells us that they have class $c = 2^h$. Not every grope is symmetric, as shown in Figure 1.

**Geometric Group Commutators.** Once one can describe iterated commutators in $\pi_1 X$ by maps of gropes, one might as well look at *embedded* gropes in order to study more geometric questions. The most direct applications seem to be the most recent ones, namely to knot theory. This is the theory of *embedded* circles in 3-space (rather than continuous maps of a circle as in the case of the fundamental group). Recall that every knot bounds a Seifert surface in 3-space but that only the trivial knot bounds an embedded disk. Thus all of knot theory is created by the difference between a surface and a disk. As we saw, this is just like the difference between a commutator in $\pi_1 X$ and the trivial group element. Gropes give us a way to filter this difference in analogy to iterated commutators in group theory.

Thinking 4-dimensionally, one is led to studying knots in $S^3 = \partial D^4$ which extend to *embeddings* of symmetric gropes of height $h$ into $D^4$. This gives a filtration of the *knot concordance group,* which was introduced by Cochran, Orr, and the author in 1998. We showed that all the previously known concordance invariants can be recovered for small $h$. For example, if a knot bounds a symmetric grope of height 4 in $D^4$, then all its Casson-Gordon invariants vanish. Using von Neumann signatures of solvable covers of the knot complement, it was shown that each of the successive quotients of the terms of this filtration are nontrivial.

Schneiderman showed that all knots with trivial Arf invariant bound (nonsymmetric) gropes of arbitrarily large *class* in $D^4$. However, if one asks for such a grope to be embedded in 3-space, then a rich obstruction theory arises. It was developed by Conant and the author and is closely related to Vassiliev's knot invariants, with the *class* of the grope corresponding exactly to the *finite type* of the invariant.

See [3] for a survey and references for these 3- and 3.5-dimensional applications of gropes.

**A Brief History of Gropes.** Grope-like objects first appeared in a 1971 article by Stanko who proved that certain wild embeddings in codimension 3 are limits of tame embeddings. In 1975 Cannon and Ancel extended Stanko's technique to codimension 1. In 1977 Cannon introduced gropes and the *disjoint disks property* to prove several manifold recognition theorems. Among them was the famous *Double Suspension Theorem,* which says that for any homology $n$-sphere, the double suspension is homeomorphic to the standard $(n+2)$-sphere. (The suspension of a space $X$ is the union, along $X$, of two cones on $X$.) The result was extremely surprising, since a single suspension of a manifold $X$ can be a manifold only if $X$ is the standard sphere. Without using gropes, Bob Edwards had proven the Double Suspension Theorem before Cannon in many cases (as well as the Triple Suspension Theorem). Inspired by their success in these problems, Edwards suggested using gropes in 4-dimensional topology. Michael Freedman introduced them in his paper that appeared in the proceedings of the 1983 International Congress of Mathematicians in Warsaw. In that paper, he extended his *Disk Embedding Theorem* from the simply connected case to 4-manifolds with *good* fundamental group. This included finite and cyclic groups (it is still an open question which groups are good, groups of subexponential growth being the most general class known). In [2] the topological theory of 4-manifolds is formulated entirely in terms of symmetric gropes.

It is amusing that the applications of gropes have moved down in dimensions over the years. However, the slogan has always remained the same: If you are looking for a disk, try to find a grope first.

**Acknowledgement.** Many thanks to Ric Ancel for clarifying the origin of the term in question.

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**Book Review**

# A Handbook of Mathematical Discourse

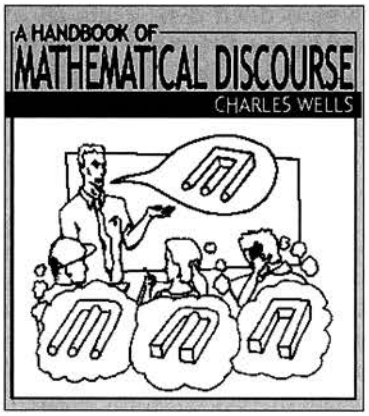
*Reviewed by Steven G. Krantz*

**A Handbook of Mathematical Discourse**
*Charles Wells*
*Infinity Publishing, 2003*
*Paperback, 300 pages, $24.95*
*ISBN 074-14-16859*

A first-class education consists of learning different modes of discourse. Certainly philosophy, history, biology, engineering, and mathematics have quite distinct and special argots. Learning these different languages causes one to turn ideas over in one's mind, and that is the purpose of education.

Thus it is a welcome breath of fresh air to see *A Handbook of Mathematical Discourse* by Charles Wells. Mathematical discourse is the heart of how we record our ideas. Our language, and mode of expression, is very special to our culture and our subject. It is well to have a book stating once and for all what we are about. This must be an ambitious project, for the language of mathematics is extensive and diverse. Even to learn all the jargon of a single area (such as algebraic topology) is a considerable challenge. The potential impact for a book such as this is considerable.

Most of us do not receive much training in mathematical writing. Perhaps, if one is lucky, one has a thesis advisor who puts one through the paces in the writing of the thesis. But after that one is on one's own. A book on mathematical discourse could be a touchstone for a young mathematician struggling to learn to articulate his thoughts clearly and effectively. It could tell the neophyte what are the issues and the challenges of mathematical writing. It could suggest finger exercises for developing writing skills. It could provide examples of good mathematical writing and bad. We note that [HIG] is a splendid example of this sort of book. [KRA] is also an effort in this direction.




Charles Wells has set for himself a weighty and potentially substantial task. His book could be the leaping-off point for the serious mathematical writer. It could be the wellspring of a future generation of fine mathematical writers. One is somewhat intimidated by the thought of even launching upon such a project. It is a ponderous responsibility and a daunting task. How does Wells succeed with his quest?

The answer is both startling and disappointing. In his introduction, Wells tells us that he will be treating the language of postcalculus mathematics and his intended audience is (i) teachers of college-level mathematics, (ii) undergraduate mathematics majors, (iii) graduate students in mathematics, and (iv) researchers in mathematics education. Thus the

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book, which is actually a lexicon of terms and concepts, contains entries such as

**theorem proposition proof logic**
**function superscript permutation**
**universal quantifier if and only if**

All good and well, but most of the entries are at this level of simplicity—very naive indeed. There is no entry for **homotopy**, no entry for **spectrum**, and certainly no entry for **pseudoconvex**.

What is even more astonishing is that there are entries for

**college synecdoche symbolitis**
**twiddle unwind bad at math**
**cognitive dissonance**
**existential bigamy grasshopper**
**enthymeme**

I have been in this business for over thirty years, and I can say with some authority that most of these words are *not* part of the standard lexicon of mathematics. I would wager that most mathematicians would have no idea what "synecdoche" or "enthymeme" means; and in fact "synecdoche" is part of the discourse of literary criticism, and "enthymeme" is part of philosophy—neither belongs to mathematics.

Wells does provide considerable and detailed discussion and examples of many of his terms, such as **function**, **Greek alphabet**, **definition**, and **convention**. He is remarkably terse in his treatment of such fundamental concepts as **theorem** and **true**. After a few hours browsing through the book, one cannot help but wonder who the audience for this book *could actually be*. Certainly a first-year graduate student or an upper-division major (Wells's professed targets) will already know the standard mathematical terminology that appears in this book. I would like to think that researchers in mathematics education would also be at least acquainted with this fundamental vocabulary. There are no deep math concepts here. Contrast Wells's book with, for example, the extremely useful and detailed *Concise Dictionary of Mathematics* [WEI] by Eric Weisstein. In Weisstein's book one can look up modern ideas such as **singular integral** or **exotic cohomology** or **spectral sequence** or **Kähler manifold** and actually find out what they are. The volume is a tremendous resource. With Wells's book one is never quite sure what one will find or not find.

I can imagine that a nonnative English speaker, newly arrived on our shores, might find something of value in the book by Wells. Reading his book might prevent such a tyro from saying something silly like "This putrescent theorem is isomorphic to a blue fish." I doubt that it would actually teach him anything of substance. And the many byways and detours that Wells takes might, in the end, prove to be confusing.

Ambrose Bierce's *Devil's Dictionary* [BIE] is a remarkable and compelling piece of writing because of its searing wit and sardonic take on life. Bierce does not define any new words. He instead gives deadly interpretations of very familiar words. Wells's book does not fit into the same category of literary effort. His book provides insipid, and often incomplete, definitions of familiar (or sometimes irrelevant) words. I would frankly be embarrassed to give this book to my students. They can learn the meaning and use of these words—at least the ones that have any bearing on the way that mathematics is practiced today—by listening to *me*; they do not need to read a book in order to internalize these ideas. And the treatment in Wells's book is so hit-and-miss that one cannot be confident that any mastery of anything worthwhile would be the result of time spent with the volume.

In sum, I find it difficult to imagine why this book was written and even more difficult to conceive of why it was published. This manuscript might be fun to circulate among friends just as a catalyst for conversation over coffee. It does not seem to have the gravitas that the title *A **Handbook** of Mathematical Discourse* might suggest. If I were to outline a book of this kind, I would suggest actual essays on why and how we formulate definitions, how we prove theorems, why we have different modes of proof, what is the difference between a lemma and a theorem, what makes for credibility in mathematical writing and what does not, what is worthwhile mathematics and what is trivia. The book *Proofs and Refutations* [LAK] by Lakatos is a step in that direction, and one well worth examining. I would give the present book a rather lower priority.

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[KRA] S. G. Krantz, *A Primer of Mathematical Writing*, Amer. Math. Soc., Providence, RI, 1996.

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# Keyfitz Named Director of Fields Institute

**Barbara Lee Keyfitz**

In July 2004 Barbara Lee Keyfitz of the University of Houston became the director of the Fields Institute for Research in the Mathematical Sciences in Toronto, Ontario, Canada. She succeeds Ken Davidson, who is returning to the University of Waterloo after a three-year term as director.

A native of Canada, Keyfitz grew up in Toronto and received her bachelor's degree from the University of Toronto. She went to New York University as a graduate student, completing her doctorate in 1970 under the direction of Peter D. Lax. She has stayed in the United States for her whole career, which has included positions at Columbia University, Princeton University, and Arizona State University. In 1983 she came to the University of Houston, where she is currently a John and Rebecca Moores Professor. She plans to return to her home institution at the end of her three-year term as director of the Fields Institute. Her areas of research are analysis of partial differential equations, hyperbolic conservation laws, and their applications.

Over the past ten years Keyfitz has become increasingly involved in Canadian mathematics, and for the past four years she served on the Scientific Advisory Panel for the Fields Institute. "The more I saw of the Fields Institute, the more impressed I was by it," she said. To be director "is a unique position, a unique opportunity."

Established in 1992, the Fields Institute is a "visitor's institute", meaning that it runs programs bringing in mathematicians for visits of varying lengths. Most activities cluster around semester- or year-long themes, though there are also shorter-term workshops and conferences outside the thematic area. One distinctive feature of the Fields Institute is that it offers courses aimed at graduate students in the thematic areas. The institute has no permanent research staff, although the director and deputy director are encouraged to continue doing research during their tenures. Funding for the institute comes from the Canadian government, from the provincial government of Ontario, and from grants, private donations, and contributions from seven sponsoring institutions. One of those institutions is the University of Toronto, where the Fields Institute is located. Although the institute occupies a university building, it is formally a separate entity from the university.

Besides Fields there are two other major mathematics institutes in Canada: the Centre de Recherches Mathématiques in Montreal and the Pacific Institute of Mathematical Sciences in Vancouver. A couple of years ago, Canada launched the Banff International Research Station (BIRS), which is a conference center for the mathematical sciences. Having begun her mathematics studies in Canada and then having been away for thirty years,

Keyfitz said, "What really struck me is how the institutes have changed how mathematics is done in Canada. It's wonderful—and it's appreciated." In particular the institutes have helped to raise the profile of mathematics within scientific disciplines, as well as the profile of Canadian mathematics on the international scene. She also noted that in Canada the directors of mathematics institutes have come to play a special role in providing scientific leadership and advocacy for the field.

Asked about her plans for her directorship, Keyfitz remarked that "there is a lot I don't want to change." The day-to-day operations, for example, "seem to be managed extremely well," she remarked. "Fields has an excellent staff, which is terrific and which everyone comments on." The institute has a track record of running high-quality programs and is known for its convenient logistical setup, including access to the excellent libraries at the University of Toronto.

Nevertheless, Keyfitz is bubbling with ideas for things she wants to work on at the institute. She would like to introduce some new areas, such as those at the interface of mathematics and the biological and biomedical sciences. This would be a natural step, as Toronto has a large hospital complex with a sizeable research component. As a frequent visitor to the Institute for Mathematics and its Applications (IMA) at the University of Minnesota, Keyfitz has come to admire the IMA's thriving program of industrial research. She would like to build upon the Fields Institute's Commercial and Industrial Mathematics program and expand in new directions. The path is not straightforward, as Canadian companies do not tend to have the large research components found in some U.S. companies. "But this would be an interesting challenge to explore," she said.

While Toronto is a bustling urban center with a lively mathematical community, there are many parts of Canada that, mathematically speaking, are rather isolated. The Fields Institute plays an important role of bringing the world mathematical community to Canada. "The idea of refreshing the stream of research in Canada by interacting with other countries is an important theme at this institute," Keyfitz remarked. In this vein she would like to see Fields reach out to mathematicians in Atlantic Canada, which consists of the provinces of Nova Scotia, New Brunswick, Newfoundland, and Prince Edward Island. She also hopes to increase the number of affiliate institutions, perhaps including some in parts of the U.S. that are close to Toronto.

Next year, in addition to being at the helm of the Fields Institute, Keyfitz will begin a two-year term as president of the Association for Women in Mathematics. Her appointment at Fields marks the first time a woman has held the position of director at a national mathematics institute. (In the 1980s Cathleen Morawetz was director of the Courant Institute of Mathematical Sciences at New York University; however, Courant differs from a national mathematics institute in that it functions more like a school of mathematics in offering courses and awarding degrees.) Keyfitz remarked that her becoming director of the Fields Institute will not solve the problems women face in mathematics. Nevertheless, she hopes she can make positive contributions "that might not have exactly the same flavor if they were not done by a woman."

*—Allyn Jackson*

# Seymour Receives Ostrowski Prize

PAUL D. SEYMOUR of Princeton University has received the 2003 Ostrowski Prize recognizing outstanding mathematical achievement. The prize carries a monetary award of 100,000 Swiss francs (approximately US$80,000) and a fellowship of 25,000 Swiss francs. The fellowship will be awarded to Seymour's student, MARIA CHUDNOVSKY. The prize ceremony will take place at the University of Waterloo on September 30 and October 1, 2004.

## Citation

What follows is the citation prepared by the jury of the Ostrowski Prize.

**Paul D. Seymour**

Paul Seymour was born in 1950 in England, obtained his D.Phil. from the University of Oxford in 1975, and is currently a professor of mathematics at Princeton University. He received the George Pólya Prize in 1983 and the Fulkerson Prize in 1979 and 1994, the second time jointly with Neil Robertson and Robin Thomas. In 1994 he gave a plenary lecture at the International Congress of Mathematicians.

Paul Seymour has enriched mathematics with a number of spectacular results. His work is known not only by all discrete mathematicians but also by most theoretical computer scientists.

For instance, Seymour gave a precise characterization of totally unimodular matrices, a result which is one of the deepest in the theory of matroids. With Robertson and Thomas he characterized completely the graphs which cannot be embedded in three-space without two cycles being linked and also solved Pólya's permanent problem from 1913 and the next open case (one past the four-color theorem) of Hadwiger's conjecture of 1943. Robertson, Sanders, Seymour, and Thomas gave a new and simpler proof of the four-color theorem of Appel and Haken. Further, in a sequence of papers with Robertson he proved that, for every infinite collection of finite graphs, there is always one which can be obtained from another by deleting and contracting edges. Their work provides polynomially bounded algorithms for all those graph properties which are closed under deleting or contracting edges.

Recently Seymour and his student Chudnovsky combined their work with that of Seymour and his close collaborators Robertson and Thomas in order to prove the strong perfect graph conjecture of Berge. Berge's conjecture had stood since 1961 and was one of the most important open problems in graph theory. The chromatic number of a graph $G$ is the minimum number of colors needed to color the vertices of $G$ so that adjacent vertices have different colors. The clique number of $G$ is the largest number of pairwise adjacent vertices of $G$. Those graphs for which the two numbers are equal for all induced subgraphs are known as perfect graphs. A hole of a graph is a chordless cycle of length at least four, and an antihole is the complement of such a cycle. Berge conjectured that a graph is perfect if and only if it contains no odd hole or antihole. The proof by Chudnovsky, Robertson, Seymour, and Thomas of Berge's conjecture is a profound contribution to the subject of combinatorial mathematics.

## About the Prize

The Ostrowski Foundation was created by Alexander Ostrowski, for many years a professor at the University of Basel. He left his entire estate to the foundation and stipulated that the income should provide a prize for outstanding recent achievements in pure mathematics and the foundations of numerical mathematics. The prize is awarded every other year. The prize jury consists of representatives from the universities of Basel, Jerusalem, and Waterloo and from the academies of Denmark and the Netherlands. For the 2003 prize, the jury members are: Joram Lindenstrauss, David Masser, Cameron Stewart, Carsten Thomassen, and Robert Tijdeman.

Previous recipients of the Ostrowski Prize are Louis de Branges (1990), Jean Bourgain (1991), Miklos Laczkovich (1993), Marina Ratner (1993), Andrew Wiles (1995), Yuri Nesterenko (1997), Gilles Pisier (1997), Alexander Beilinson (1999), Helmut Hofer (1999), Henryk Iwaniec (2001), Peter Sarnak (2001), and Richard L. Taylor (2001).

*—Allyn Jackson*

# 2003 Annual Survey of the Mathematical Sciences

*(Third Report)*

## Faculty Profile
## Enrollment and Undergraduate Degrees Profile
## Graduate Student Profile

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

This Third Report of the 2003 Annual Survey gives information about faculty size, departmental enrollments, majors, and graduate students for departments of mathematical sciences in four-year colleges and universities in the United States. Prior to 2000, these data were included as part of the Second Report.

The 2003 Annual Survey represents the forty-seventh in an annual series begun in 1957 by the American Mathematical Society. The 2003 Survey is under the direction of the Data Committee, a joint committee of the American Mathematical Society, the American Statistical Association, the Institute of Mathematical Statistics, and the Mathematical Association of America. The current members of this committee are Amy Cohen-Corwin, Donald M. Davis, Nicholas M. Ercolani, J. Douglas Faires, Alexander J. Hahn, Naresh Jain, Stephen F. Kennedy, Ellen E. Kirkman (chair), David J. Lutzer, Polly Phipps, and James W. Maxwell (ex officio). The committee is assisted by AMS survey analyst Colleen Rose. Comments or suggestions regarding this Survey Report may be directed to the committee.

**Introduction**

The Annual Survey of the Mathematical Sciences collects information each year about departments, faculties, and students in the mathematical sciences at four-year colleges and universities in the United States. Definitions of the various groups surveyed in the Annual Survey can be found in the box on page 911 of this report. Departments in the former Group Vb are no longer surveyed. We present information about the faculties and instructional programs at the undergraduate and graduate levels in these departments for the 2003–2004 academic year. For 1999–2000 and earlier years, these data were presented as part of the Second Report.

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

The Departmental Profile questionnaire is mailed to a stratified random sample of departments drawn from each of Groups M and B, and standard statistical projections are made using the data from the respondents. The stratification for Groups M and B is based on the enrollment of the school and whether it is a public or a private school. For the third year, standard errors are reported for several of the more important projections made in Groups M and B. The box on page 902 discusses these standard errors in more detail.

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

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

## Highlights

- The estimated total number of full-time doctoral positions under recruitment in mathematics departments (Groups I, II, III, Va, M, and B combined) is down to 1,504 from 1,867 last year (a drop of 19%). Of these 1,504 full-time positions, 1,007 were tenured/tenure-track, down from 1,320 last year (a drop of 24%). Of the 1,007 full-time tenured/tenure-track doctoral positions, 869 were open to new doctorates, down from 1,124 last year (a drop of 23%).
- The estimated total number of full-time doctoral positions filled with a doctoral hire in mathematics departments is down to 1,116 from 1,319 last year (a decrease of 15%); this total number is down 28% (427 from 593) in Groups I, II, III, and Va combined, and down 5% (688 from 725) in Groups M and B combined. The total number of tenured/tenure-track doctoral hires is down 14% in Groups I, II, III, and Va combined (to 220 from 254 last year), and 4% in Groups M and B combined (to 503 from 528 last year).
- The estimated total number of new doctoral hires in mathematics departments is down 38% (384 from 623) this year from last year; it is down 44% (to 174 from 309) in Groups I, II, II, Va combined, and down 33% (to 210 from 314) in Groups M and B combined. The number of new doctoral tenured/tenure-track hires is down 43% (193 from 337); it is down 58% (to 33 from 79) in Groups I, II, III, Va combined, and down 38% (to 160 from 258) in Groups M and B combined.
- The estimated number of not-new doctoral hires in mathematics departments is up 5% to 731 from 695 last year (this number is up in Groups M and B combined, and down in Groups I, II, III, Va combined). The estimated number of not-new doctoral hires into tenured/tenure-track positions is up both in Groups I, II, III, and Va combined (187 from 175 last year) and in Groups M and B combined (344 from 270 last year, a 27% increase over last year).
- The total number of full-time faculty in Groups I, II, III, Va, M, and B combined is estimated at 20,421, with a standard error of 347; this total is up 414 from last year. The number of full-time faculty having doctorates in this total is estimated at 16,819, up from 16,430 last year. The number of full-time doctoral non-tenure-track faculty in this total is estimated at 2,032, down from 2,057 last year. The size of the standard error makes it possible that the changes observed are due to sampling error.
- The number of female full-time faculty in Groups I, II, III, Va, M, and B combined is estimated at 5,195, up from 5,019 last year. The number of non-doctoral full-time faculty is estimated at 3,602, up from 3,577 last year. The estimated number of part-time doctoral faculty in this total is 7,338, down from 7,771 last year. Detailed information is given in this report about these groups.
- The estimated number of full-time graduate students in mathematics departments decreased to 11,997 from 12,647 last year. The estimated number of full-time graduate students in Groups I, II, III, and Va combined who are first year is up 21% over last year, and is at the highest level in ten years; this number has been increasing each year beginning in 1997 and is up 51% since 1997. The number of full-time graduate students who are first year and U.S. citizens is down 13% over last year.

### Remarks on Statistical Procedures

This report is based on information gathered from departments of mathematical sciences in the U.S., separated into groups by highest degree granted as defined on page 911. Groups for doctoral-granting departments are I (Public), I (Private), II, III, IV, and Va. Groups M and B consist of those departments offering master's and bachelor's degrees respectively.

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

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

The stratified random sampling procedures used for Groups M and B were put in place four years ago. Beginning last year, standard errors were calculated for some of the key estimates. Standard errors are calculated using the variability in the data and can be used to crudely measure how closely our estimate is to the true value for the population. As an example, the number of full-time faculty in Group M is estimated at 4,101, with a standard error of 134. This means the actual number of full-time faculty in Group M is most likely between 4,101 plus or minus two standard errors, or between 3,833 and 4,369. This is much more informative than simply giving the estimate of 4,101.

Estimates are also given for parameters that are totals from all groups, such as the total number of full-time faculty. The values given for the doctoral groups are assumed to be the true parameters for these groups, because they are not sampled and hence are not subject to sampling variability. The only variability in a total of several groups comes from the sampling for Groups M and B. Using the standard errors for M and B, it is possible to calculate a standard error for the total. For example, an estimate of the total number of full-time faculty in all groups but group IV is 20,421, with a standard error of 347.

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

**Table 1: Faculty Attrition,[1] Fall 2003**

| | GROUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | I, II, III, & Va | M | B | I, II, III, Va, M, & B | IV |
| **Full-time faculty who retired or died** | | | | | | | | | | |
| Total number | 33 | 8 | 72 | 61 | 11 | **184** | 119 | 222 | **525** | 26 |
| *(Standard error)* | | | | | | | *(8)* | *(33)* | *(34)* | |
| Percentage | 1.9 | 1.0 | 2.9 | 2.9 | 3.3 | **2.4** | 2.9 | 2.5 | **2.6** | 1.8 |

[1] Number and percentage of full-time faculty who were in the department in fall 2002 but were reported to have retired or died by fall 2003.

# Faculty Profile

The Departmental Profile, sent in fall 2003 to mathematical sciences departments at four-year colleges and universities as part of the Annual Survey, gathered information about faculties at these schools, which is reported in this section. The 2003 First Report presented data collected earlier about faculty salaries (pages 218–33 of the February 2004 issue of the *Notices of the AMS*.)

### Faculty Attrition

Table 1 displays losses of full-time mathematical sciences faculty due to retirements and deaths. The fall 2003 mathematics faculty attrition rate for Groups I, II, III, Va, M, and B combined is 2.6%. Figure 1 shows the trend in the attrition rate for these departments during the years 1988 to 2003. After a significant increase from 1997 to 1998, the overall rate has remained relatively stable over the last five years. However, the rates vary quite a bit from group to group and from year to year within each of the groups. For fall 2003, Group I Private had

**Figure 1: Percent of Full-Time Doctoral Faculty Who Retired or Died in Groups I, II, III, Va, M, & B, Fall 1988 to Fall 2003**

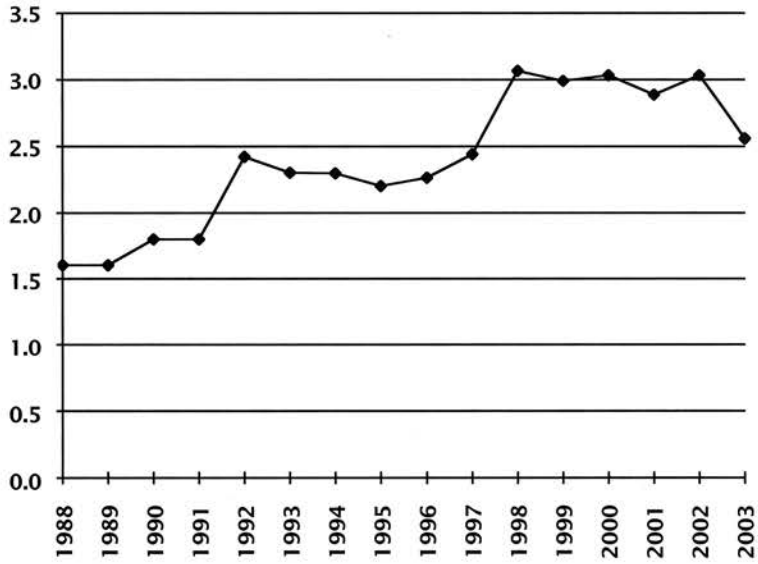



**Table 2A: Recruitment of Doctoral Faculty, Fall 2003**

| | GROUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | I, II, III, & Va | M | B | I, II, III, Va, M, & B | IV |
| **Posted Doctoral Positions** | | | | | | | | | | |
| **Total number**[1] | **135** | **114** | **128** | **133** | **22** | **532** | **308** | **664** | **1504** | **134** |
| *(Standard error)* | | | | | | | *(27)* | *(67)* | *(72)* | |
| Tenured/tenure-track | 64 | 43 | 72 | 104 | 13 | **296** | 242 | 470 | **1007** | 90 |
| Open to new doctoral recipients | 101 | 74 | 103 | 105 | 15 | **398** | 273 | 631 | **1302** | 91 |
| Tenured/tenure-track | 38 | 7 | 52 | 78 | 8 | **183** | 242 | 444 | **869** | 59 |
| Open at assoc/full level | 17 | 24 | 22 | 34 | 11 | **108** | 59 | 103 | **269** | 38 |
| **Reported Hires for Above** | | | | | | | | | | |
| **Total number** | **117** | **105** | **117** | **101** | **14** | **454** | **241** | **563** | **1258** | **93** |
| Male doctoral hires | 94 | 84 | 73 | 78 | 13 | **342** | 122 | 375 | **839** | 62 |
| Tenured/tenure-track | 41 | 29 | 45 | 57 | 5 | **177** | 100 | 247 | **524** | 44 |
| Female doctoral hires | 22 | 18 | 27 | 17 | 1 | **85** | 66 | 125 | **277** | 29 |
| Tenured/tenure-track | 12 | 3 | 15 | 12 | 1 | **43** | 62 | 94 | **200** | 19 |
| Male temporary hires | 1 | 3 | 13 | 5 | 0 | **22** | 23 | 23 | **67** | 2 |
| Female temporary hires | 0 | 0 | 4 | 1 | 0 | **5** | 30 | 39 | **75** | 0 |
| Total new doctoral hires | 59 | 49 | 40 | 24 | 2 | **174** | 67 | 143 | **384** | **43** |
| Male new doctoral hires | 49 | 39 | 30 | 20 | 1 | **139** | 38 | 93 | **270** | 25 |
| Tenured/tenure-track | 4 | 5 | 5 | 13 | 0 | **27** | 32 | 68 | **127** | 19 |
| Female new doctoral hires | 10 | 10 | 10 | 4 | 1 | **35** | 29 | 50 | **114** | 18 |
| Tenured/tenure-track | 1 | 0 | 0 | 4 | 1 | **6** | 29 | 31 | **66** | 10 |
| **Unfilled positions** | **18** | **9** | **11** | **32** | **8** | **78** | **67** | **101** | **246** | **41** |

[1] Number of full-time doctoral positions under recruitment in 2002–2003 to be filled for 2003–2004.

the lowest attrition rate at 1%, while Group Va the highest at 3.3%.

**Faculty Recruitment**

Table 2A contains detailed information on the number of full-time doctoral faculty positions in mathematical sciences departments under recruitment in 2002–2003 for employment beginning in the academic year 2003–2004. Among mathematics departments (Groups I, II, III, Va, M, and B), 1,504 positions were under recruitment in 2002–2003 for employment beginning in the academic year 2003–2004, down 19% compared to last year. Of those 1,504 positions, 1,302 (87%) were available to new doctoral recipients, and of those 1,302 positions, 869 (67%) were tenured/tenure-track positions. The 869 tenured/tenure-track positions open to new doctoral recipients is down 23% from the 1,124 such positions under recruitment in 2001–2002; in Groups M and B combined the total number of tenured/tenure-track positions open to new doctoral recipients dropped from 851 last year to 686 this year (a 19% drop), and in Groups I, II, III, Va combined this number dropped from 272 to 183 (a 33% drop). The total number of tenured/tenure-track full-time doctoral positions under recruitment in Groups I, II, III, Va, M, and B combined is 1,007, down from last year's 1,320 (a drop of 24%). In Groups I, II, III, and Va combined, the total number of posted doctoral positions open at the associate/full level dropped from 159 last year to 108 this year.

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

From Table 2B we find that the total number of full-time doctoral positions filled in mathematics departments (Groups I, II, III, Va, M, and B combined) is down to 1,116 from 1,319 last year (a decrease of 15%) mainly because the number of full-time doctoral hires in Groups I, II, III, Va combined is down 28%. This year Groups I, II, III, and Va combined filled 427 doctoral positions, of which 220 (52%) were tenured/tenure-track positions. Last year these same groups filled 593 doctoral positions, of which 254 (43%) were tenured/tenure-track. Groups M and B combined filled 689 doctoral positions this year, and 504 (73%) of these were tenured/tenure-track positions. Last year these two groups filled 725 doctoral positions, of which 528 (73%) were tenured/tenure-track.

Beginning with the 2003 Annual Survey, departments were asked to report the number of tenured/tenure-track positions filled by individuals who held a postdoctoral appointment the previous year. For Groups I, II, III, and Va combined, 93 (42%) of the 220 tenured/tenure-track positions filled were filled by such individuals. For Groups M and B combined, 188 (37%) of the 504 tenured/tenure-track positions filled were filled by such individuals.

This year there are fewer new doctoral hires in mathematics departments, but more not-new doctoral hires in Groups M and B combined. The estimated total number of new doctoral hires in mathematics departments is down 38% (384 from 623) this year from last year; it is down 44% (to 174 from 309) in Groups I, II, II, Va combined, and down 33% (to 210 from 314) in Groups M and B combined. The number new doctoral tenured/tenure-track hires is down 43% (193 from 337); it is down 58% (to 33 from 79) in Groups I, II, III, Va com-

### Table 2B: A Summary of Recruitment of Doctoral Faculty, Fall 2003

| | GROUP | | |
|---|---|---|---|
| | I, II, III, & Va | M & B | IV |
| **Posted Doctoral Positions** | | | |
| **Total number** | **532** | **972** | **134** |
| Tenured/tenure-track | 296 | 712 | 90 |
| Open to new doctoral recipients | 398 | 905 | 91 |
| Tenured/tenure-track | 183 | 686 | 59 |
| **Reported Hires for Above** | | | |
| **Total new doctoral hires** [1] | **174** | **210** | **43** |
| Tenured/tenure-track | 33 | 160 | 30 |
| Male | 139 | 131 | 25 |
| Tenured/tenure-track | 27 | 100 | 19 |
| Female | 35 | 79 | 18 |
| Tenured/tenure-track | 6 | 60 | 10 |
| **Total other doctoral hires** | **253** | **479** | **48** |
| Tenured/tenure-track | 187 | 344 | 34 |
| Male | 203 | 367 | 38 |
| Tenured/tenure-track | 150 | 247 | 25 |
| Female | 50 | 113 | 10 |
| Tenured/tenure-track | 37 | 97 | 9 |

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

### Table 2C: Percentage Tenured/Tenure-Track for Positions Posted and Filled, Fall 2003

| | GROUP | | |
|---|---|---|---|
| | I, II, III, & Va | M & B | IV |
| Positions opened to | | | |
| New doctoral recipients | 398 | 905 | 91 |
| % tenured/tenure-track | 46 | 76 | 65 |
| Positions filled by | | | |
| New doctoral Recipients | 174 | 210 | 43 |
| % tenured/tenure-track | 19 | 76 | 69 |
| Positions filled by | | | |
| Not-new doctoral recipients [1] | 253 | 479 | 48 |
| % tenured/tenure-track | 74 | 72 | 70 |

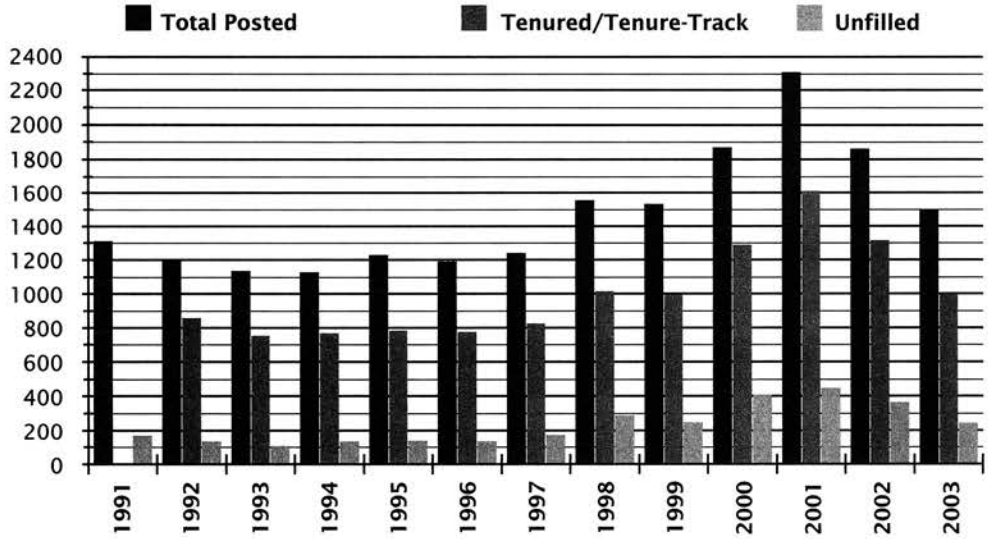
[1] Not-new doctoral recipients are individuals who've held their doctorate for more than one year at the time of hiring.

bined, and down 38% (to 160 from 258) in Groups M and B combined.

The estimated number of not-new doctoral hires in mathematics departments is up 5% to 732 from 695 last year (this number is up in Groups M and B combined, and down in Groups I, II, III, Va combined). The estimated total of not-new doctoral hires into tenured/tenure-track positions is up in Groups I, II, III, and Va combined (187 from 175 last year) and up in Groups M and B combined (344 from 270 last year a 27% increase over last year).

From Tables 2B and 2C we can compare the hiring patterns of Groups I, II, III, and Va with that of Groups M and B. In Groups I, II, III, and Va 41% of

**Figure 2: Number of Full-Time Doctoral Positions under Recruitment: Total, Tenured/Tenure-Track, and Unfilled in Groups I, II, III, Va, M, & B Combined, Fall 1991 to Fall 2003**




Note: The tenured/tenure-track status of positions under recruitment was not surveyed until 1992.

**Table 3A: Total Faculty, Fall 2003**

| | GROUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | I, II, III, & Va | M | B | I, II, III, Va, M, & B | IV |
| **Total full-time faculty** *(Standard error)* | **1758** | **969** | **2452** | **2076** | **323** | **7578** | **4101** *(134)* | **8742** *(320)* | **20421** *(347)* | **1482** |
| Doctoral full-time faculty | 1700 | 964 | 2159 | 1771 | 308 | **6902** | 3285 | 6632 | **16819** | 1430 |
| Tenured | 1143 | 556 | 1545 | 1264 | 172 | **4680** | 2283 | 4117 | **11080** | 796 |
| Untenured, tenure-track | 158 | 76 | 277 | 337 | 32 | **880** | 772 | 2055 | **3707** | 307 |
| Postdoctoral appointments | 253 | 170 | 168 | 52 | 69 | **712** | 21 | 74 | **807** | 91 |
| Other non-tenure-track *(Standard error)* | 146 | 162 | 169 | 118 | 36 | **631** | 208 *(29)* | 386 *(51)* | **1225** *(58)* | 236 |
| Nondoctoral full-time faculty | 58 | 5 | 293 | 305 | 15 | **676** | 816 | 2110 | **3602** | 52 |
| **Total part-time faculty** *(Standard error)* | **194** | **52** | **390** | **715** | **38** | **1389** | **1952** *(211)* | **3997** *(259)* | **7338** *(335)* | **263** |

**Table 3B: Female Faculty, Fall 2003**

| | GROUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | I, II, III, & Va | M | B | I, II, III, Va, M, & B | IV |
| **Female full-time faculty** *(Standard error)* | **240** | **105** | **463** | **456** | **49** | **1313** | **1217** *(74)* | **2666** *(135)* | **5195** *(153)* | **401** |
| Doctoral full-time faculty | 204 | 103 | 287 | 284 | 41 | **919** | 752 | 1698 | **3370** | 372 |
| Tenured | 77 | 28 | 119 | 145 | 18 | **387** | 440 | 921 | **1748** | 130 |
| Untenured, tenure-track | 28 | 6 | 61 | 95 | 4 | **194** | 237 | 685 | **1116** | 118 |
| Postdoctoral appointments | 52 | 36 | 37 | 4 | 14 | **143** | 3 | 0 | **146** | 32 |
| Other non-tenure-track | 47 | 33 | 70 | 40 | 5 | **195** | 73 | 92 | **360** | 92 |
| Nondoctoral full-time faculty | 36 | 2 | 176 | 172 | 7 | **393** | 464 | 967 | **1825** | 30 |
| **Female part-time faculty** | 70 | 5 | 137 | 262 | 10 | **484** | 720 | 1672 | **2875** | 99 |

## Table 3C: Number and Percentage of Full-Time Faculty, Fall 2003

| | GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | M | B | IV | TOTAL |
| **Full-Time Faculty** | | | | | | | | | |
| Number | 1758 | 969 | 2452 | 2076 | 323 | 4101 | 8742 | 1482 | **21903** |
| Percentage of total full-time faculty | 8 | 4 | 11 | 9 | 1 | 19 | 40 | 7 | **100** |
| **Female Full-Time Faculty** | | | | | | | | | |
| Number | 240 | 105 | 463 | 456 | 49 | 1217 | 2666 | 401 | **5596** |
| Percentage of female full-time faculty | 4 | 2 | 8 | 8 | 1 | 22 | 48 | 7 | **100** |
| **Female Full-Time Faculty** | | | | | | | | | |
| Percentage female full-time faculty by group | 14 | 11 | 19 | 22 | 15 | 30 | 30 | 27 | **26** |

## Table 3D: Number, and Percentage of Those Female, of Non-tenure-track Doctoral Full-Time Faculty and Part-Time Faculty by Group, Fall 1997 to Fall 2003

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|
| **Groups I, II, III, & Va** | | | | | | | |
| Non-tenure-track doctoral full-time faculty | 708 | 904 | 1014 | 993 | 1233 | 1274 | 1343 |
| Percentage female | 22 | 21 | 22 | 21 | 21 | 23 | 25 |
| Part-time faculty | 954 | 1141 | 1217 | 1399 | 1467 | 1504 | 1389 |
| Percentage female | 37 | 38 | 38 | 37 | 38 | 35 | 35 |
| **Group M** | | | | | | | |
| Non-tenure-track doctoral full-time faculty | 216 | 140 | 146 | 262 | 183 | 276 | 230 |
| Percentage female | 30 | 27 | 56 | 29 | 24 | 39 | 33 |
| Part-time faculty | 1612 | 1768 | 1768 | 1906 | 2323 | 2393 | 1952 |
| Percentage female | 46 | 43 | 43 | 35 | 36 | 37 | 37 |
| **Group B** | | | | | | | |
| Non-tenure-track doctoral full-time faculty | 385 | 427 | 514 | 407 | 504 | 507 | 460 |
| Percentage female | 26 | 31 | 24 | 30 | 29 | 36 | 20 |
| Part-time faculty | 3107 | 3585 | 3298 | 3580 | 4197 | 4117 | 3997 |
| Percentage female | 46 | 42 | 41 | 40 | 43 | 45 | 42 |

the positions hired went to new doctoral recipients (last year 52%), while in Groups M and B 31% of the positions hired went to new doctoral recipients (last year 43%). In Groups I, II, III, and Va 19% of the hires of new doctoral recipients are in tenured/tenure-track positions (last year it was 26%), while in Groups M and B 76% of the new doctoral hires are in tenured/tenure-track positions (last year it was 82%).

From Table 2B we find that of the new doctoral recipients hired in Groups I, II, III, and Va combined, 19% of the males and 17% of the females took tenured/tenure-track positions. For new doctoral recipients hired in Groups M and B combined, 76% of the males and 76% of the females took tenured/tenure-track positions.

Figure 2 shows the number of full-time doctoral positions available in all groups except Group IV, as well as the number of those that were tenured/tenure-track and the number unfilled for the years 1991 to 2003. There was a sharp decrease in available positions in the first few years of the 1990s, but the number of positions and the number of tenured/tenure-track positions steadily increased, reaching a maximum in 2001, and has declined the past two years.

The recruitment situation in statistics (Group IV) is much like last year, but with fewer tenure-track positions available and fewer tenure-track hires. This year there were 134 (90 tenure-track) positions under recruitment, while last year there were 169 (141 tenure-track). This year 91 positions were open to new doctorates and last year this number was 121. However, the number of tenure-track positions open to new doctorates declined from 108 last year to 59 this year. The number of hires of new doctoral recipients is 43 (30 tenure-track) this year and 58 (48 tenure-track) last year. The number of not-new doctoral hires is 48 (34 tenure-track) this year and 52 (39 tenure-track) last year. Females were 34% of the new doctoral tenure-track hires, and 26% of the not-new doctoral tenure-track hires.

**Faculty**

Table 3A gives the number of faculty for different categories of faculty broken down by group. Table 3B gives the same information for females only. The estimated total number of full-time faculty in Groups I, II, III, Va, M, and B combined is 20,421, up 414 from last year, with a standard error of 347. We can be quite confident that the actual total number of faculty in these groups is in the interval 20,421 plus or minus 694. The doctoral mathematics departments I, II, III, and Va are up 67 full-time faculty members, Group M is down 241 faculty members, and Group B is up 588. Since the standard errors for the total number of full-time faculty in Groups M and B are 134 and 320 respectively, there may not be an actual change, as these increases are well within the variability we expect with standard errors of 134 and 320. The total faculty size in Group IV is up to 1,482 this year from 1,397 last year.

This year for the first time the Departmental Profile Survey requested the number of postdoctoral appointments to be broken out of the number of non-tenure track appointments. In the future we will be able to track the changes in the number of postdoctoral appointments.

Table 3C gives some percentages based on the information in Tables 3A and 3B. The number of non-tenure-track doctoral full-time faculty and the number of part-time faculty in mathematics departments had been increasing in recent years, a disturbing trend highlighted in "Staffing shifts in mathematical sciences departments, 1990–2000" (David J. Lutzer and James W. Maxwell, *Notices of the AMS*, June/July 2003, pages 683–6). However, this year the estimated number of part-time faculty is down to 7,338 from 7,771 last year, and the number of non-tenure-track doctoral faculty (including postdoctoral positions) is estimated at 2,032 this year, down from 2,057 last year. But in Groups I, II, III, and Va combined the number of non-tenure-track doctoral faculty increased 5% from 1,274 last year to 1,343 this year. Table 3D gives a seven-year history of these two types of faculty for Groups I, II, III, and Va combined; for Group M; and for Group B. Also shown for each number in this table is the percentage of females.

Table 3E gives a summary of the various types of faculty found in departments of mathematical sciences by sex and group.

Tables 3F and 3G give more information about two types of faculty: full-time faculty without a doctorate and part-time faculty. The top half of Table 3F is

**Table 3E: Summary of Full-Time and Part-Time Faculty by Sex, Fall 2003**

| | GROUP | | | | | |
|---|---|---|---|---|---|---|
| | I, II, III, & Va | | M & B | | IV | |
| | Male | Female | Male | Female | Male | Female |
| **Full-time faculty** | **6265** | **1313** | **8961** | **3882** | **1080** | **401** |
| Percentage | 83 | 17 | 70 | 30 | 73 | 27 |
| Doctoral full-time faculty | 5971 | 919 | 7467 | 2450 | 1058 | 372 |
| Percentage | 87 | 13 | 75 | 25 | 74 | 26 |
| Tenured | 4293 | 387 | 5039 | 1361 | 666 | 130 |
| Percentage | 92 | 8 | 79 | 21 | 84 | 16 |
| Untenured, tenure-track | 686 | 194 | 1905 | 922 | 189 | 118 |
| Percentage | 78 | 22 | 67 | 33 | 62 | 38 |
| Postdoctoral appointments | 569 | 143 | 92 | 3 | 59 | 32 |
| Percentage | 80 | 20 | 96 | 4 | 65 | 35 |
| Other non-tenure-track | 436 | 195 | 430 | 165 | 143 | 92 |
| Percentage | 69 | 31 | 72 | 28 | 61 | 39 |
| Nondoctoral full-time faculty | 282 | 393 | 1494 | 1432 | 23 | 30 |
| Percentage | 42 | 58 | 51 | 49 | 43 | 57 |
| **Part-time faculty** | **906** | **484** | **3557** | **2392** | **164** | **99** |
| Percentage | 65 | 35 | 60 | 40 | 62 | 38 |

**Table 3F: Doctoral and Nondoctoral Full-Time Faculty, Fall 2003**

| | GROUP | | | | | |
|---|---|---|---|---|---|---|
| | I, II, III, & Va | | M & B | | TOTAL | |
| | Male | Female | Male | Female | Male | Female |
| **Doctoral full-time faculty** | **5971** | **919** | **7467** | **2450** | **13438** | **3370** |
| Tenured | 4293 | 387 | 5039 | 1361 | 9332 | 1748 |
| Untenured, tenure-track | 686 | 194 | 1905 | 922 | 2591 | 1116 |
| Postdoctoral appointments | 569 | 143 | 92 | 3 | 661 | 146 |
| Other non-tenure-track | 436 | 195 | 430 | 165 | 866 | 360 |
| **Nondoctoral full-time faculty** | **282** | **393** | **1494** | **1432** | **1776** | **1825** |
| Tenured | 13 | 7 | 573 | 337 | 586 | 344 |
| Untenured, tenure-track | 14 | 4 | 191 | 153 | 205 | 157 |
| Postdoctoral appointments | 8 | 3 | 0 | 0 | 8 | 3 |
| Other non-tenure-track | 255 | 382 | 730 | 942 | 985 | 1324 |

**Table 3G: Part-Time Faculty, Fall 2003**

| | GROUP | | | | |
|---|---|---|---|---|---|
| | I, II, III, & Va | | M & B | | |
| | Male | Female | Male | Female | TOTAL |
| Doctoral part-time faculty | 405 | 125 | 839 | 264 | **1633** |
| Nondoctoral part-time faculty | 500 | 358 | 2718 | 2128 | **5705** |
| **TOTAL** | **906** | **484** | **3557** | **2392** | **7338** |

### Table 4A: Undergraduate and Graduate Enrollments (thousands), Fall 2003

| | GROUP | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | I, II, III, & Va | M | B | IV | TOTAL |
| **Undergraduate Course Enrollments** Total number (thousands) *(Standard error)* | 185 | 41 | 283 | 255 | 17 | **782** | 498 *(25)* | 774 *(26)* | 72 | **2125** *(36)* |
| **Graduate Course Enrollment** Total number (thousands) | 10 | 5 | 11 | 11 | 2 | **40** | 16 | - | 31 | **87** |

### Table 4B: Total Undergraduate Enrollments (thousands), Fall 1998 to Fall 2003

| | GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | M | B | IV | TOTAL |
| 1998 | 182 | 43 | 258 | 214 | 20[1] | 585 | 741 | 78 | **2121** |
| 1999 | 182 | 45 | 271 | 251 | 13 | 568 | 810 | 92 | **2232** |
| 2000 | 175 | 47 | 279 | 241 | 13 | 526 | 729 | 77 | **2087** |
| 2001 | 176 | 42 | 279 | 246 | 12 | 513 | 743 | 81 | **2092** |
| 2002 | 187 | 41 | 275 | 250 | 16 | 507 | 774 | 76 | **2125** |
| 2003 | 185 | 41 | 283 | 255 | 17 | 498 | 774 | 72 | **2125** |

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

a somewhat condensed version of the doctoral full-time faculty in Table 3A broken down by sex. The bottom half of Table 3F shows this same information for the 3,602 full-time faculty who do not have doctoral degrees. The majority of these faculty, 2,926 (81%), are found in Group M and B departments. Table 3G shows the part-time faculty broken down by sex and whether they have a doctoral degree.

### Faculty Profile for Females

Table 3B gives a complete breakdown of all categories of female faculty by group and shows increasing estimated numbers of female faculty in most categories. The estimated total number of full-time faculty in Groups I, II, III, Va, M & B combined for 2003–2004 is 20,421, of which 5,195 (25%) are females, up from 5,019 (25%) last year. In the B group doctoral female faculty increased to 1,698 from 1,473 last year, tenured female faculty increased from 791 last year to 921 this year, and non-tenure-track doctoral female faculty dropped from 182 last year to 92 this year. In the M group doctoral full-time female faculty dropped from 811 last year to 752 this year, and the number of females in each category of Table 3B in Group M is down this year over last year.

Table 3C shows the number and percentage of all full-time and female full-time faculty that fall in each group for 2003–2004. The number of faculty in each group and the percentage who are female are given in the bottom section of Table 3C. The number of females as a percentage

### Table 4C: Undergraduate and Graduate Enrollments per Full-Time Faculty Member, Fall 2003

| | GROUP | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | M | B | IV |
| **Undergraduate Course Enrollments** Number per full-time faculty member | 104 | 42 | 113 | 121 | 46 | 121 | 89 | 46 |
| **Graduate Course Enrollments** Number per full-time faculty member | 6 | 5 | 4 | 5 | 6 | 4 | - | 20 |

### Table 4D: Undergraduate Enrollments per Full-Time Faculty Member, Fall 1998 to Fall 2003

| | GROUP | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | M | B | IV |
| 1998 | 109 | 52 | 114 | 108 | -[1] | 117 | 94 | 60 |
| 1999 | 115 | 54 | 111 | 122 | 43 | 127 | 114 | 68 |
| 2000 | 107 | 52 | 117 | 119 | 39 | 110 | 95 | 56 |
| 2001 | 101 | 47 | 114 | 120 | 41 | 118 | 94 | 57 |
| 2002 | 107 | 43 | 114 | 121 | 50 | 117 | 95 | 55 |
| 2003 | 104 | 42 | 113 | 121 | 46 | 121 | 89 | 46 |

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

**Table 5A: Undergraduate Degrees Awarded (hundreds), Fall 2003**

| | GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | M | B | I, II, III, Va, M, & B | IV |
| **Total Undergraduate Degrees awarded** (hundreds) | 22 | 9 | 17 | 17 | 3 | 41 | 111 | 220 | 4 |
| *(Standard error)* | | | | | | *(4)* | *(6)* | *(7)* | |
| Computer science only | 1 | 0 | 0 | 3 | 0 | 10 | 27 | 42 | 0 |
| **Female Undergraduate Degrees awarded** (hundreds) | 8 | 2 | 7 | 7 | 1 | 19 | 47 | 90 | 2 |
| Computer science only | 0 | 0 | 0 | 1 | 0 | 4 | 6 | 11 | 0 |

**Table 5B: Undergraduate Degrees Awarded (hundreds) in Groups I, II, III, Va, M & B Combined, Fall 2002 to Fall 2003**

| | 2002 | 2003 |
|---|---|---|
| **Total Undergraduate** Degrees awarded (hundreds) | 217 | 220 |
| **Female Undergraduate** Degrees awarded (hundreds) | 91 | 90 |
| Percentage female | 42 | 41 |

of full-time faculty varies considerably among the groups, from 11% for Group I Private to 30% for Groups M and B. This is similar to the pattern reported last year. Note: In Table 3C the percentages for each group in rows 2 and 4 are of the row totals. The percentages in row 5 are column percentages using the numbers in rows 1 and 3.

Table 3D contains information about non-tenure-track doctoral full-time faculty and part-time faculty for the years 1997 to 2003 for Groups I, II, III, and Va combined, M, and B. This table includes the total number for each category as well as the percentage female for each number.

Table 3E gives the male/female breakdown by count and percentage for Groups I, II, III, and Va combined, Groups M and B combined, and Group IV for various categories of faculty. It shows that the percentage of women is generally higher in statistics (Group IV) than in the doctoral mathematics groups (Group I, II, III, Va combined), and that the percentage of tenured faculty who are women is highest in Group M and B combined.

Table 3F shows that of the 3,602 nondoctoral full-time faculty in Groups I, II, III, Va, M, and B, 1,825 (51%) are females. In Table 3G we see that in these same groups there are 7,338 part-time faculty, of which 2,876 (39%) are females.

# Enrollment Profile and Undergraduate Degrees Profile

**Enrollment**

The Departmental Profile Survey obtained information about enrollments and numbers of undergraduate degrees awarded in mathematical sciences departments. Table 4A gives the total undergraduate and total graduate enrollments in mathematics courses for each group that is part of the Annual Survey. Each enrollment in this and other tables in this section is projected from schools responding to the survey, as discussed on page 902. In fall 2003, for the fifth year the projections for Groups M and B were made from those schools responding in the stratified random sample for each of these groups. This makes it possible to calculate standard errors for the estimated enrollments for these groups and for the estimated total enrollment for all groups. These standard errors, available for the third year, are also found in Table 4A. The estimated total enrollment for all groups is 2,125,000, with a standard error of 36,000, indicating that the actual total enrollment is likely within 2,125,000 plus or minus 72,000. Table 4B gives these totals for fall 1998 to fall 2003.

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

Table 4C gives the undergraduate enrollments per faculty member and the graduate enrollments per faculty member for each group. Table 4D gives the undergraduate enrollments per faculty member in each group for fall 1998 to fall 2003.

Looking at the historical data among the enrollment tables just presented for fall 1998 to fall 2003, one sees no major trends. This has been a relatively stable period for enrollments.

**Undergraduate Degrees**

Table 5A gives the number of undergraduate degrees awarded, the number of each that are female, and the number that are in computer science for each group. Last year for the first time we began tabulating the number of "undergraduate degrees", rather than the number of "junior/senior majors"; hence comparisons to previous years' numbers of undergraduate degrees can be made only to last year, and this is done in Table 5B.

The reader should be aware that at least 50 of the 192 departments in the 2003 Group M population and at least 270 of the 1,029 departments in the 2003 Group B population also offer a computer science program in addition to their offerings in mathematics. In some instances, these computer programs account for a major fraction of the department's undergraduate degrees. This year's estimated 22,000 undergraduate degrees awarded includes 4,200 in computer science.

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

# Graduate Student Profile

Table 6A summarizes information gathered about graduate students by the 2003 Departmental Profile survey. This table gives the number of full-time, full-time first year, and part-time graduate students for each type of graduate department. These same numbers are also given for female graduate students and for U.S. citizen graduate students.

The total number of full-time graduate students in Groups I, II, III, Va, and M combined decreased from 2002 to 2003, with 12,647 and 11,997 respectively, though this year's total is the third highest during the period 1995-2003. The numbers of total full-time graduate students listed in Table 6A this year showed gains in Groups I Public, II, Va,

**Table 6A: Graduate Students, Fall 2003**

| | GROUP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | I Public | I Private | II | III | Va | I, II, III, & Va | M | I, II, III, Va, & M | IV |
| **Total Graduate Students** | | | | | | | | | |
| **Full-time** | **2992** | **1347** | **3009** | **1530** | **853** | **9731** | **2265** | **11997** | **4262** |
| *(Standard error)* | | | | | | | *(172)* | *(172)* | |
| First-year full-time | 798 | 615 | 1142 | 743 | 314 | **3612** | 1220 | **4831** | 2195 |
| **Part-time** | **198** | **225** | **415** | **706** | **45** | **1590** | **2528** | **4117** | **665** |
| *(Standard error)* | | | | | | | *(308)* | *(308)* | |
| **Female Graduate Students** | | | | | | | | | |
| **Full-time** | **790** | **311** | **987** | **567** | **283** | **2938** | **928** | **3866** | **2203** |
| First-year full-time | 254 | 165 | 401 | 280 | 107 | **1207** | 508 | **1716** | 1118 |
| **Part-time** | **75** | **60** | **151** | **322** | **10** | **618** | **1222** | **1839** | **315** |
| **U.S. Citizen Graduate Students** | | | | | | | | | |
| **Full-time** | **1642** | **620** | **1718** | **720** | **468** | **5168** | **1698** | **6866** | **1578** |
| *(Standard error)* | | | | | | | *(136)* | *(136)* | |
| First-year full-time | 270 | 263 | 474 | 299 | 119 | **1426** | 816 | **2242** | 550 |
| **Part-time** | **126** | **123** | **269** | **467** | **43** | **1028** | **2247** | **3274** | **528** |
| *(Standard error)* | | | | | | | *(298)* | *(298)* | |

**Table 6B: Full-Time Graduate Students in Groups I, II, III, & Va by Sex and Citizenship, Fall 1994 to Fall 2003**

| | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total full-time graduate students** | **10185** | **9761** | **9476** | **9003** | **8791** | **8838** | **9637** | **9361** | **9972** | **9731** |
| First-year full-time | 2668 | 2601 | 2443 | 2386 | 2458 | 2664 | 2839 | 2875 | 2996 | 3612 |
| First-year full-time, U.S. citizen | 1664 | 1551 | 1465 | 1316 | 1349 | 1401 | 1527 | 1517 | 1630 | 1426 |
| Female full-time graduate students | 2927 | 2877 | 2760 | 2691 | 2770 | 2766 | 3016 | 2899 | 3136 | 2938 |
| Male full-time graduate students | 7258 | 6884 | 6716 | 6312 | 6021 | 6072 | 6621 | 6462 | 6836 | 6793 |
| U.S. citizen full-time graduate students | 5945 | 5623 | 5445 | 4947 | 4831 | 4668 | 5085 | 4631 | 5055 | 5168 |
| Non-U.S. citizen full-time graduate students | 4240 | 4138 | 4031 | 4056 | 3960 | 4170 | 4552 | 4730 | 4917 | 4563 |

and IV. The number of first-year full-time graduate students is up over last year in all groups except Group III, and the number of first-year full-time students in Groups I, II, III, Va, and M combined increased by 823 to 4,831, an increase of 21%. The number of full-time graduate students in Group IV increased this year by 7% to 4,262, and the first year full-time graduate student enrollment in Group IV increased by 793 to 2,195, an increase of 57%. The number of female full-time graduate students in Groups I, II, III, Va, and M combined decreased from 4,328 to 3,866, an 11% decrease, and in Group IV increased from 2,151 to 2,203, a 2% increase. The number of U.S. citizen full-time graduate students in Groups I, II, III, Va, and M combined increased by 2% to 6,866, and in Group IV decreased by 8% to 1,578. There is a great deal of variability in the number of full-time graduate students in Group M, even in universities that are roughly the same size, and this is reflected in the standard errors of 172 this year and 336 last year. We can also expect substantial variation in the total number of all full-time graduate students from year to year due to the large variation in Group M.

The number of part-time graduate students in Groups I, II, III, and Va increased to 1,590, a 7% increase this year, and in Group IV decreased 27% to 665. Group III has 706 (44%) of the part-time graduate students in the doctoral mathematics groups. In the doctoral mathematics groups, 39% of the part-time graduate students are females and 65% are U.S. citizens, and in Group IV 47% of the part-time graduate students are females and 79% are U.S. citizens. The number of Group M part-time graduate students decreased from 3,064 to 2,528 but the standard error for part-time graduate students in Group M departments is 308 this year and was 806 last year, indicating huge differences in the number of part-time graduate students from department to department. This also means we can expect to see large differences from year to year in the total number of part-time graduate students in all groups. For Group M, 48% of the part-time graduate students are females, and 89% are U.S. citizens.

Table 6B gives the total number of full-time, full-time first-year, full-time female, full-time male, full-time U.S. citizen, and full-time non-U.S. citizen graduate students in Groups I, II, III, and Va combined for fall 1994 through 2003. From this data we can see that total full-time graduate enrollment in the doctoral mathematics groups was falling until 1998, and has been generally increasing beginning in 1999. The estimated number of full-time graduate students in mathematics departments decreased to 11,997 from 12,647 last year. The estimated number of full-time graduate students in Groups I, II, III, and Va combined who are first

## Definitions of the Groups

As has been the case for a number of years, much of the data in these reports is presented for departments divided into groups according to several characteristics, the principal one being the highest degree offered in the mathematical sciences. Doctoral-granting departments of mathematics are further subdivided according to their ranking of "scholarly quality of program faculty" as reported in the 1995 publication *Research-Doctorate Programs in the United States: Continuity and Change.*[1] These rankings update those reported in a previous study published in 1982.[2] Consequently, the departments which now comprise Groups I, II, and III differ significantly from those used prior to the 1996 survey.

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

Brief descriptions of the groupings are as follows:

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

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

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

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

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

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

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

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

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

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

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

year is up, and is at the highest level in ten years; this number has been increasing each year beginning in 1997 and is up 51% since 1997. The estimated number of full-time graduate students who are first year and U.S. citizens had been generally increasing beginning in 1998, but this year's number is down 13% over last year's number, and is lower than the numbers in each of the preceding three years.

**Previous Annual Survey Reports**

The 2003 Annual Survey First and Second Reports were published in the *Notices of the AMS* in the February and August 2004 issues respectively. For the last version of this report, the 2002 Annual Survey Third Report was published in the *Notices of the AMS* in the September 2003 issue. These reports and earlier reports, as well as a wealth of other information from these surveys, are available on the AMS website at `www.ams.org/employment/surveyreports.html`.

**Acknowledgments**

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

# Mathematics People

## Banchoff Receives NSF Distinguished Teaching Scholar Award

THOMAS F. BANCHOFF of Brown University has been named one of eight recipients of the Director's Award for Distinguished Teaching Scholars (DTS) from the National Science Foundation (NSF). According to the prize citation, Banchoff "has been influential in his pioneering geometry work on smooth and polyhedral surfaces beyond the third dimension." He has also done substantial work in computer graphics and visualization techniques.

The DTS awards are given to scientists and engineers who are outstanding educators and mentors as well as researchers. Each award carries a grant of about $300,000 over four years.

*—From an NSF announcement*

## AMS Menger Prizes at the 2004 ISEF

The 2004 Intel-International Science and Engineering Fair (ISEF) was held May 9–15 in Portland, Oregon. This year marked the fifty-fifth anniversary of the ISEF. More than 1,200 ninth- through twelfth-graders competed in the fair. The participants had qualified by winning competitions in local, regional, and state fairs in the United States or national science fairs abroad. In addition to the general awards of the ISEF, more than fifty organizations, including the AMS, participated by giving ISEF Special Awards. These prizes include cash prizes, scholarships, T-shirts, magazines, and books.

This was the seventeenth year of participation in ISEF by the AMS and the fifteenth year of presentation of the Karl Menger Memorial Awards. The AMS Menger Prize Committee served as the Special Awards Panel of Judges for the AMS; the members were Elwyn Berlekamp, University of California, Berkeley; Gisele R. Goldstein, University of Memphis (chair); and Hugh L. Montgomery, University of Michigan, Ann Arbor. The AMS gave one first-place award, two second-place awards, four third-place awards, and five honorable-mention awards.

The Karl Menger Memorial Prize winners were as follows:

First-Place Award: ($1,000): "A Proof of Seymour's Conjecture for All Oriented Graphs", BRETT A. HARRISON, Half Hollow Hills High School West, Dix Hills, New York.

Second-Place Awards ($500): "On the Properties of Jump Points in the Game of $n$-times Nim", BRIAN T. RICE, Marion Senior High School, Marion, Virginia; "Deviations from an Isotropic and Homogeneous Expansion of the Universe",

**Menger Prize winners: Front row (left to right), Gisele Goldstein, Brett Harrison, Ilya Gurwich, Brian Rice; middle row, Huan-Chun Yeh, Brianna Satinoff, Ning Zhang, Sam Lewallen; back row, Nimish Ramanlal, Nurlan Bakitzhanov, Ginger Howell, Carlos Arreche-Aguayo, Allison Berke. Tair Assangali is not in the photograph.**

ILYA GURWICH, Amit State Religious/Municipal Comprehensive School, Beer-Sheva, Israel.

Third-Place Awards ($250): "An Investigation of Irreducible Polynomials over $Zp$ Using Abstract Algebra", BRIANNA R. SATINOFF, Palm Harbor University High School, Palm Harbor, Florida; "A Novel Set of Representations of the Two-Component Link Group and Consequent Link Invariants", SAM J. LEWALLEN, Stuyvesant High School, New York, New York; "$m \times n$ Admissible Boards", HUAN-CHUN YEH, Taipei Municipal Junior High School, Taipei, Taiwan; "Research on the Number-Reasoning Problem", NING ZHANG, High School Affiliated to Fudan University, Shanghai, China.

Honorable-Mention Awards: "The Membership Problem for Ideals in the Ring of Polynomials over the Integers $Z[x]$", CARLOS E. ARRECHE-AGUAYO, University Gardens High School, San Juan, Puerto Rico; "Diophantine Equations: Which Numbers Are Linear Combinations?", GINGER B. HOWELL, Trinity Collegiate School, Darlington, South Carolina; "A Quantum Algorithm for the Simultaneous Evaluation of Functions: A Combinatorics Solution with Fractal Properties", NIMISH P. RAMANLAL, Seminole High School, Sanford, Florida; "The Snake Lemma and Its Applications to Graph Theory", ALLISON P. BERKE, Mira Loma High School, Sacramento, California; "Constructing Boxes with $N$-Tetracubes", TAIR ASSANGALI and NURLAN BAKITZHANOV, Kasakh-Turkish Lycée, Aktobe, Kazakhstan.

The Society's participation in the Intel-ISEF is supported in part by income from the Karl Menger Fund, which was established by the family of the late Karl Menger. For more information about this program or to make contributions to the fund, contact the AMS Development Office, 201 Charles Street, Providence, RI 02904; send email to `development@ams.org`; or telephone 401-455-4111.

*—Elaine Kehoe*

# Royal Society of London Elections

Four mathematical scientists are among those elected as new fellows of the Royal Society of London for 2004. They are SAMSON ABRAMSKY, University of Oxford; JULIAN BESAG, University of Washington; DAVID B. A. EPSTEIN, University of Warwick; and DAVID PREISS, University College of London.

*—From a Royal Society announcement*

# Mathematics Opportunities

## American Mathematical Society Centennial Fellowships

*Invitation for Applications for Awards for 2005–2006*
*Deadline: December 1, 2004*

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

The primary selection criterion for the Centennial Fellowship is the excellence of the candidate's research. Preference will be given to candidates who have not had extensive fellowship support in the past. Recipients may not hold the Centennial Fellowship concurrently with another research fellowship such as a Sloan or NSF Postdoctoral Fellowship. Under normal circumstances, the fellowship cannot be deferred. A recipient of the fellowship shall have held his or her doctoral degree for at least three years and not more than twelve years at the inception of the award (that is, received between September 1, 1993, and September 1, 2002). Applications will be accepted from those currently holding a tenured, tenure-track, postdoctoral, or comparable (at the discretion of the selection committee) position at an institution in North America.

The stipend for fellowships awarded for 2005–2006 is expected to be $62,000, with an additional expense allowance of about $3,000. Acceptance of the fellowship cannot be postponed.

The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Society supplements contributions as needed. At most, two fellowships will be awarded for the 2005-2006 academic year. A list of previous fellowship winners can be found at `http://www.ams.org/prizes-awards`.

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

The deadline for receipt of applications is **December 1, 2004.** Awards will be announced in February 2005 or earlier if possible.

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

*—AMS announcement*

## NSA Grant and Sabbatical Programs

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

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

all grant proposals is **October 15, 2004.** Grants begin in the fall of the following year.

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

Further information may be obtained from the NSA's website: `http://www.nsa.gov/msp/index.cfm`. The telephone number is 301-688-0400, and the postal address is: Dr. Charles F. Osgood, NSA Mathematical Sciences Program and Mathematical Sabbatical Programs, National Security Agency, ATTN: R51A, Suite 6557, Ft. George G. Meade, MD 20755-6557.

*—From an NSA announcement*

# NSF Distinguished International Postdoctoral Research Fellowships

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

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

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

The deadline for full proposals is **October 13, 2004.** For technical and scientific information, contact Lynne Walling, Program Director, Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; telephone 703-292-8104; email: `walling@nsf.gov`. The program announcement is available at `http://www.nsf.gov/pubs/2001/nsf01154/nsf01154.txt`.

*—From an NSF announcement*

# NSF International Research Fellow Awards

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

The deadline for applying is **November 1, 2004.** For further information contact the program officer, Susan Parris, 703-292-8711, email: `sparris@nsf.gov`; or visit the website `http://www.nsf.gov/sbe/int/fellows/start.htm`.

*—From an NSF announcement*

# NSF Graduate Fellowships

The National Science Foundation (NSF) awards Graduate Research Fellowships to graduating seniors and first-year graduate students. These are three-year fellowships awarded to U.S. students for full-time graduate study at the institutions of their choice. The fellowships include a stipend, tuition coverage, and possible international travel allowances. Awards are made based on the candidates' intellectual merit and potential for research achievement. The deadline for applications had not been set at the time of this writing but will occur in the **first week of November 2004**. More information and applications for the upcoming competition will be available during the first week of August 2004 at `http://www.nsf.gov/grfpd`.

*—Allyn Jackson*

# AWM Travel Grants for Women

The National Science Foundation (NSF) and the Association for Women in Mathematics (AWM) sponsor two travel grant programs for women mathematicians.

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

AWM Mentoring Travel Grants are designed to help junior women develop long-term working and mentoring relationships with senior mathematicians. A mentoring travel grant funds travel, subsistence, and other expenses for an untenured woman mathematician to travel to an institute

or a department to do research with a specified individual for one month.

The final deadline for the Travel Grants program for 2004 is **October 1, 2004**; the deadlines for 2005 are **February 1, 2005; May 1, 2005;** and **October 1, 2005.** For the Mentoring Travel Grants program the deadline is **February 1, 2005.** For further information and details on applying, see the AWM website, `http://www.awm-math.org/travelgrants.html`; or telephone 301-405-7892; or send email to `awm@math.umd.edu`. The postal address is: Association for Women in Mathematics, 4114 Computer and Space Sciences Building, University of Maryland, College Park, MD 20742-2461.

*—From an AWM announcement*

# Research Experiences for Undergraduates

The Research Experiences for Undergraduates (REU) program supports active research participation by undergraduate students in any of the areas of research funded by the National Science Foundation (NSF). Student research may be supported in two forms: REU supplements and REU sites. REU supplements may be included in proposals for new or renewal NSF grants or cooperative agreements or as supplements to ongoing NSF-funded projects. REU sites are based on independent proposals to initiate and conduct undergraduate research participation projects for a number of students. REU site projects may be based in a single discipline or academic department or on interdisciplinary or multidepartment research opportunities with a strong intellectual focus. Proposals with an international dimension are welcomed. Undergraduate student participants supported with NSF funds in either supplements or sites must be citizens or permanent residents of the United States or its possessions.

The deadline for full proposals for REU sites is **September 15, 2004**. Deadline dates for REU supplements vary with the research program; contact the program director for more information. The full program announcement can be found at the website `http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf02136`.

*—From an NSF announcement*

# News from BIRS

The Banff International Research Station for Mathematical Innovation and Discovery (BIRS) is now accepting proposals for its 2006 program. Full information, guidelines, and online forms are available at the website `http://pims.math.ca/birs`.

BIRS will again be operating for 40 weeks in 2006 and each week will run either a full workshop (40 people for 5 days) or two half-workshops (20 people for 5 days). BIRS provides full meals, accommodations, and research facilities at no cost to the organizers and to the invited participants, in a setting conducive to research and collaboration.

The deadline for 5-day workshop proposals and Summer Schools is **October 15, 2004.**

In addition, BIRS will operate its Research in Teams and Focused Research Groups programs, which allow smaller groups of researchers to get together for several weeks of uninterrupted work at the station. **October 15, 2004**, is also a preferred date to apply for these programs. However, proposals for projects involving Research in Teams or Focused Research Groups can still be submitted anytime—subject to availability—but should be submitted at least four months before their requested start date.

If possible, proposal submissions should be made using the online submission form. Please see `http://www.pims.math.ca/birs/`.

*—BIRS announcement*

# News from PIMS

The Pacific Institute for the Mathematical Sciences (PIMS) welcomes applications for support for conferences, workshops, seminars and related activities in the mathematical sciences, to occur after April 1, 2005. The deadline for applications is **October 15, 2004.** The results will be announced by January 31, 2005. For more information please see: `http://www.pims.math.ca/opportunities/proposals.html`.

PIMS is pleased to announce the appointment of Alejandro Adem as the PIMS deputy director. He will take up his appointment on January 1, 2005. Until this date Manfred Trummer will continue to act as deputy director.

Adem is a distinguished topologist who has made important contributions to the study of group actions and to the cohomology of finite groups. He received his Ph.D. from Princeton University in 1986. He was a Szego Assistant Professor at Stanford University (1986–89) and a member of the Institute for Advanced Study (1989–90) before moving to the University of Wisconsin at Madison.

He has held visiting positions at the Mathematical Sciences Research Institute (MSRI) in Berkeley (1990), the Eidgenössisches Technische Hochscule in Zurich (1993–94), the Max-Planck-Institut für Mathematik in Bonn (1997–98), Université de Paris VII (1998), the Centre de Recerca Matemàtica in Barcelona (1998), Université de Paris XIII (2000), and Hong Kong University of Science and Technology (2001). His awards include a Sloan Foundation Doctoral Dissertation Fellowship (1985), the National Science Foundation Young Investigator Award (1992), the Romnes Faculty Fellowship (1995), and the Vilas Associate Award (2003).

Adem brings to PIMS high scientific prestige and considerable administrative experience. He has been chair of the Department of Mathematics at the University of Wisconsin-Madison (1999–2002), and he is currently cochair of the Scientific Advisory Committee of MSRI.

*—PIMS announcement*

# Inside the AMS

## Jane E. Kister Retires from MR

Jane E. Kister is retiring after twenty-five years of service at *Mathematical Reviews*, for the past six years as executive editor. Her successor, Kevin Clancey of the University of Louisville, comes on board in September of this year.

MR, particularly its web version MathSciNet, is one of the Society's most important enterprises, and today it is thriving. Over the years MR has had its share of financial and organizational difficulties, and there were even times when its continued existence seemed uncertain. MR not only surmounted those problems but today stands as a strong and efficient organization producing a tool that is essential to the daily work of mathematicians the world over. This feat is due in no small part to the dedication and hard work of Jane Kister.

Jane received her Ph.D. in mathematics from the University of Oxford in 1972 and came to MR in 1979 as an associate editor. In 1984 she became associate executive editor and in 1998 was appointed to the top position of executive editor. When she arrived at MR, the operation had just gone through a difficult period of clearing backlogs and adjusting to new computer systems. Her steady hand and attention to detail proved invaluable in bringing stability to MR. Later on she made important contributions toward the creation and development of MathSciNet, which has revolutionized the way the MR database is used by making it available over the web.

"What Jane brought was a grace, fine style, and intelligence to every thing she did", commented her longtime MR colleague Drew Burton, manager of the MR computing systems. "She set the standard for everything she worked on exceptionally high."

Jane helped MR to grow in response to the increase in the mathematical literature. When she first came to MR, it was publishing about 30,000 reviews per year. By 1998, the year she became executive editor, the number of items added to the MR database was about 65,000; in 2003, more than 77,000 items were put in. On top of that, in the last several years almost 400,000 links have been added from MathSciNet items to original articles, and about half a million reference lists have been appended. Not only is MR able to handle this tremendous increase in material, under Jane's stewardship it has become more efficient, better organized, and less dependent on paper processing. One reason for her effectiveness is her complete mastery of every phase of the MR operation. "Because of that mastery she has been able to simplify what we do without sacrificing quality", said Burton.

**Jane E. Kister**

Just as MathSciNet necessitated changes in the internal operations of MR, it brought new expectations and pressures from outside. At the time Jane became executive editor, "Math Reviews needed a diplomat", said executive director John H. Ewing, "someone who could cooperate and interact with the community of mathematicians, but at the same time someone who could forcefully represent the interests of Math Reviews and the AMS. Jane has done all these things—and done them spectacularly."

Jane combined a high sense of professionalism and conscientiousness with personal kindness that endeared her to everyone at the AMS, staff and members alike. "Thank you, Jane, for all you've done in your twenty-five years of service", said Ewing. "Thank you for being a fine editor, a true leader—and a superb colleague."

*—Allyn Jackson*

## Math in Moscow Scholarships Awarded

The AMS has made awards to four undergraduate students to attend the Math in Moscow program in fall 2004.

The names of the students and their institutions are: CHRISTOPHER CHURCH, University of North Texas, ALLISON

MOORE, University of Texas at Austin; STEPHEN MCINTYRE, Virginia Polytechnic Institute and State University; and ALEX USTIAN, Ohio State University.

Math in Moscow is a program of the Independent University of Moscow that offers foreign students (undergraduate or graduate students specializing in mathematics and/or computer science) the opportunity to spend a semester in Moscow studying mathematics. The fifteen-week program is similar to the Research Experiences for Undergraduates programs that are held each summer across the United States. Math in Moscow draws on the Russian tradition of teaching mathematics, which emphasizes creative approaches to problem solving and in-depth understanding. All instruction is in English.

Since 2001, the AMS has awarded each semester several scholarships of approximately $5,000 each for U.S. students to attend the Math in Moscow program. The scholarships are made possible through a grant from the National Science Foundation. Information about how to apply may be found in the August 2004 issue of the *Notices*, page 805, or on the webpage `http://www.ams.org/careers-edu/mimoscow.html`. For more information about Math in Moscow, consult `http://www.mccme.ru/mathinmoscow`, and the article "Bringing Eastern European Mathematical Traditions to North American Students," *Notices*, November 2003, pages 1250–1254.

—*Allyn Jackson*

# William Ted Martin (1911–2004)

William Ted Martin, professor emeritus at the Massachusetts Institute of Technology, died on May 30, 2004, at the age of 92. Martin had a long record of service to the AMS that spanned four decades, including a total of twenty years on the Board of Trustees and eight years as Treasurer.

Ted Martin, as he preferred to be called, was born in Arkansas in 1911, received his B.A. (1930) from the University of Arkansas, and his M.A. (1931) and Ph.D. (1934) from the University of Illinois at Urbana-Champaign. Following an appointment as a National Research Council Fellow at the Institute for Advanced Study, he went to MIT in 1936. In 1943 he became department head at Syracuse University, then rejoined the MIT faculty in 1946 as a professor.

Martin's area of research was several complex variables and harmonic analysis. His collaborations with MIT faculty R. H. Cameron, Stefan Bergman, and Norbert Wiener produced basic results on analytic functions of several complex variables, and on the Wiener integral, or Wiener measure, which had been proposed by Norbert Wiener in 1930. During the 1950s Martin wrote a series of papers with Salomon Bochner, establishing generalizations of classical results in function theory for analytic functions on complex spaces with singularities.

Martin's service to the Society began in 1949, when he served on the AMS Council as a Vice President. He was a member of the Board of Trustees (1953–1954, 1956–1964, and 1965–1973) and was AMS Treasurer from 1965 to 1973. Most recently, he chaired the Board of Trustees' Committee on Endowment and Planned Giving (1987–1994).

Serving as head of the MIT mathematics department from 1947 to 1968, Martin oversaw some twenty-four faculty appointments in mathematics. Under his leadership, the department grew from what was largely a small service department into one of the major world centers of pure and applied mathematics. He also initiated MIT's C.L.E. Moore Instructorship Program, which began in 1949 and continues to this day.

A gifted lecturer and teacher, Martin maintained a lifelong dedication to teaching and curriculum development, including primary and secondary education. Beginning in 1961, he served as chair of the Steering Committee of the Education Development Center's African Mathematics Program to improve mathematical educational programs in English-speaking African nations. He visited Africa regularly over a fourteen-year period and was a member of numerous regional African management committees.

—*Allyn Jackson*

# Deaths of AMS Members

JACOB T. B. BEARD JR, retired from Tennessee Tech University, died on February 20, 2004. Born on November 30, 1940, he was a member of the Society for 34 years.

ROBERT L. GRAVES, emeritus professor, Flossmoor, Illinois, died on March 2, 2004. Born on September 1, 1926, he was a member of the Society for 54 years.

M. S. JAGADISH, of Barry University, Miami Shores, FL, died on March 30, 2004. Born on June 1, 1941, he was a member of the Society for 27 years.

DAN LORENZ, of the Technion–Israel Institite of Technology, died on January 25, 2001. Born on June 29, 1931, he was a member of the Society for 42 years.

FLEMMING DAMHUS PEDERSEN, retired lecturer of the Technical University of Denmark, died on March 12, 2004. Born on May 19, 1925, he was a member of the Society for 42 years.

GERT K. PEDERSEN, of the University of Copenhagen, died on March 15, 2004. Born on April 13, 1940, he was a member of the Society for 31 years.

MEIR REICHAW, of the Technion–Israel Institute of Technology, died on February 28, 2000. Born on December 20, 1923, he was a member of the Society for 38 years.

YUNG-CHOW WONG, of Hong Kong, People's Republic of China, died on May 13, 2004. Born on June 2, 1913, he was a member of the Society for 60 years.

# Reference and Book List

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

## Contacting the *Notices*

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

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

The electronic-mail addresses are `notices@math.ou.edu` in the case of the editor and `notices@ams.org` in the case of the managing editor. The fax numbers are 405-325-7484 for the editor and 401-331-3842 for the managing editor. Postal addresses may be found in the masthead.

## Upcoming Deadlines

**September 15, 2004:** Full proposals for REU sites. See "Mathematics Opportunities" in this issue.

**September 15, 2004:** Nominations for Alfred P. Sloan Foundation fellowships. See `http://www.sloan.org/programs/fellowship_brochure.shtml` or write to Sloan Research Fellowships, Alfred P. Sloan Foundation, 630 Fifth Avenue, Suite 2550, New York, New York 10111.

**September 16, 2004:** Proposals for NSF Enhancing the Mathematical Sciences Workforce in the Twenty-First Century program (including VIGRE). See the website `http://www.nsf.gov/pubs/2003/nsf03575/nsf03575.htm`.

**September 30, 2004:** Nominations for Information-Based Complexity Young Researcher Award. Contact Joseph F. Traub at `traub@cs.columbia.edu`.

### Where to Find It

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

**October 1, 2004:** Applications for AWM Travel Grants. See "Mathematics Opportunities" in this issue.

**October 1, 2004:** Nominations for the Louise Hay Award and the Alice T. Schafer Mathematics Prize. Contact Hay Award Selection Committee or Alice T. Schafer Award Selection Committee, Association for Women in Mathematics, 4114 Computer & Space Sciences Building, University of Maryland, College Park, MD 20742-2461; telephone 301-405-7892; e-mail to `awm@math.umd.edu`.

**October 1, 2004:** Nominations for CRM-Fields Prize. See `http://www.fields.utoronto.ca/proposals/crm-fields_prize.html`, or contact the Director, The Fields Institute, 222 College Street, Toronto, Ontario M5T 3J1, Canada.

**October 13, 2004:** Full proposals for NSF Distinguished International Postdoctoral Research Fellowships. See "Mathematics Opportunities" in this issue.

**October 15, 2004:** Applications for support for activities at the Pacific Institute for the Mathematical Sciences. See "Mathematics Opportunities" in this issue.

**October 15, 2004:** Applications for support for activities at Banff International Research Station for Mathematical Innovation and Discovery. See "Mathematics Opportunities" in this issue.

**October 15, 2004:** Proposals for NSA Grant and Sabbatical Programs. See "Mathematics Opportunities" in this issue.

**October 15, 2004:** Applications for NSF Postdoctoral Research Fellowships. See `http://www.nsf.gov/pubs/2001/nsf01126/nsf01126.htm`.

**November 1, 2004:** Applications for NSF International Research Fellow Awards. See "Mathematics Opportunities" in this issue.

**December 1, 2004:** Applications for AMS Centennial Research Fellowships. See "Mathematics Opportunities" in this issue.

**December 1, 2004:** Nominations for the Ferran Sunyer i Balaguer Prize. See `http://www.crm.es/Ferran-SunyerBalaguer/ffsb.htm`.

**January 1, 2005:** Entries for *Cryptologia* undergraduate paper competitions. See `http://www.dean.usma.edu/math/pubs/cryptologia/` or contact *Cryptologia,* Department of Mathematical Sciences, United States Military Academy, West Point, NY 10996; email: `Cryptologia@usma.edu`.

**February 1, 2005:** Applications for AWM Travel Grants and AWM Mentoring Travel Grants. See "Mathematics Opportunities" in this issue.

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

## Conference Board on the Mathematical Sciences

1529 Eighteenth Street, NW
Washington, DC 20036
202-293-1170
`http://www.cbmsweb.org/`

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Administrative Officer
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## Member Societies

American Mathematical Association of Two-Year Colleges (AMATYC)
American Mathematical Society (AMS)
American Statistical Association (ASA)
Association for Symbolic Logic (ASL)
Association for Women in Mathematics (AWM)
Association of Mathematics Teacher Educators (AMTE)
Association of State Supervisors of Mathematics (ASSM)
Benjamin Banneker Association (BBA)
Institute for Operations Research and the Management Sciences (INFORMS)
Institute of Mathematical Statistics (IMS)
Mathematical Association of America (MAA)
National Association of Mathematicians (NAM)
National Council of Supervisors of Mathematics (NCSM)
National Council of Teachers of Mathematics (NCTM)
Society for Industrial and Applied Mathematics (SIAM)
Society of Actuaries (SOA)

## Book List

*The Book List highlights books that have mathematical themes and are aimed at a broad audience potentially including mathematicians, students, and the general public. When a book has been reviewed in the* Notices, *a reference is given to the review. Generally the list will contain only books published within the last two years, though exceptions may be made in cases where current events (e.g., the death of a prominent mathematician, coverage of a certain piece of mathematics in the news) warrant drawing readers' attention to older books. Suggestions for books to include on the list may be sent to* `notices-booklist@ams.org`.

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

*Abel's Proof: An Essay on the Sources and Meaning of Mathematical Unsolvability*, by Peter Pesic. MIT Press, May 2003. ISBN 0-262-16216-4. (Reviewed March 2004.)

*Across the Board: The Mathematics of Chessboard Problems*, by John J. Watkins. Princeton University Press, April 2004. ISBN 0-691-11503-6.

*Adam Spencer's Book of Numbers*, by Adam Spencer. Four Walls Eight Windows, January 2004. ISBN 1-568-58289-7.

*After Math,* by Miriam Webster. Zinka Press, June 1997. ISBN 0-9647-1711-5. (Reviewed October 2003.)

*Alan Turing: Life and Legacy of a Great Thinker,* edited by Christof Teuscher. Springer, 2004. ISBN 3-540-20020-7.

*Alpha & Omega: The Search for the Beginning and End of the Universe*, by Charles Seife. Viking, July 2003. ISBN 0-670-03179-8.

*Automated Reasoning and the Discovery of Missing and Elegant Proofs*, by Larry Wos and Gail Pieper. Rinton Press, December 2003. ISBN 1-58949-023-1.

* *Beyond Coincidence*, by Martin Plimmer and Brian King. Icon Books, March 2004. ISBN 1-840-46534-4.

*Beyond the Limit: The Dream of Sofya Kovalevskaya*, by Joan Spicci. Forge, August 2002. ISBN 0-765-30233-0. (Reviewed January 2004.)

*The Book of My Life*, by Girolamo Cardano. New York Review of Books

Classics Series/Granta. ISBN 1-590-17016-4.

*Calculated Risks: How to Know When Numbers Decieve You*, by Gerd Gigerenzer. Simon & Schuster, March 2003. ISBN 0-743-25423-6.

*California Dreaming: Reforming Mathematics Education*, by Suzanne M. Wilson. Yale Univ Press, January 2003. ISBN 0-300-09432-9. (Reviewed November 2003.)

*The Changing Shape of Geometry: Celebrating a Century of Geometry and Geometry Teaching*, edited by Chris Pritchard. Cambridge University Press, January 2003. ISBN 0-521-53162-4.

*Cogwheels of the Mind: The Story of Venn Diagrams*, by A. W. F. Edwards. Johns Hopkins University Press, April 2004. ISBN 0-801-87434-3.

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

*Corréspondance Grothendieck-Serre*, Pierre Colmez and Jean-Pierre Serre, editors. Société Mathématique de France, 2001. ISBN 2-85629-104-X. (Reviewed October 2003.)

*Count Down: Six Kids Vie for Glory at the World's Toughest Math Competition*, by Steve Olson. Houghton Mifflin, April 2004. ISBN 0-618-25141-3. (Reviewed August 2004.)

*The Curious Life of Robert Hooke, the Man Who Measured London*, by Lisa Jardine. HarperCollins, February 2004. ISBN 0-060-53897-X.

*Einstein's Clocks, Poincaré's Maps: Empires of Time*, by Peter Galison. W.W. Norton & Company, August 2003. ISBN 0-393-02001-0.

*Everything and More: A Compact History of Infinity*, by David Foster Wallace. W. W. Norton, October 2003. ISBN 0-393-00338-8. (Reviewed June/July 2004.)

*The Fabric of the Cosmos*, by Brian Greene. Knopf, February 2004. ISBN 0-375-41288-3.

*Fields Medalists' Lectures*, edited by Sir Michael Atiyah and Daniel Iagolnitzer. World Scientific, 2nd edition, December 2003. ISBN 9-812-38259-3.

*Four Colors Suffice: How the Map Problem Was Solved*, by Robin Wilson. Princeton University Press, March 2003. ISBN 0-691-11533-8. (Reviewed February 2004.)

*The Fractal Murders*, by Mark Cohen. Mysterious Press, Warner Books, May 2004. ISBN 0-89296-799-4. (Reviewed October 2003.)

*From Newton to Hawking: A History of Cambridge University's Lucasian Professors of Mathematics*, edited by Kevin C. Knox and Richard Noakes. Cambridge University Press, November 2003. ISBN 0-521-66310-5.

*Galois' Theory of Algebraic Equations*, by Jean-Pierre Tignol. World Scientific Publishing. ISBN 981-02-4541-6

*Gamma: Exploring Euler's Constant*, by Julian Havil. Princeton University Press, May 2003. ISBN 0-691-09983-9. (Reviewed August 2004.)

*Geometry: Our Cultural Heritage*, by Audun Holme. Springer, April 2002. ISBN 3-540-41949-7. (Reviewed May 2004.)

*Gödel's Proof*, by Ernest Nagel and James R. Newman. New York University Press, revised edition, February 2002. ISBN 0-8147-5816-9. (Reviewed March 2004.)

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

*A Handbook of Mathematical Discourse*, by Charles Wells. Infinity Publishing Company, 2003. ISBN 0-7414-1685-9. (Reviewed in this issue.)

*How Economics Became a Mathematical Science*, by E. Roy Weintraub. Duke University Press, June 2002. ISBN 0-822-32856-9.

*Imagining Numbers (particularly the square root of minus fifteen)*, by Barry Mazur. Farrar, Straus and Giroux, February 2003. ISBN 0-374-17469-5. (Reviewed November 2003.)

*Isaac Newton*, by James Gleick. Pantheon Books, May 2003. ISBN 0-375-42233-1. (Reviewed December 2003.)

*Infinity: the Quest to Think the Unthinkable*, by Brian Clegg. Carroll & Graf, December 2003. ISBN 0-786-71285-6.

*Information: The New Language of Science*, by Hans Christian von Baeyer. Weidenfeld & Nicolson, October 2003. ISBN 0-297-60725-1 (hardcover) 0-753-81782-9 (paperback).

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

*Linked: The New Science of Networks*, by Albert-László Barabási. Perseus Publishing, May 2002. ISBN 0-738-20667-9. (Reviewed February 2004.)

*Masters of Theory: Cambridge and the Rise of Mathematical Physics*, by Andrew Warwick. University of Chicago Press, July 2003. ISBN 0-226-87375-7.

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

* *The Mathematical Century: The 30 Greatest Problems of the Last 100 Years*, by Piergiorgio Odifreddi. Translated by Arturo Sangalli. Princeton University Press, May 2004. ISBN 0-691-09294-X.

*Mathematical Constants*, by Steven R. Finch. Cambridge University Press, August 2003. ISBN 0-521-81805-2.

*Mathematical Journeys*, by Peter D. Schumer. Wiley-Interscience, February 2004. ISBN 0-471-22066-3.

*Mathematicians as Enquirers: Learning about Learning Mathematics*, edited by Leone Burton. Kluwer, April 2004. Hardbound, ISBN 1-4020-7853-6; paperback, ISBN 1-4020-7859-5; eBook, ISBN 1-4020-7908-7.

*A Mathematician's Survival Guide: Graduate School and Early Career Development*, by Steven G. Krantz. AMS, August 2003. ISBN 0-821-83455-X. (Reviewed April 2004.)

*Mathematicians Under the Nazis*, by Sanford L. Segal. Princeton University Press, July 2003. ISBN 0-691-00451-X.

*Mathematics and Culture I*, edited by Michele Emmer. Springer, January 2004. ISBN 3-540-01770-4.

*Mathematics and War*, by Bernhelm Booss-Bavnbek and Jens Høyrup, editors. Birkhäuser, December 2003. ISBN 3-764-31634-9.

*Mathematics, Art, Technology, and Cinema*, edited by Michele Emmer and Mirella Manaresi. Springer, 2003. ISBN 3-540-00601-X.

*Mathematics by Experiment: Plausible Reasoning in the 21st Century*, by David Bailey, Jonathan Borwein. A K Peters, September 2003. ISBN 1-568-81136-5.

*Mathematics for the Imagination*, by Peter M. Higgins. Oxford University Press, November 2002. ISBN 0-198-60460-2.

*Mathematics in Nature: Modeling Patterns in the Natural World*, by John Adam. Princeton University Press, November 2003. ISBN 0-691-11429-3.

*The Mathematics of Juggling*, by Burkard Polster. Springer, November 2002. ISBN 0-387-95513-5. (Reviewed January 2004.)

*Memoirs of a Proof Theorist: Gödel and Other Logicians*, by Gaisi Takeuti. Translated by Mariko Yasugi and Nicholas Passell. World Scientific, February 2003. ISBN 981-238-279-8.

*Meta Math! The Quest for Omega*, by Gregory J. Chaitin. April 2004. Available at `http://www.cs.umaine.edu/~chaitin/omega.html`.

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

*The Music of the Primes: Searching to Solve the Greatest Mystery in Mathematics*, by Marcus Du Sautoy. HarperCollins, April 2003. ISBN 0-066-21070-4.

*Newton's Apple: Isaac Newton and the English Scientific Renaissance*, by Peter Aughton. Weidenfeld & Nicolson, October 2003. ISBN 0-297-84321-4.

*The Number π*, by Pierre Eymard and Jean-Pierre Lafon. AMS, 2004. ISBN 0-8218-3246-8.

*On the Nature of Human Romantic Interaction*, by Karl Iagnemma. Dial Press, April 2003. ISBN 0-385-33593-8.

*Phase Change: The Computer Revolution in Science and Mathematics*, by Douglas S. Robertson. Oxford University Press, March 2003. ISBN 0-195-15748-6.

*Portraits of the Earth: A Mathematician Looks at Maps*, by Timothy G. Freeman. AMS, September 2002. ISBN 0-8218-3255-7.

*Predicting Presidential Elections and Other Things*, by Ray C. Fair. Stanford University Press, August 2002. ISBN 0-804-74509-9.

*Prime Obsession: Bernhard Riemann and the Greatest Unsolved Problem*, by John Derbyshire. Joseph Henry Press, March 2003. ISBN 0-309-08549-7.

*Probability Theory: The Logic of Science*, by E. T. Jaynes. Edited by G. Larry Bretthorst. Cambridge University Press, April 2003. ISBN 0-521-59271-2.

*Proofs from the Book*, by Martin Aigner and Günter M. Ziegler. Springer Verlag, third edition, December 2003. ISBN 3-540-40460-0.

*The Riemann Hypothesis: The Greatest Unsolved Problem in Mathematics*, by Karl Sabbagh. Farrar Straus & Giroux, April 2003. ISBN 0-374-25007-3.

*The Saga of Mathematics: A Brief History*, by Marty Lewinter and William Widulski. Prentice Hall, January 2002. ISBN 0-130-34079-0.

*Science in the Looking Glass*, by E. Brian Davies. Oxford University Press, August 2003. ISBN 0-19-852543-5.

*Shooting the Sun*, by Max Byrd. Bantam, December 2003. ISBN 0-553-80208-9.

*Signs of the Inka Khipu: Binary Coding in the Andean Knotted-String Records*, by Gary Urton. University of Texas Press, August 2003. ISBN 0-292-78540-2.

*Six Degrees: The Science of a Connected Age*, by Duncan J. Watts. W. W. Norton & Company, February 2003. ISBN 0-393-04142-5. (Reviewed February 2004.)

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

*Sync: The Emerging Science of Spontaneous Order*, by Steven Strogatz. Hyperion, February 2003. ISBN 0-786-86844-9. (Reviewed March 2004.)

*Travels in Four Dimensions: The Enigmas of Space and Time*, by Robin Le Poidevin. Oxford University Press, February 2003. ISBN 0-19-875254-7.

*Turing (A Novel about Computation)*, by Christos H. Papadimitriou. MIT Press, November 2003. ISBN 0-262-16218-0.

*What Is Thought?*, by Eric B. Baum. MIT Press, January 2004. ISBN 0-262-02548-5.

*What the Numbers Say: A Field Guide to Mastering Our Numerical World*, by Derrick Niederman and David Boyum. Broadway Books, April 2003. ISBN 0-767-90998-4.

*When Least Is Best: How Mathematicians Discovered Many Clever Ways to Make Things as Small (or as Large) as Possible*, by Paul J. Nahin. Princeton University Press, November 2003. ISBN 0-691-07078-4.

# Backlog of Mathematics Research Journals

| Journal (Print and Electronic) | Number issues per Year | Approximate Number Pages per Year | 2003 Median Time (in Months) from: Submission to Final Acceptance | Acceptance to Print | Acceptance to Electronic Posting | Editor's Current Estimate of Waiting Time between Submission and Publication (in Months) Print | Electronic |
|---|---|---|---|---|---|---|---|
| Abstr. Appl. Anal. | 12 | 650 | 5 | 6 | 6 | 8 | 8 |
| Acta Inform. | 9 | 720 | 12 | 3 | 2 | 12 | 11 |
| Acta Math. | 4 | 600 | 8 | 14 | 14 | 16 | 16 |
| Aequationes Math. | 6 | 640 | 12 | 12 | 12 | 14 | 14 |
| Algorithmica | 12 | 1100 | 7 | 8 | 6 | 6 | 5 |
| Amer. J. Math. | 6 | 1400 | NA | 9.19 | 8.19 | 14 | 13 |
| Ann. Appl. Prob. | 4 | 2000 | 9 | 11 | 10 | 17 | 16 |
| Ann. Mat. Pura Appl. | 4 | 512 | 9.9 | 19.6 | 12 | 15 | 10 |
| Ann. of Math. | 6 | 2000 | 10 | 14 | 14 | 16 | 16 |
| Ann. Probab. | 4 | 2200 | 10.8 | 21.6 | NA | 14 | NA |
| Ann. Statist. | 6 | 2100 | 17 | 12 | 12 | 22 | 20 |
| Anziam J. | 5* | 576/183* | 10.92 | 17.15 | .84 | 16.92 | 11.76 |
| Appl. Math. Lett. | 12 | 1600 | 6 | 5 | 3 | 8 | 7 |
| Appl. Math. Optim. | 6 | 530 | 7 | 7 | 4 | 7 | 4 |
| Arch. Hist. Exact Scis. | 6 | 540 | 6 | 12** | 7** | 8.5** | 4.5** |
| Arch. Math. Logic | 8 | 800 | 14 | 10.5 | 6 | 25.4 | 20 |
| Arch. Rational Mech. Anal. | 12 | 1800 | 6 | 6 | 3 | 6 | 3 |
| Balkan J. Geom. Appl. | 2 | 280 | 4 | 7 | 3 | 7 | 3 |
| Bull. London Math. Soc. | 6 | 864 | 6 | 9 | 9.5 | 15 | 14.5 |
| Bull. Soc. Math. France | 4 | 600 | 6.7 | 12 | 7–8 | 11 | 9 |
| Calc. Var. Partial Diff. Equations | 12 | 1345 | 7 | 12.5 | 4.3 | 13.3 | 10 |
| Canad. J. Math. | 6 | 1342 | 9 | 8.3 | 9 | 17 | 18 |
| Canad. Math. Bull. | 4 | 638 | 7.3 | 11.5 | 12 | 17 | 18 |
| Combinatorica | 4 | 600 | 8 | 15 | 15 | 12 | 12 |
| Comm. Algebra | 12 | 5000 | 20 | NA | NA | 18 | 17 |
| Comm. Math. Phys. | 27 | 5800 | 5 | 2.5** | 1.5** | 3.5** | 2.5** |
| Comm. Partial Diff. Equations | 6 | 1800 | 8 | 12 | 12 | 12 | 12 |
| Comm. Pure Appl. Anal. | 4 | 700 | 5 | 4 | 3 | 9 | 8 |
| Compos. Math. | 6 | 1700 | NA | NA | NA | 19 | 17 |
| Comput. Math. Appl. | 24 | 4100 | 6 | 5 | 3 | 10 | 8 |
| Computing | 8 | 768 | 8.3 | 4.2 | 3.5 | 10 | 9 |
| Constr. Approx. | 4 | 625 | 11 | 12 | 6 | 18 | 8 |
| Discrete Comput. Geom. | 8 | 1280 | 8 | 9 | 7 | 13 | 12 |
| Discrete Contin. Dyn. Syst. | 8 | 2400 | 6 | 7 | 6 | 13 | 12 |
| Discrete Contin. Dyn. Syst. Ser. B | 4 | 900 | 5 | 6 | 5 | 11 | 10 |
| Duke Math. J. | 15 | 3000 | 8 | 10 | 10 | 18 | 18 |
| Found. Comp. Math. | 4 | 430 | 8.2 | 8.5 | 2.6 | 15 | 10 |
| Graphs Combin. | 4 | 600 | 8 | 8 | 5 | 12 | 12 |
| Houston J. Math. | 4 | 1150 | 9 | 15 | 12 | 19 | 17 |
| Illinois J. Math. | 4 | 1350 | 6 | 9 | 8 | 12 | 11 |
| IMA J. Appl. Math. | 6 | 624 | 10 | 18 | 18 | 11 | 11 |
| IMA J. Math. Control Inform. | 4 | 120 | 8 | 9 | 5 | 12 | 8 |
| IMA J. Numer. Anal. | 4 | 720 | 8 | 8 | 8 | 16 | 16 |
| Indiana Univ. Math. J. | NR | NR | NR | NR | NR | NR | NR |
| Inst. Hautes Études Sci. Publ. Math. | 2 | 500 | 6 | 6 | 6 | 6 | 6 |
| Internat. J. Math. Math. Sci. | 72 | 4500 | 4 | 6 | 6 | 9 | 9 |
| Internat. Math. Res. Not. | 80 | 4500 | 3 | 2 | 2 | 4 | 4 |
| Invent. Math. | 12 | 2740 | 10 | 6.4 | 3.3 | 16 | 14.5 |
| J. Algebraic Geometry | 4 | 800 | 12 | 8 | 6 | 16 | 10 |
| J. Algorithms | NR | NR | NR | NR | NR | NR | NR |

| Journal (Print and Electronic) | Number issues per Year | Approximate Number Pages per Year | 2003 Median Time (in Months) from: Submission to Final Acceptance | Acceptance to Print | Acceptance to Electronic Posting | Editor's Current Estimate of Waiting Time between Submission and Publication (in Months) Print | Electronic |
|---|---|---|---|---|---|---|---|
| J. Amer. Math. Soc. | 4 | 1000 | 11.6 | 3.4 | .9 | 11.3 | 8.8 |
| J. Amer. Statist. Assoc.*** | 4 | 1200–1400 | 13 | 6 | NA | 15–18 | NA |
| J. Appl. Math. | 12 | 650 | 5 | 6 | 6 | 8 | 8 |
| J. Assoc. Comput. Mach. | 6 | 1000 | 20 | 3 | 3 | 15 | 15 |
| J. Classification | 2 | 325 | 10 | 3 | 3 | 9 | 3 |
| J. Complexity | 6 | 1000 | 8 | 9 | 4 | 14 | 3 |
| J. Comput. System Sci. | 8 | 1600 | 12 | 18 | 18 | 18 | 18 |
| J. Cryptology | 4 | 300 | 22 | 10 | 10 | 15 | 15 |
| J. Differential Geom. | 9 | 175 | NA | NA | NA | 3.5 | 3.5 |
| J. Engrg. Math. | 12 | 1200 | 6 | 1.5 | .75 | 6 | 5 |
| J. Eur. Math. Soc. | 4 | 520 | NA | 6 | 3 | 9 | 9 |
| J. Lie Theory | 2 | 615 | 8 | 6 | 6 | 11 | 11 |
| J. London Math. Soc. | 6 | 1632 | 6.5 | 8.5 | 9 | 14.5 | 14 |
| J. Math. Biol. | 12 | 1152 | 10.2 | 6.6 | 3.5 | 16.8 | 13.7 |
| J. Math. Phys. | 12 | 6300 | 4 | 5 | 4.5 | 4 | 4 |
| J. Symbolic Logic | 4 | 1400 | 9 | 7 | 4 | 12 | 10 |
| Linear Algebra Appl. | 18 | 6400 | 12 | 7 | 3 | 12 | 8 |
| Linear Multilinear Algebra | 6 | 480 | 6 | 6 | 1 | 12 | 6 |
| Manuscripta Math. | 12 | 1632 | 7.8 | 4.6 | 2.4 | 12.4 | 12.2 |
| Math. Ann. | 12 | 2500 | 12 | 6.6 | 3.9 | 13 | 11.5 |
| Math. Biosci. | 12 | 1400 | 8 | 4 | 1 | 6 | 5 |
| Math. Comp. | 4 | 2000 | 11.5 | 15.8 | 9.8 | 27.8 | 21.7 |
| Math. Comput. Modelling | 26 | 3200 | 6 | 5 | 3 | 10 | 8 |
| Math. Control Signals Systems | 4 | 350 | 16 | 5 | NA | 20 | 18 |
| Math. Oper. Res. | 4 | 900 | 13 | 6 | 5 | 16 | 14 |
| Math. Programming | 9 | 1548 | 14.5 | 4.8 | 2.1 | 19.3 | 16.6 |
| Math. Z. | 12 | 2650 | 11 | 7.2 | 4.4 | 17 | 14 |
| Michigan Math. J. | 3 | 720 | 5 | 12 | 11 | 12 | 11 |
| Monatsh. Math. | 12 | 1056 | 7 | 10 | 7 | 18–24 | 12 |
| Multiscale Model. Simul. | 4 | 680 | 5.17 | 4.71 | 2.53 | 9 | 7 |
| Nonlinear Anal. | 27 | 4292 | 12 | 8 | 7 | 5 | 4 |
| Numer. Funct. Anal. Optim. | 8 | 1050 | 11 | 5 | 5 | 11 | 11 |
| Numer. Math. | 12 | 2400 | 10.4 | 14 | 6 | 22 | 16 |
| Oper. Res. | 6 | 6600 | 14 | 12 | 12 | 14 | 12 |
| Pacific J. Math. | 10 | 2000 | 6 | 12–14 | NA | 10 | NA |
| Probab. Theor. Relat. Fields | 12 | 1824 | 10.2 | 5.5 | 3.4 | 15.7 | 13.6 |
| Proc. Amer. Math. Soc. | 12 | 3520 | 5.8 | 13.6 | 7.7 | 18.4 | 13.6 |
| Proc. London Math. Soc. | 6 | 1632 | 8 | 12 | 12 | 17.5 | 17 |
| Quart. J. Math. | 4 | 512 | 6 | 5 | 5 | 11 | 11 |
| Quart. J. Mech. Appl. Math. | 4 | 650 | 5 | 6 | 6 | 12 | 12 |
| Reliab. Comput. | 6 | 510 | 6 | 6 | 3 | 11 | 8 |
| Rocky Mountain J. Math. | 4 | 1600 | 9 | 20 | 19 | 28 | 27 |
| Semigroup Forum | 6 | 960 | 11 | 6 | 2 | 16 | 12 |
| SIAM J. Appl. Math. | 6 | 2200 | 8.16 | 9.2 | 5.98 | 16 | 12 |
| SIAM J. Comput. | 6 | 1530 | 15.17 | 5.52 | 3.68 | 19 | 17 |
| SIAM J. Control Optim. | 6 | 2300 | 12.87 | 15.4 | 5.98 | 26 | 16 |
| SIAM J. Discrete Math. | 4 | 680 | 20.2 | 8.85 | 4.83 | 26 | 22 |
| SIAM J. Math. Anal. | 6 | 1650 | 8.28 | 12.18 | 5.75 | 19 | 12 |
| SIAM J. Matrix Anal. Appl. | 4 | 1200 | 9.66 | 12.4 | 5.52 | 19 | 13 |
| SIAM J. Numer. Anal. | 6 | 2400 | 11.26 | 17.93 | 6.44 | 28 | 15 |
| SIAM J. Optim. | 4 | 1250 | 13.79 | 12.87 | 5.52 | 25 | 17 |
| SIAM J. Sci. Comput. | 6 | 2180 | 11.26 | 11.26 | 5.86 | 21 | 15 |
| SIAM Rev. | 4 | 800 | 6.67 | 7.18 | 6.18 | 12 | 11 |
| Smarandache Notions J. | 1 | 350–400 | 1 | **** | 1 | **** | 1 |
| Theory Comput. Syst. | 6 | 700 | 10 | 8 | 5 | 8 | 5 |
| Topology | 6 | 1400 | 5 | 14 | 15 | 17 | 18 |
| Topology Appl. | 27 | 2700 | 9 | 8 | 4 | 16 | 12 |
| Trans. Amer. Math Soc. | 12 | 5000 | 8.7 | 5.9 | 3.1 | 19.7 | 15.7 |

| Journal (Print) | Number issues per Year | Approximate Number Pages per Year | 2003 Median Time (in Months) from: Submission to Final Acceptance | Acceptance to Final Publication | Editor's Current Estimate of Waiting Time between Submission and Publication (in Months) |
|---|---|---|---|---|---|
| Algebras Groups Geom. | 4 | 600 | 1 | 2 | 2 |
| Bull. Austral. Math. Soc. | 6 | 1056 | 10 | 6 | 10 |
| Circuits Systems Signal Proc. | 6 | 720 | 11 | 5 | 14 |
| Indag. Math. | 4 | 588 | 3 | 3 | 8 |
| Israel J. Math. | 6 | 2280 | 6 | 10 | 9 |
| J. Appl. Math. Stochastic Anal. | 4 | 408 | 11 | 6 | 10 |
| J. Austral. Math. Soc. | 6 | 860 | 27 | 16 | 24–30 |
| J. Geom. Anal. | 4 | 855 | 5.5 | 8 | 8 |
| J. Integral Equations Appl. | 4 | 520 | 6 | 7 | 8 |
| J. Operator Theory | 4 | 900 | 10 | 22 | 32 |
| J. Theoret. Probab. | 4 | 1050 | more than 8–10 | 8–10 | 15–18 |
| Math. Res. Let. | 6 | 830 | 5 | 5 | 10 |
| Math. Social Sci. | NA | NA | NA | NA | 3–4 |
| Mem. Amer. Math. Soc. | 6 | 3200 | 10.2 | 10.8 | 30 |
| Methods Appl. Anal. | 4 | 800 | 3–6 | 3–6 | 7–8 |
| Quart. Appl. Math. | 4 | 800 | 9.7 | 16.2 | 17.6 |
| Results Math. | 4 | 800 | 5.7 | 4.5 | 10 |

| Journal (Electronic) | Number of Articles Posted in 2003 | 2003 Median Time (in days) from: Submission to Final Acceptance | Acceptance to Posting | Format(s) |
|---|---|---|---|---|
| ACM J. Exp. Algorithmics (www.jea.acm.org) | 16 | NA | NA | pdf, ps, tex |
| Acta Math. Acad. Paedagog. Nyházi. (www.emis.de/journals/AMAPN) | 20 | 148 | 167 | pdf, ps |
| Algebr. Geom. Topol. (www.maths.warwick.ac.uk/agt/index.html) | 46 | 225 | 10 | pdf, ps |
| Algebra Montpellier Announcements (www.emis.ams.org/journals/AMA/index.html) | 11 | 90 | 30 | pdf, ps, dvi |
| Appl. Math. E-Notes (www.math.nthu.edu.tw/~amen/) | 24 | 153 | 92 | pdf |
| Appl. Sci. (www.mathem.pub.ro/apps) | 6 | 30 | 60 | pdf, ps |
| Cent. Eur. J. Math. (www.cesj.com/mathematics.html) | 40 | 81 | 43 | pdf, ps, dvi, tex, other |
| Chicago J. Theoret. Comp. Sci. (cjtcs.cs.uchicago.edu/) | 0 | 0 | 0 | pdf, ps, dvi, tex |
| Conform. Geom. Dyn. (www.ams.org/ecgd/) | 6 | 570 | 89 | pdf, ps, dvi, tex |
| Diff. Eq. Contr. Process (www.neva.ru/journal) | 19 | 50 | 7 | pdf, tex |
| Differ. Geom. Dyn. Syst. (www.mathem.pub.ro/dgds) | 7 | 45 | 90 | pdf, ps |
| Discrete Math. Theor. Comput. Sci. (www.dmtcs.org) | 15 | 330 | 15 | pdf, ps |
| Doc. Math. (www.mathematik.uni-bielefeld.de/documenta/) | 19 | 119 | 12 | pdf, ps, dvi |
| Electron. Comm. Probab. (www.math.washington.edu/~ejpecp) | 21 | 124 | 26 | html, pdf, ps |
| Electron. J. Combin. (www.combinatorics.org) | 77 | 197 | 14 | pdf, ps |
| Electron. J. Differential Equations (ejde.math.unt.edu; ejde.math.txstate.edu; www.emis.de/journals/EJDE) | 125 | 116 | 8 | pdf, ps, dvi, tex |

| Journal (Electronic) | Number of Articles Posted in 2003 | 2003 Median Time (in days) from: Submission to Final Acceptance | Acceptance to Posting | Format(s) |
|---|---|---|---|---|
| Electron. J. Linear Algebra (www.math.technion.ac.il/iic/ela) | 25 | 158 | 18 | pdf, ps, tex, other |
| Electron. J. Probab. (www.math.washington.edu/~ejpecp/) | 24 | 208 | 24 | html, pdf, ps |
| Electron. J. Qual. Theory Differ. Equ. (www.math.u-szeged.hu/ejqtde/) | 22 | 100 | 7 | pdf, ps, dvi, tex, other |
| Electron. Res. Announc. Amer. Math. Soc. (www.ams.org/era/) | 19 | 80 | 12 | pdf, ps, dvi, tex |
| Electron. Trans. Numer. Anal. (etna.mcs.kent.edu) | 10 | 283 | 35 | pdf, ps |
| ESAIM Control Optim. Calc. Var. (www.edpsciences.org/cocv/) | 33 | 231 | 93 | pdf |
| ESAIM Probab. Statist. (www.edpsciences.org/ps/) | 13 | 254 | 105 | pdf |
| Forum Geom. (forumgeom.fau.edu) | 26 | 41 | 22 | pdf, ps |
| Geom. Topol. (www.maths.warwick.ac.uk/gt/index.html) | 30 | 215 | 8 | pdf, ps |
| Homology Homotopy Appl. (www.rmi.acnet.ge/hha/) | 30 | 175 | 10 | pdf, ps, dvi |
| Integers. Electron. J. Combin. Numb. Th. (www.integers-ejcnt.org) | 24 | 201 | 1 | pdf, ps, dvi, tex |
| J. Artificial Intelligence Res. (www.jair.org/) | NR | NR | NR | NR |
| J. Funct. Logic Programming (danae.uni-muenster.de/lehre/kuchen/JFLP/) | 3 | 100 | 100 | pdf, ps |
| J. Graph Algorithms Appl. (jgaa.info/) | 20 | 240 | 20 | pdf, ps, tex |
| J. High Energy Phys. (jhep.sissa.it) | 808 | 62 | 16 | pdf, ps |
| J. Inequal. Pure Appl. Math. (jipam.vu.edu.au/) | 109 | 100† | 30 | ps |
| J. Integer Seq. (www.math.uwaterloo.ca/JIS/) | 32 | 116 | 17 | pdf, ps, dvi, tex |
| JoT J. Turbul. (jot.iop.org) | 33 | 50 | 22 | html, pdf |
| LMS J. Comput. Math. (www.lms.ac.uk/jcm/) | 15 | 184 | 70 | html, pdf, other |
| Lobachevskii J. Math. (ljm.ksu.ru) | 15 | 70 | 120 | ps, dvi, tex, other |
| Math. Phys. Electron. J. (www.maia.ub.es/mpej) | 6 | 126 | 10 | ps |
| New York J. Math. (nyjm.albany.edu:800/nyjm.html) | 19 | 230 | 10 | pdf, ps, dvi |
| Represent. Theory (www.ams.org/ert/) | 26 | 255 | 34 | pdf, ps, dvi, tex |
| Sem. Lothar. Combin. (igd.univ-lyon1.fr/~slc) | 13 | 231 | 17 | pdf, ps, dvi, tex |
| SIAM J. Appl. Dyn. Syst. (epubs.siam.org/sam-bin/dbq/toclist/SIADS) | 23 | 193.2 | 110.4 | pdf, ps, dvi, other |
| Southwest J. Pure Appl. Math. (rattler.cameron.edu/swjpam/swjpam.html) | 20 | 198 | 254 | pdf, dvi, tex |
| Theory Appl. Categ. (www.tac.mta.ca/tac/) | 20 | 189 | 11 | pdf, ps, dvi, other |

NR means no response received. NA means not available or not applicable. *4 hard copy and 1 electronic; 576 pages hard copy and 183 electronic. **From arrival of final manuscript at the publisher to print and electronic posting. ***Estimates apply to the journal as a whole; however, the data obtained comes only from the Theory and Methods section of the journal. ****All papers are published in 1 issue at the end of the year. †Working days.

# Stipends for Study and Travel

## Graduate Support

### American Association for the Advancement of Science

*Mass Media Summer Fellowship*

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

**Description:** Fellows work for newspapers, magazines, and radio and television stations. Travel expenses and stipends are paid by the AAAS. Fellows have the opportunity to: observe and participate in the process by which events and ideas become news, improve their communication skills by learning to describe complex technical subjects in a manner understandable by the public, and increase their understanding of editorial decision making and the manner in which information is effectively disseminated. Each fellow will: attend an orientation and evaluation session in Washington, DC; begin the 10-week internship in mid-June; and submit an interim and final report to AAAS to help evaluate the program.
**Eligibility:** Provides support for 20–25 outstanding graduate students in mathematics, the natural and social sciences, and engineering as reporters, researchers, and production assistants in the mass media. (Exceptional undergraduate or postdoctoral students also considered.)
**Grant amount:** $450/week stipend for ten weeks.
**Deadline:** January 15, 2005.
**Application information:** Stacey Pasco, Manager, Mass Media Program, Mass Media Science and Engineering Fellows Program, American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005; telephone: 202-326-6441; `http://ehrweb.aaas.org/massmedia.htm`.

### American Association of University Women (AAUW) Educational Foundation

*Selected Professions Fellowships*

**Description:** These fellowships are awarded to women of outstanding academic ability who are citizens or permanent residents of the U.S. for full-time graduate study in designated fields where women's participation has traditionally been low. Eligible fields currently include mathematics and statistics.
**Eligibility:** Fellowships are for the final year of the master's degree. Fellowship year is July 1–June 30. Degree must be earned at the end of the fellowship year.
**Grant amount:** $5,000–$12,000.
**Deadline:** Must be postmarked by January 10 (applications are available August 1–December 20).
**Application information:** For more information contact: AAUW Educational Foundation, 2201 Dodge Street, Iowa City, IA 52243-4030; tel: 319-337-1716; or visit our website at `http://www.aauw.org/`.

### Burroughs Wellcome Fund

*Career Awards at the Scientific Interface*

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

topological clues and mechanical forces, and developing a new conceptual understanding of the complexity of living organisms. Proposals that include experimental validation of theoretical models are particularly encouraged.

**Eligibility:** Candidates must hold a Ph.D. degree in the fields of mathematics, physics, chemistry (physical, theoretical, or computational), computer science, statistics, or engineering. Exceptions will be made only if the applicant can demonstrate significant expertise in one of these areas, evidenced by publications or advanced course work. Candidates must have completed at least six months but not more than 48 months of postdoctoral training at the time of application and must not hold or have accepted a faculty appointment as a tenure-track assistant professor at the time of application. Candidates who are not citizens of the United States or Canada must provide documentation of their visa status at the time of application.

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

**Deadline:** May 3, 2005.

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

## Florida Education Fund

*The McKnight Doctoral Fellowship Program*

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

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

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

**Deadline:** The deadline for applications for fall 2005 is January 15, 2005.

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

## Ford Foundation Dissertation Fellowships for Minorities

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

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

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

## Ford Foundation Predoctoral Fellowships for Minorities

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

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

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

## Georgia Institute of Technology

*President's Fellowships*

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

## National Academies

*Christine Mirzayan Science and Technology Policy Internship Program*

**Description:** The Christine Mirzayan Science and Technology Policy Internship Program of the National Academies is designed to engage graduate and postdoctoral science, engineering, medical, veterinary, business, and law students in science and technology policy and to familiarize them with the interactions between science, technology, and government. As a result, students develop essential skills different from those attained in academia and make the transition from being a graduate student to a professional.
**Eligibility:** Applications for the internships are invited from graduate students through postdoctoral candidates in any physical, biological, or social science field or any field of engineering, medicine/health, or veterinary medicine, as well as business and law education, and other graduate and professional programs.
**Grant amount:** The stipend for the 12-week January program is $5,700. The stipend for the 10-week June program is $4,800. The stipend for the September program is $5,700. In addition, travel expenses of up to $500 will be provided.
**Deadline:** Deadline for the receipt of materials is November 1 for the January program, March 1 for the June program, and June 1 for the September program.
**Application information:** For program details and a link to the online application, please visit the website at `http://national-academies.org/internship`. For further information, email: `internship@nas.edu` (preferred) or phone 202-334-2455. Résumés are not accepted.

## National Science Foundation

*Graduate Research Fellowships*

**Description:** Three-year awards available to U.S. citizens or nationals, or permanent resident aliens of the U.S. Fellowships are awarded for graduate study leading to research-based master's or doctoral degree in the fields of science, mathematics, and engineering supported by the NSF. Women in Engineering and Computer and Information Science: Additional awards will be offered to encourage women to undertake graduate study in engineering and computer and information science.
**Eligibility:** Fellowships are intended for individuals in the early stages of their graduate study in science, mathematics, or engineering.
**Application information:** Apply to NSF Graduate Research Fellowship Program, Oak Ridge Associated Universities, P. O. Box 3010, Oak Ridge, TN 37831-3010; tel: 865-241-4300; fax: 865-241-4513; email: `nsfgrfp@orau.gov`; website: `http://www.orau.gov/orise/edu/NSF/gi-gGRF.htm`.

## Zonta International Foundation

*Amelia Earhart Fellowship Awards*

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

# Postdoctoral Support

## Air Force Office of Scientific Research

*Research Contracts and Grants*

**Description:** Mathematicians and computer scientists are encouraged to submit through their organizations proposals for research support. Research areas include mathematics of dynamics and control, physical mathematics and applied analysis, computational mathematics, optimization and discrete mathematics, signal processing, probability and statistics, software and systems, intelligent software agents, and electromagnetics.

**Application information:** Research proposals should be forwarded to the Mathematics and Space Sciences Directorate, Air Force Office of Scientific Research (AFOSR/NM), 4015 Wilson Blvd., Room 713, Arlington, VA 22203-1954.

## American Mathematical Society Centennial Fellowships

*Postdoctoral Fellowships*

**Description:** The AMS Centennial Research Fellowship Program makes awards annually to outstanding mathematicians to help further their careers in research. The number of fellowships to be awarded is small and depends on the amount of money contributed to the program. The Society supplements contributions as needed. At most, two fellowships will be awarded for the 2005-06 academic year. A list of previous fellowship winners can be found at `http://www.ams.org/prizes-awards`.

**Eligibility:** The eligibility rules are as follows. The primary selection criterion for the Centennial Fellowship is the excellence of the candidate's research. Preference will be given to candidates who have not had extensive fellowship support in the past. Recipients may not hold the Centennial Fellowship concurrently with another research fellowship such as a Sloan or NSF Postdoctoral Fellowship. Under normal circumstances the fellowship cannot be deferred. A recipient of the fellowship shall have held his or her doctoral degree for at least three years and not more than twelve years at the inception of the award (that is, received between September 1, 1993, and September 1, 2002). Applications will be accepted from those currently holding a tenured, tenure-track, postdoctoral, or comparable (at the discretion of the selection committee) position at an institution in North America. Applications should include a cogent plan indicating how the fellowship will be used. The plan should include travel to at least one other institution and should demonstrate that the fellowship will be used for more than reduction of teaching at the candidate's home institution. The selection committee will consider the plan in addition to the quality of the candidate's research and will try to award the fellowship to those for whom the award would make a real difference in the development of their research careers. Work in all areas of mathematics, including interdisciplinary work, is eligible.

**Grant amount:** The stipend for fellowships awarded for 2005-06 is expected to be $62,000, with an additional expense allowance of about $3,000. Acceptance of the fellowship cannot be postponed.

**Deadline:** The deadline for receipt of applications is December 1, 2004. Awards will be announced in February 2005 or earlier if possible.

**Application information:** Application forms are available via the Internet at `http://www.ams.org/employment/centflyer.html`. For paper copies of the form write to the Membership and Programs Department, American Mathematical Society, 201 Charles Street, Providence, RI 02904-2294; or send electronic mail to `prof-serv@ams.org`; or call 401-455-4107. Please note that completed applications and references should be sent to the AMS at the address given above, marked "Centennial Fellowships".

## American Philosophical Society

*Franklin Research Grants*

**Description:** Postdoctoral research grants to aid specific research projects. The purpose of the program is to connect scholars with the objects of their research. Tenable abroad and in the U.S. The Committee on Research meets in January and in March.

**Eligibility:** For candidates with Ph.D. for at least one year.

**Grant amount:** Up to $6,000. Grants contribute toward travel expenses, food and lodging, and photoduplication. No funds are available for attending conferences or consulting with colleagues.

**Deadline:** October 1, December 1.

**Application information:** For application forms please consult the website at `http://www.amphilsoc.org/`. If electronic access is denied, briefly describe your project and proposed budget in a letter to: Committee on Research, American Philosophical Society, 104 South Fifth Street, Philadelphia, PA 19106; or to `eroach@amphilsoc.org`.

## California Institute of Technology

*Harry Bateman Research Instructorships in Mathematics*

**Description:** Appointments are for two years. The academic year runs from approximately October 1 to June 1. Instructors are expected to teach one course per quarter for the full academic year and to devote the rest of their time to research. During the summer months there are no duties except research.

**Eligibility:** Open to persons who have recently received their doctorates in mathematics.

**Grant amount:** The annual salary for academic year 2005-06 is $50,600.

**Deadline:** January 1, 2005.

**Application information:** Please send applications to Instructorship Search Committee, 253-37 Sloan Laboratory, California Institute of Technology, Pasadena, CA 91125. Include a C.V. and a statement of anticipated research. The candidate is requested to ensure that at least three letters of recommendation be sent to Caltech. To avoid duplication of paperwork, your application may also be considered for an Olga Taussky and John Todd Instructorship. Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

## California Institute of Technology

*Olga Taussky and John Todd Instructorships in Mathematics*

**Description:** Appointments are for three years. There are three terms in the Caltech academic year, and instructors are expected to teach one course in all but two terms of the total appointment. These two terms will be devoted to research. During the summer months there are no duties except research.
**Eligibility:** Offered to persons within three years of having received the Ph.D. who show strong research promise in one of the areas in which Caltech's mathematics faculty is currently active.
**Grant amount:** The annual salary for 2005–06 is $53,600 plus a $2,000 per year research fund.
**Deadline:** January 1, 2005.
**Application information:** Apply to the Instructorship Search Committee, 253–37 Sloan Laboratory, California Institute of Technology, Pasadena, CA 91125. Include a C.V. and a statement of anticipated research. Please ensure that at least three letters of recommendation are sent to Caltech. To avoid duplication of paperwork, your application may also be considered for the Harry Bateman Research Instructorship. Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

## Ford Foundation Postdoctoral Fellowships for Minorities

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

## John Simon Guggenheim Memorial Foundation Fellowships

**Description:** Fellowships are on an advanced professional level. Approximately 221 awards are made.
**Eligibility:** U.S. or Canadian citizenship or permanent residence is required. Fellowships are also offered to citizens or permanent residents of Latin America and the Caribbean.
**Grant amount:** Approximately $36,652 in 2004.
**Deadline:** Application deadline: October 1 for the U.S. and Canada competition, December 1 for the Latin American and Caribbean competition.
**Application information:** For more information write to John Simon Guggenheim Memorial Foundation, 90 Park Avenue, New York, NY 10016; tel: 212-687-4470; fax: 212-697-3248; email: `fellowships@gf.org`; World Wide Web: `http://www.gf.org/`.

## IBM Herman Goldstine Postdoctoral Fellowship in Mathematical Sciences

**Description:** The fellowship provides scientists of outstanding ability an opportunity to advance their scholarship as resident department members at the research center. The department provides an atmosphere in which basic research is combined with work on technical problems arising in industry. Close interaction with permanent department members is expected, but fellows will be free to pursue their own research interests. The fellowship has a period of one year and may be extended by another year by mutual agreement. One fellowship will be awarded yearly. Please see `http://www.research.ibm.com/math/goldstine.html` for further information.
**Eligibility:** Candidates must have a doctorate and no more than five years of postdoctoral professional experience (with a preference for less) when the fellowship commences.
**Grant amount:** Salary: $87,000 to $107,000, depending on experience, plus an allowance for moving expenses.
**Deadline:** December 2004 (check website above).
**Application information:** Please visit website above.

## Institute for Advanced Study Memberships

**Description:** The School of Mathematics will grant a limited number of memberships, some with financial support, for research in mathematics at the Institute during the academic year 2005–06.
**Eligibility:** Candidates must give evidence of ability in research comparable at least with that expected for the Ph.D. degree.
**Deadline:** December 1, 2004.
**Application information:** Application blanks may be obtained from The School of Mathematics, Institute for Advanced Study, Princeton, NJ 08540, and should be returned (whether or not funds are expected from some other source) by December 1. Forms may also be downloaded but not submitted via Web connection at `http://www.math.ias.edu/`. An Equal Opportunity/Affirmative Action Employer.

## Institute for Mathematics and its Applications (IMA)

*General Memberships*

**Description:** The Institute for Mathematics and its Applications at the University of Minnesota announces the availability of general memberships in connection

with its 2005–06 thematic program on *Imaging*. General memberships provide an excellent opportunity for mathematicians and scientists employed elsewhere to spend a period of one month to one year in residence at the IMA and to participate in the 2005–06 thematic program. The program runs from September 2005 through June 2006, and the residency period should fall between June 1, 2005, and August 31, 2006. IMA members are provided with an excellent and extremely stimulating research environment within a large community of researchers.

**Eligibility:** Candidates must be recipients of a doctoral degree and have research interests related to the thematic program. Preference will be given to supplementary support for persons with sabbatical leaves, fellowships, or other stipends.

**Grant amount:** Local expenses and travel costs may be requested.

**Deadline:** Applications will be accepted continuously through the end of the program or until funds are exhausted.

**Application information:** Application forms and instructions are available at `http://www.ima.umn.edu/docs/genmemap.html`. The IMA website is `http://www.ima.umn.edu`. Questions should be directed to `applications@ima.umn.edu` or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

## Institute for Mathematics and its Applications (IMA)

*Industrial Postdoctoral Memberships*

**Description:** The Institute for Mathematics and its Applications at the University of Minnesota announces the availability of several industrial postdoctoral memberships. IMA industrial postdoctoral positions are funded jointly by the IMA and an industrial sponsor, and holders devote 50% effort to their own research and the IMA program and 50% effort working with industrial scientists. Industrial postdoctoral memberships run one or two years at the option of the holder, starting September 1, 2005. The 2005–06 thematic program at the IMA is on *Imaging*, and the 2006–07 program is on *Applications of Algebraic Geometry*. Industrial Postdoctoral positions are designed to prepare mathematicians for research careers in industry or involving industrial interaction.

**Eligibility:** Candidates must have completed the Ph.D. in mathematics or a related area by the start of the appointment and within the last three years.

**Grant amount:** The annual salary for 2005 will be approximately $45,000, and a travel stipend will be furnished.

**Deadline:** January 15, 2005.

**Application information:** Application forms and instructions are available at `http://www.ima.umn.edu/docs/postdocapp.html`. The IMA website is `http://www.ima.umn.edu`. Questions should be directed to `applications@ima.umn.edu` or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

## Institute for Mathematics and its Applications (IMA)

*New Directions Visiting Professorships*

**Description:** The IMA invites applications by established mathematicians for two Visiting Professorships for a period of 9 to 12 months, including the 2005–06 thematic program on *Imaging* (`http://www.ima.umn.edu/imaging`), which runs from September 2005 through June 2006. Visiting Professors will enjoy an excellent research environment and stimulating scientific program with broad mathematical connections, including partial differential equations, probability and statistics, topology and geometry, dynamical systems, representation theory, and scientific computation. New Directions Visiting Professors are expected to be resident and active participants in the program but are not assigned formal duties.

**Eligibility:** Established mathematical scientists with permanent university employment.

**Grant amount:** The New Directions program will supply 50% of faculty salary up to $45,000 maximum. The Visiting Professor's home institution must commit to providing a minimum of 50% of academic year salary and all health and other relevant fringe benefits.

**Deadline:** March 1, 2005.

**Application information:** Application forms and instructions are available at `http://www.ima.umn.edu/docs/newdirapp.html`. The IMA website is `http://www.ima.umn.edu`. Questions should be directed to `ndprof@ima.umn.edu` or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

## Institute for Mathematics and its Applications (IMA)

*Postdoctoral Fellowships*

**Description:** The Institute for Mathematics and its Applications at the University of Minnesota announces the availability of postdoctoral memberships in connection with its 2005–06 thematic program on *Imaging*. Postdoctoral fellowships provide an excellent opportunity for mathematical scientists near the beginning of their career who have a background in and/or an interest in learning about imaging science and its mathematical underpinnings. IMA postdoctoral memberships run one to two years, at the option of the holder, starting September 1, 2005. In the second year of the appointment there are a variety of options to enhance career development, including teaching, working on an industrial project, and participation in the 2006–07 academic year program on *Applications of Algebraic Geometry*, teaching and working on an industrial project.

**Eligibility:** Candidates must have completed the Ph.D. in mathematics or a related area by the start of the appointment and within the last three years.

**Grant amount:** The annual salary for 2005 will be approximately $45,000, and a travel stipend will be furnished.

**Deadline:** January 5, 2005.

**Application information:** Application forms and instructions are available at http://www.ima.umn.edu/docs/postdocapp.html. The IMA website is http://www.ima.umn.edu. Questions should be directed to applications@ima.umn.edu or by phone to 612-624-6066. The University of Minnesota is an Equal Opportunity Educator and Employer.

## Los Alamos National Laboratory

*Postdoctoral Appointments and Fellowships*

**Description:** Research opportunities are granted in many areas of chemistry, mathematics, computer science, materials science, biological sciences, environmental science, geoscience, and many engineering fields. Appointments are available for two years, subject to renewal for a third year. A postdoctoral committee meets to review candidates for postdoctoral fellowships in February, May, August, and December.
**Eligibility:** Candidates must be recipients of a doctoral degree within the past five years.
**Grant amount:** Starting salary: $60,800–$72,500.
**Application information:** Los Alamos National Laboratory is an Equal Opportunity Employer. For more information: email: postdoc-info@lanl.gov; tel: 505-667-0872; fax: 505-665-4562; see details and apply online at: http://www.hr.lanl.gov/postdoc/.

## Los Alamos National Laboratory

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

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

## Mathematical Sciences Research Institute (MSRI)

*General Memberships*

**Description:** The Institute will invite an undetermined number of general members for stays of 1 month or more during 2005–06, when four half-year programs will be featured: *Nonlinear Elliptic Equations and Applications* (August 15 to December 16, 2005); *Nonlinear Dispersive Equations* (August 15 to December 16, 2005); *Rational and Integral Points on Higher-Dimensional Varieties* (January 9, 2006, to May 19, 2006); and *New Topological Structures in Physics* (January 9, 2006, to May 19, 2006). Some awards will be made in other areas, so applications from candidates in all fields are welcome.
**Eligibility:** For mathematicians postdoctoral and above.
**Grant amount:** While there is no stipend for general members, MSRI may offer partial expense reimbursement of up to $2,728/month and may offer travel expense reimbursement. General members are expected to visit with at least some outside financial support.
**Deadline:** Files must be complete by November 12, 2004.
**Application information:** Please complete online application form at: http://www.msri.org/applications/applying/.

## Mathematical Sciences Research Institute (MSRI)

*Microsoft Research Postdoctoral Grant*

**Description:** The Mathematical Sciences Research Institute announces the availability of a postdoctoral fellowhip combined with an internship at Microsoft Research in Redmond, Washington. Because of the variety of mathematical work done at Microsoft Research, no particular fields of mathematics have been specified. However, an essential prerequisite is a strong interest in the applications of mathematics as well as in the research environment at MSRI. This postdoctoral fellowship is normally a two-year award, with the recipient spending one year at MSRI and the second year at Microsoft Research.
**Eligibility:** For new and recent Ph.D.'s (Ph.D. earned in 2000 or later). Applicants should apply through the usual process for MSRI Postdoctoral Fellowships, indicating their interest in this internship/fellowship and adding relevant documentation. Applications indicating interest in this program will be reviewed by Microsoft Research as well as by MSRI.
**Deadline:** Files must be completed by November 12, 2004.
**Application information:** Please complete online application form at: http://www.msri.org/applications/applying/.

## Mathematical Sciences Research Institute (MSRI)

*Postdoctoral Fellowships*

**Description:** The Institute will award about 20 postdoctoral fellowships during 2005–06, when four half-year programs will be featured: *Nonlinear Elliptic Equations and Applications* (August 15 to December 16, 2005); *Nonlinear Dispersive Equations* (August 15 to December 16, 2005); *Rational and Integral Points on Higher-Dimensional Varieties* (January 9, 2006, to May 19, 2006); and *New Topological Structures in Physics* (January 9, 2006, to May 19, 2006). Some awards will be made in other areas, so applications from candidates in all fields are welcome.
**Eligibility:** For new and recent Ph.D.'s (Ph.D. earned in 2000 or later).

**Grant amount:** The stipend will be $4,000/month for 5 months for each semester program.
**Deadline:** Files must be complete by November 12, 2004.
**Application information:** Please complete online application form at: http://www.msri.org/applications/applying/.

## Mathematical Sciences Research Institute (MSRI)

*Research Professorships*

**Description:** The Institute will award about ten research professorships for stays of 3 months or more during 2005–06, when four half-year programs will be featured: *Nonlinear Elliptic Equations and Applications* (August 15 to December 16, 2005); *Nonlinear Dispersive Equations* (August 15 to December 16, 2005); *Rational and Integral Points on Higher-Dimensional Varieties* (January 9, 2006, to May 19, 2006); and *New Topological Structures in Physics* (January 9, 2006, to May 19, 2006). Some awards will be made in other areas, so applications from candidates in all fields are welcome.
**Eligibility:** For midcareer mathematicians (Ph.D. earned in 1999 or earlier).
**Grant amount:** The stipend will be limited to a ceiling of $25,000 (for 5 months) and normally will not exceed half the applicant's salary.
**Deadline:** Files must be complete by September 17, 2004.
**Application information:** Please complete online application form at: http://www.msri.org/applications/applying/.

## The Michigan Society of Fellows

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

**Description:** The Michigan Society of Fellows was founded in 1970 through grants from the Ford Foundation and Horace H. Rackham Graduate School for the purpose of promoting academic and creative excellence in the arts, sciences, and professions. The objective of the program is to support individuals selected for outstanding achievement, professional promise, and interdisciplinary interests. We invite applications from qualified candidates for three-year postdoctoral fellowships at the University of Michigan. Fellows are appointed as assistant professors/postdoctoral scholars with departmental affiliations. They spend the equivalent of one academic year teaching; the balance of time is devoted to their own scholarly research and creative work. Applications will be screened by faculty in relevant University of Michigan departments. Final selections will be made by the senior fellows of the society. New fellows will be selected for three-year terms beginning September 2005.
**Eligibility:** Candidates must have received the Ph.D. degree between June 1, 2002, and September 1, 2005.
**Grant amount:** The annual stipend will be $45,895.
**Deadline:** Completed applications due October 1, 2004.
**Application information:** Please see the application on our website or send requests for application materials to: Michigan Society of Fellows, 3572 Rackham Building, University of Michigan, 915 E. Washington St., Ann Arbor, MI 48109-1070; tel: 734-763-1259; email: society.of.fellows@umich.edu; Web: http://www.rackham.umich.edu/Faculty/society.html.

## Michigan State University

*MSU Postdoctoral Instructorships*

**Description:** Several two-year positions will be available beginning fall 2005 for new or recent Ph.D.'s who show strong promise in research and teaching. The teaching load is four semester courses per year, and participation in the research activities of the department is expected.
**Grant amount:** A starting salary of $41,000 per year. Additional income from summer teaching is usually available if desired.
**Deadline:** Completed applications (including letters of recommendation) received by November 15, 2004, are assured of consideration.
**Application information:** An applicant should send a vita as well as a brief statement of research interests and arrange for at least four letters of recommendation to be sent, one of which must specifically comment on the applicant's ability to teach. Application via email is strongly encouraged. To receive an electronic application and information, send an email to: jobs@math.msu.edu with the message "send application info". Application materials can also be mailed to The Hiring Committee, Department of Mathematics, Michigan State University, East Lansing, MI 48824-1027. Application should be made as soon as possible. Women and minorities are strongly encouraged to apply. MSU is an Affirmative Action/Equal Opportunity Institution.

## National Center for Atmospheric Research

*Advanced Study Program*

**Description:** Postdoctoral fellowships are offered for highly qualified atmospheric scientists and scientists from related disciplines who wish to continue basic research in the atmospheric sciences. Appointments are for a one-year period with a possible extension for an additional year.
**Eligibility:** For recent recipients of the Ph.D. with no more than 4 years' experience past their Ph.D.
**Grant amount:** Stipends are $45,000 and are adjusted annually in June.
**Deadline:** The application deadline is January 5, 2005.
**Application information:** Tel: 303-497-1601; email: barbm@ucar.edu; or Barbara Hansford, NCAR, ASP, P. O. Box 3000, Boulder, CO 80307-3000; fax: 303-497-1646.

## National Science Foundation

*Mathematical Sciences Postdoctoral Research Fellowships (with Research Instructorship Option)*

**Description:** The format of the 2005 Fellowship program has not been changed from that of 2004. The stipend

portion of the awards will consist of support for eighteen academic-year months or their equivalent and six summer months. Awardees have two options for academic year stipends, subject to the constraints that their academic-year support begin by October 1 of the award year and be configured in intervals no shorter than three consecutive months. An awardee may have full-time support for any eighteen academic-year months in a 3-year period (the Research Fellowship Option) or have a combination of full-time and half-time support over a period of three academic years, usually as one academic year full-time and two academic years half-time (the Research Instructorship Option). Summer month stipends are limited to two per calendar year.

**Grant amount:** Stipend amounts are $4,000 per full-time month and $2,000 per half-time month, plus institutional and special allowances, for a total award of $108,000 to be used within 48 months.

**Deadline:** Deadline for applications is October 15, 2004; applicants will be notified of decisions on or about March 1, 2005.

**Application information:** For further details write to the Mathematical Sciences Infrastructure Program, Division of Mathematical Sciences, Room 1025, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230; call 703-306-1870; send an inquiry to email: `msprf@nsf.gov`; or under "Postdoctoral Fellowships" at `http://www.fastlane.nsf.gov/`.

## National Security Agency

*Grants Program*

**Description:** Standard research proposals designed principally to provide summer salary for professors and limited support for their graduate students in areas of interest listed below. The National Security Agency (NSA) awards grants to universities in support of self-directed research in the following areas of the mathematical sciences (including possible computational aspects): algebra, number theory, discrete mathematics, probability, and statistics. The NSA also accepts proposals for small grants for conferences, workshops, and special academic endeavors.

**Deadline:** October 15 each year for all grant and conference proposals. Grants awarded from this funding can expect to incur expenses in the fall of the following year.

**Application information:** For further information about the program, please call 301-688-0400. All correspondence should be addressed to: Dr. Charles F. Osgood, Director, Mathematical Sciences Program, National Science Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557. Queries can also be made by email to `msp@math.umbc.edu`.

## National Security Agency

*Sabbatical Program*

**Description:** The National Security Agency (NSA) has a program supporting sabbaticals for academic mathematical scientists to visit the NSA, usually from 9 to 24 months.

**Eligibility:** American citizenship for the applicant and all immediate family members is required. Because a complete background investigation is required, applications should be submitted as soon as possible.

**Grant amount:** (Compensation) A supplement to the university's stipend to bring the visitor's salary up to his or her regular monthly salary and a choice of either an allowance for moving expenses or a housing supplement.

**Application information:** For further information on the sabbatical program, contact: Dr. Charles F. Osgood, Director, Mathematical Sciences Program, National Security Agency, Suite 6557, Ft. George G. Meade, MD 20755-6557; tel: 301-688-0400; email: `msp@math.umbc.edu`.

## Radcliffe Institute Fellowship Program

**Description:** The Radcliffe Institute for Advanced Study is a scholarly community where individuals pursue advanced work across a wide range of academic disciplines, professions, or creative arts. Within this broad purpose, and in recognition of Radcliffe's historic contributions to the education of women, the Radcliffe Institute sustains a continuing commitment to the study of women, gender, and society.

**Eligibility:** Radcliffe Institute Fellowships are designed to support scholars, scientists, artists, or writers of exceptional promise and demonstrated accomplishment who wish to pursue independent work in academic and professional fields and in the creative arts. Applications are judged on the quality and significance of the proposed project and on the applicant's record of accomplishment and promise. Women and men from across the United States and throughout the world, including developing countries, are encouraged to apply. Proposals are accepted from applicants in any field with the receipt of a doctorate or appropriate terminal degree at least two years prior to appointment or with comparable professional achievement in the area of the proposed project.

**Grant amount:** Stipends are funded up to $50,000 for one year, with additional funds for project expenses.

**Deadline:** Applications must be postmarked by December 1, 2004.

**Application information:** For more information visit `http://www.radcliffe.edu/`. Write, call, or e-mail for an application: Application Office, 34 Concord Avenue, Cambridge, MA 02138; tel: 617-496-3048; fax: 617-496-5299; or e-mail: `science@radcliffe.edu`.

## Rice University

*Griffith Conrad Evans Instructorships*

**Description:** Postdoctoral appointments for two to three years for promising research mathematicians with research interests in common with the active research areas at Rice. Rice University encourages applications from women and minority group members.

**Deadline:** Applications received by December 15, 2004, will receive thorough consideration.

**Application information:** Inquiries and applications should be addressed to: Chairman, Evans Committee, Department of Mathematics, Rice University, 6100 Main St.-MS 136, Houston, TX 77005.

## Sloan Foundation

*Research Fellowships*

**Description:** Unrestricted grants made to selected university scientists in chemistry, physics, mathematics, computer science, economics, neuroscience or computational and evolutionary molecular biology, or in a related interdisciplinary field. Candidates do not apply, but are nominated by their department chairmen or other senior scientists.

**Eligibility:** Candidates must be members of the regular (i.e., tenure-track) faculty, though not necessarily in a tenured position, at a recognized college or university in the United States or Canada.

**Deadline:** Nominations are due by September 15 for awards to begin the following September.

**Application information:** For information write to the Sloan Research Fellowships, Alfred P. Sloan Foundation, Suite 2550, 630 Fifth Ave., New York, NY 10111; email: `teitelbaum@sloan.org`; Web: `http://www.sloan.org/`.

## Trinity College

*Harold L. Dorwart Visiting Assistant Professorship*

**Description:** The Department of Mathematics solicits applications for the sixth Harold L. Dorwart Visiting Assistant Professorship. This three-year, nonrenewable position offers a competitive salary and monetary support for research-related travel. The normal teaching load is five semester courses per year ("3/2"), one of which is a research seminar to be taught with a senior member of the faculty.

**Eligibility:** We are seeking applicants with a Ph.D. in mathematics and a specialization in graph theory. Anticipated fields in future years include complex analysis and functional analysis.

**Deadline:** There is no closing date for applications; however, the department will begin to read applications in early December, and those completed by December 1, 2004, will be assured full consideration.

**Application information:** Please send a letter of application; curriculum vitae; a statement of teaching philosophy; and three letters of reference, one of which addresses teaching, to: Search Committee, Department of Mathematics, Trinity College, 300 Summit Street, Hartford, CT 06106. Be sure to include email contact information. Representatives of the Search Committee will be at the Joint Mathematics Meetings in Atlanta, Georgia, to participate in the Employment Center. Trinity College is an Affirmative Action/Equal Opportunity Employer. Women and members of minority groups are encouraged to apply. Applicants with disabilities should request in writing any needed accommodations in order to participate more fully in the application process.

## University of Michigan, Ann Arbor

*Assistant Professorships, VIGRE Assistant Professorships, and T. H. Hildebrandt Research Assistant Professorships*

**Description:** These positions for up to three years are designed to provide mathematicians with favorable circumstances for academic career development in research and teaching. Assistant professorships have a teaching responsibility of two courses per semester; the VIGRE and T. H. Hildebrandt positions have a responsibility of one course per semester. These positions may be combined with other postdoctoral fellowships, giving additional reductions in teaching responsibility.

**Eligibility:** Preference is given to candidates who receive the Ph.D. degree in 2003 or later and who submit a completed application by December 15, 2004.

**Grant amount:** Salary is competitive, and there are opportunities for supplemental summer salary.

**Application information:** An application form for these positions, along with a list of current tenured mathematics faculty, is available for download in *Microsoft Word* or *PDF* format. Please provide evidence of teaching excellence. This form may also be obtained by E-mail from `math-fac-search@umich.edu`; or by mail to: Hiring Committee, Department of Mathematics, University of Michigan, 2074 East Hall, 525 E. University, Ann Arbor, MI 48109-1109. The University of Michigan is an equal opportunity, affirmative action employer. Women and minorities are encouraged to apply. The University is responsive to the needs of dual career couples.

## University of Wisconsin-Madison

*Van Vleck Assistant Professorship*

**Description:** The Department of Mathematics invites applications for possible Van Vleck assistant professorships to begin on August 22, 2005. Appointments are for a fixed term of two or three years. The usual teaching load is two courses per semester.

**Eligibility:** Ordinarily only those applicants who have received their doctorates since 2002 will be considered. Promise of excellence in research and teaching is important. Preference will be given to candidates who are likely to interact well with other members of the department.

**Deadline:** The application deadline is December 15, 2004, although applications will continue to be considered until all available positions are filled.

**Application information:** Applicants should send a completed AMS Standard Cover Sheet, a curriculum vitae that includes a publication list, and a brief statement of research plans to: Hiring Committee, Dept. of Mathematics, Van Vleck Hall, University of Wisconsin-Madison, 480 Lincoln Drive, Madison, WI 53706-1388. Applicants should also arrange to have three or four letters of recommendation sent to the above address. At least one of these letters must discuss the applicant's teaching experience and capabilities. Other evidence of good teaching will be helpful. The University of

Wisconsin is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities.

### Yale University

*Josiah Willard Gibbs Instructorships/Assistant Professorships*

**Description:** Offered to men and women with the doctorate who show definite promise in research in pure mathematics. Applications from women and members of minority groups are welcome. Appointments are for two/three years. The teaching load is kept light to allow ample time for research. This will consist of 3 one-semester courses. Part of the teaching duties over the term of the appointment may consist of a one-semester course at the graduate level in the general area of the instructor's research.
**Grant amount:** The 2005–06 salary will be at least $56,500.
**Deadline:** January 1, 2005.
**Application information:** Applications are available at `http://www.math.yale.edu/`. Inquiries and application supporting documents should be sent to the Gibbs Committee, Department of Mathematics, Yale University, via email: `gibbs.committee@math.yale.edu`. Yale University is an Affirmative Action/Equal Opportunity Employer.

## Travel and Study Abroad

### Alexander von Humboldt Foundation

*Research Fellowships*

**Description:** The Humboldt Foundation grants up to 600 Humboldt Research Fellowships annually to highly qualified scholars under the age of 40 holding doctorates, enabling them to undertake long-term periods of research (6–12 months) in Germany. Applications are decided upon by a selection committee which is composed of eminent German scholars from all disciplines. Candidates' academic attainments are the only criterion for selection; there are no limitations in respect to specific countries or subjects.
**Eligibility:** Application requirements include high academic qualifications, academic publications, a specific research plan, and for humanities scholars a good command of the German language. As part of the Humboldt Research Fellowship Program, U.S. citizens and residents from all disciplines may also apply for these variations: Summer Research Fellowship for U.S. Scientists and Scholars (3 months per year in 3 consecutive years), `http://www.humboldt-foundation.de/en/programme/stip_aus/tshp2.htm`; 2-year Post-Doctoral Fellowship for U.S. Scientists and Scholars (24 consecutive months), `http://www.humboldt-foundation.de/en/programme/stip_aus/tshp1.htm`.
**Grant amount:** Monthly stipends range from 2,100 to 3,000 euros. Family allowances, travel expenses, and language courses are covered by the fellowship.
**Deadline:** Applications may be submitted at any time; however, the actual selection committees meet in March, July, and November. Applications should be submitted 5 months before the meeting at which the candidate wishes to be considered.
**Application information:** Interested scholars may contact the Alexander von Humboldt Foundation, Jean-Paul-Str. 12, D-53173 Bonn, Germany; tel: +49-228-833-0; fax: +49-228-833-212; email: `select@avh.de`; homepage: `http://www.humboldt-foundation.de`; or, U.S. Liaison Office, 1012–14th Street, NW, Suite 1015, Washington, DC 20005; tel: 202-783-1907; fax: 202-783-1908; email: `avh@verizon.net`.

### Fulbright Teacher & Administrator Exchange Program

**Description:** Sponsored by the United States Department of State, this program offers international exchange opportunities for two-year college faculty members and elementary and secondary school teachers and administrators. Currently the program conducts exchanges with over 30 countries in Eastern and Western Europe, Latin America, Africa, and Canada. (The list of countries is subject to change.) Most exchanges are for the full academic year; however, some are for a semester or six weeks. In most cases both the U.S. and international teacher remain on the payroll of their respective home institutions. The Fulbright Teacher & Administrator Exchange Program also offers six- to eight-week summer seminars in Italy and Greece which are open to four-year and two-year college faculty and teachers (grades 9–12) of Latin, Greek, and the Classics.
**Eligibility:** Eligibility requirements are U.S. citizenship, fluency in English, a bachelor's degree or higher, three years' full-time teaching/administrative experience, a current full-time teaching/administrative position, approval of school administration, and no participation in a Fulbright Program longer than eight weeks in the last two years. In addition to the general eligibility requirements, each applicant must meet the specific subject, level, and language fluency requirements for the countries to which he/she applies; these requirements are detailed in the application booklet.
**Deadline:** The application deadline is October 15 for the following year's program.
**Application information:** The application booklet should be requested from the Fulbright Teacher Exchange Program, 600 Maryland Ave., SW, Room 320, Washington, DC 20024-2520; tel: 800-726-0479.

### Marshall Scholarships

**Description:** Marshall Scholarships finance young Americans of high ability to study for a degree in the United Kingdom. The scholarships are tenable at any British university and cover two years of study in any discipline, at either undergraduate or graduate level, leading to the award of a British university degree.
**Eligibility:** Open only to United States citizens who (by the time they take up their scholarship) hold a first degree from an accredited four-year college or university

in the United States with a minimum GPA of 3.7. To qualify for awards tenable from October 2005, candidates must have graduated from their undergraduate college or university after April 2002 (although this restriction may be waived in the case of those wishing to read business studies or an allied subject). N.B. Persons already studying for or holding a British degree or degree-equivalent qualification are **not** eligible to apply for a Marshall Scholarship.

**Deadline:** October 1, 2004 (although some universities might have earlier internal application deadlines), to commence the following September.

**Application information:** The application process is all online, interested parties should visit: `http://www.marshallscholarship.org`. For further information please contact your local British Consulate General: Atlanta, 404-954-7708; Boston, 617-245-4513; Chicago, 312-346-1810; Houston, 713-659-6270; Los Angeles, 310-996-3028; New York, 212-745-0252; San Francisco, 415-617-1300; Washington, DC, 202-588-7854.

### U.S. Department of State Fulbright U.S. Student Program

*Fulbright and Related Grants for Graduate Study, Research, and Teaching Assistantships Abroad*

**Description:** For graduate study or research in any field in which the project can be profitably undertaken abroad. If an applicant is already enrolled in a U.S. university, he must apply directly to the Fulbright Program adviser on his campus. Unenrolled students may apply to the Institute of International Education.

**Eligibility:** Applicant must be a U.S. citizen, hold a B.A. degree or the equivalent, and have language proficiency sufficient to carry out the proposed study and to communicate with the host country.

**Deadline:** Application deadline is October 21.

**Application information:** Further details may be obtained from the U.S. Department of State Fulbright U.S. Student Program, U.S. Student Programs Division, Institute of International Education, 809 United Nations Plaza, New York, NY 10017; tel: 212-984-5330; website: `http://www.iie.org.fulbright/us`.

### Winston Churchill Foundation of the United States

**Description:** A scholarship program for graduate work in engineering, mathematics, and science at Churchill College, Cambridge University.

**Grant amount:** Tuition and living allowance worth approximately $29,000, depending upon course of study.

**Application information:** Application forms are available from representatives on campuses of colleges and universities participating in the program. For further information write to the Winston Churchill Foundation, P. O. Box 1240, Gracie Station, New York, NY 10028; or see foundation homepage, `http://www.thechurchillscholarships.com/`.

## Study in the U.S. for Foreign Nationals

### American Association of University Women (AAUW) Educational Foundation

*International Fellowships*

**Description:** These are awarded to women of outstanding academic ability who are not citizens or permanent residents of the U.S. for full-time graduate or postgraduate study in the U.S. Six of the 57 awards are available to members of the International Federation of University Women to study in any country other than their own. Upon completion of studies, fellowship recipients are expected to return to their home countries to pursue professional careers. Previous and current recipients of AAUW fellowships are not eligible.

**Eligibility:** Applicants must hold the equivalent of a U.S. bachelor's degree by December 31.

**Grant amount:** The fellowships provide $18,000 for master's/first professional degree, $20,000 for predoctoral study, and $30,000 for postdoctoral study.

**Deadline:** The deadline is December 15 (postmark deadline). *If an application postmark deadline falls on a weekend or holiday, applications may be postmarked the next business day.

**Application information:** For more information contact: AAUW Educational Foundation, P.O. Box 4030, Iowa City, IA 52243-4030; tel: 319-337-1716; fax: 319-337-1204.

### Kennedy Scholarships

**Description:** These grants are for postgraduate study at Harvard University or the Massachusetts Institute of Technology.

**Eligibility:** For citizens of the United Kingdom.

**Deadline:** Application deadline is October 22, 2004.

**Application information:** Write to Secretary, Kennedy Memorial Trust, 3 Birdcage Walk, Westminster, London SWIH 9JJ, England.

## Sources of Fellowship Information

### Financial Aid for Minorities in Engineering and Science

Financial assistance, scholarship and fellowship programs, resources for further information (1999); Garrett Park Press, P. O. Box 190, Garrett Park, MD 20896. $5.95 + $1.50 shipping.

### Pathways to Career Success for Minorities

(2000, 378 pages), Garrett Park Press, Garrett Park, MD 20896. $29.95 plus $3 shipping. Tel: 301-946-2863; fax: 301-949-3955.

SPECIAL SECTION

*American Mathematical Society*

# Election of Officers for 2005

## CONTENTS

# 2004 AMS Elections—Special Section

You should have received either a traditional paper ballot or email with instructions for voting online by September 20. If you have not received this information, please contact the AMS (preferably before October 1) to request a ballot. Send email to `ballot@ams.org` or call the AMS at 800-321-4267 (within the U.S. and Canada) or 401-455-4000 (worldwide) and ask to speak with Member Services.

Dear Colleagues:

Once again members of the Society are invited to vote for candidates for several of the Society's governing bodies. This year, for the second time, AMS members will have the opportunity to vote either electronically or by paper ballot. The online voting option first made available in 2003 boosted the vote count by almost 50%.

The candidates for election and their biographies are presented in the September 2004 issue of the *Notices*. This information and the official ballot will be available to you in early September. Consult the "From the AMS" section of the October 2003 or 2004 *Notices* for lists of (relatively) current office holders. The choices you make in these elections directly affect the direction that the Society takes. How this happens may not be obvious to the casual member, so let me take a few lines to explain.

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

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

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

The Editorial Boards Committee is responsible, as you might suspect, for the staffing of the editorial boards of the Society. Members are elected for three-year terms from a list of candidates named by the president. The Editorial Boards Committee makes recommendations for almost all editorial boards of the Society. Chief or managing editors of eight specific journals named in the AMS bylaws are officially appointed by the Council, upon recommendation of the Editorial Boards Committee; in virtually all other cases, the editors are appointed by the president, again upon recommendation by the Editorial Boards Committee.

Elections to the Nominating Committee and the Editorial Boards Committee are conducted by the method of approval voting. In the approval voting method, you can vote for as many or as few of the candidates as you wish. The candidates with the greatest number of the votes win the election.

It is suggested that names for write-in votes be given in exactly the form that the name occurs in the *Combined Membership List* (available online at `www.ams.org/cml`). Otherwise the identity of the individual for whom the vote is cast may be in doubt and the vote may not be properly credited.

As an aside, if you inadvertently spoil your ballot, you may return it to the Secretary, AMS, 201 Charles Street, Providence, RI 02904-2294, USA, and request a new ballot. The September 2004 it *Notices* contains instructions about replacement ballots.

If the past election serves as a reliable measure, about 17 percent of you will vote in the coming election, which is comparable with voter participation in other professional organizations which allow an online voting option. This is not mentioned as encouragement for you to throw the ballot in the trash; instead, the other officers and Council members join me in urging you to take a few minutes to review the election material, fill out your ballot, and submit it by some means, either by regular mail or electronically. The Society belongs to its members. You can influence the policy and direction it takes by voting.

Finally, let me urge anyone still reading to consider

other ways of participating in Society activities. The Nominating Committee, the Editorial Boards Committee, and the Committee on Committees are always interested in learning of members who are willing to serve the Society in various capacities. Names are always welcome, particularly when accompanied by a few words detailing the person's background and interests. Self-nominations are probably the most useful. Recommendations can be transmitted from the Web (`http://www.ams.org/committee-nominate`, also linked from the AMS website home page via the Secretary's page) or sent directly to the secretary (`secretary@ams.org`), who will forward them to the cognizant body.

PLEASE VOTE.

*—Robert J. Daverman*
*Secretary*

## List of Candidates–2004 Election

**Vice President**
*(one to be elected)*
Haïm Brezis
Fan Chung Graham

**Board of Trustees**
*(one to be elected)*
Eric M. Friedlander
Philippe M. Tondeur

**Member at Large of the Council**
*(five to be elected)*
Sara C. Billey
Christian H. Borgs
Carolyn S. Gordon
Sheldon H. Katz
Felix Lazebnik
Rafe Mazzeo
Henri Moscovici
Michael F. Singer
Catherine H. Yan

**Nominating Committee for 2005**
*(three to be elected)*
Karen L. Collins
Robin Forman
Phillip A. Griffith
David Jerison
Linda Keen
Robert E. Megginson

**Editorial Boards Committee for 2005**
*(two to be elected)*
Margaret Cheney
Fritz Gesztesy
Kailash C. Misra
Abigail A. Thompson

### Election Information

The ballot for election of officers, members of the Council, a trustee, and committee members will be available, either online or by mail, on or shortly after August 23, 2004, in order for members to have the opportunity to vote well in advance of the November 5, 2004, deadline. A list of members of the Council and Board of Trustees serving terms during 2004 will appear in the "AMS Officers and Committee Members" section of the October issue of the *Notices*.

### Replacement Ballots

For those who wish to vote by paper ballot, the following replacement procedure has been devised: A member who has not received a ballot by October 1, 2004, or who has received a ballot but has accidentally spoiled it may write after that date to the Secretary of the AMS, 201 Charles St., Providence, RI 02904-2294, USA, asking for a second ballot. The request should include the individual's member code and the address to which the replacement ballot should be sent. Immediately upon receipt of the request in the Providence office, a second ballot, which will be indistinguishable from the original, will be sent by first class or airmail. Although a second ballot will be supplied on request and will be sent by first class or airmail, the deadline for receipt of ballots cannot be extended to accommodate these special cases.

### Suggestions for 2005 Nominations

Each year the members of the Society are given the opportunity to propose for nomination the names of those individuals they deem both qualified and responsive to their views and needs as part of the mathematical community. Candidates will be nominated by the Council to fill positions on the Council and Board of Trustees to replace those whose terms expire January 31, 2006. See the "AMS Officers and Committee Members" section of the October issue for the list of current members of the Council and Board of Trustees. Members are requested to write their suggestions for such candidates in the appropriate spaces below.

COUNCIL AND BOARD OF TRUSTEES

Vice President *(1)*

_____

Members at Large of the Council *(5)*

_____

_____

_____

_____

_____

Member of the Board of Trustees *(1)*

_____

The completed form should be addressed to AMS Nominating Committee, Office of the Secretary, American Mathematical Society, 312D Ayres Hall, University of Tennessee, Knoxville, TN 37996-1330, to arrive no later than **November 5, 2004.**

# Biographies of Candidates 2004

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

Candidates have had the opportunity to supply a photograph to accompany their biographical information.

Candidates with an asterisk (*) beside their names were nominated in response to a petition.

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

## Vice President

**Haïm Brezis**

*Professor, Université Paris VI and Institut Universitaire de France.*

**Born:** June 1, 1944, Riom-es-Montagnes, France.

**Ph.D.:** University of Paris, 1971.

**AMS Offices:** Member at Large of the Council, 1999–2001.

**AMS Committees:** Committee on Human Rights, 1999–2001; Committee on the Profession, 1999–2001.

**Selected Addresses:** AMS Invited Address, Progress in Mathematics, Boulder, 1989; AMS-MAA Invited Address, Baltimore, 1998; "Mathematical Challenges of the 21st Century", AMS Celebration of the Year 2000, Los Angeles, 2000; Louis de Broglie lecture, Accademia dei Lincei, Rome, 1996; Euler Vorlesung, Berlin, 1997.

**Additional Information:** Member, Academie des Sciences, Paris, 1988 and Academia Europaea, 1989; Foreign Member, Romanian Academy, 1993, American Academy of Arts and Sciences, 1994, Royal Academy of Sciences, Madrid, 2000, Royal Academy of Belgium, 2002, National Academy of Sciences USA, 2004; Doctor Honoris Causa, Catholic University of Louvain, Belgium, 1996; Technion, Haifa, Israel, 1998; Universidad Autónoma, Madrid, 2001; University of Bucharest, 2001; University of Leiden, Netherlands, 2001. Honorary Professor, Academia Sinica Beijing, 1999, and Fudan University, Shanghai, 1999. Visiting Distinguished Professor, Rutgers University, since 1988. Chief-Editor, *J. European Mathematical Society*, since 2003.

**Selected Publications:** 1. *Opérateurs Maximaux Monotones et Semi-groupes de Contractions dans les Espaces de Hilbert*, North-Holland Mathematics Studies, no. 5, North-Holland Publishing Co., Amsterdam-London; American Elsevier Publishing Co. Inc., New York, 1973. MR **50:**1060; 2. with F. Bethuel and F. Hélein, *Ginzburg-Landau Vortices*, Progress in Nonlinear Differential Equations and Their Applications, vol. 13, Birkhäuser Boston, 1994. MR **95c:**58044; 3. with Y. Li, Topology and Sobolev spaces, *J. Funct. Anal.* **183** (2001), 321-369. MR **2002h:**58009; 4. The interplay between analysis and topology in some nonlinear PDEs, Lecture at the AMS meeting "Mathematical Challenges of the 21st Century", Los Angeles (2000), *Bull. Amer. Math. Soc. (N. S.)* **40** (2003), 179–201. MR **2004a:**35038; 5. with J. Bourgain and P. Mironescu, $H^{1/2}$ maps into the circle: Minimal connections, lifting, and the Ginzburg-Landau equation, Publications mathematiques de l'IHES, to appear.

**Statement:** It is vital to see more talented young people from all countries and all genders entering the field of mathematics. In France I have been very concerned with mathematical education, have supervised over 50 PhD students and stimulated postdocs coming from many countries (Brazil, Chile, China, India, Israel, Italy, Japan, Netherlands, Spain, Tunisia, etc.).

I believe that I am in a position where I can promote stronger links between Europe and the USA, as a frequent visitor in American universities and strongly involved with numerous European mathematical initiatives. I am aware of the political context in which mathematical research and education takes place in Europe and in the USA.

My own work lies at the interface between pure and applied mathematics. Some of the most fruitful developments in modern mathematics have been motivated by problems coming from the real world. I would like to share my experience in this direction and promote the image of a mathematician open to other sciences.

**Fan Chung Graham**

*Professor of Mathematics, University of California, San Diego.*

**Born:** October 9, 1949, Taiwan, R. O. C.

**Ph.D.:** University of Pennsylvania, 1974.

**AMS Committees:** Member of Council, 1989–1991; Conference Board on Mathematics Sciences, 1989–1992, 2001–2002; AMS-SIAM-IMS Joint Summer Research Conference Committee, 1991–1993; Editorial Board Committee, 1993–1996 (chair, 1994); Committee on Committees, 1995–1996; National Award and Public Representation, 2000–2002; Fan Fund Committee, 2000–2003; Morgan Prize Committee, 2001–2004.

**Selected Addresses:** AMS/MAA Invited Address, Orono, Maine, 1991; AMS Invited Address, Washington, DC, 1993; ICM Invited Address, Zurich, 1994; CBMS Lectures on Spectral Graph Theory, Fresno, CA, 1994; CBMS Lectures on the Combinatorics of Large Sparse Graphs, San Marcos, CA, 2004.

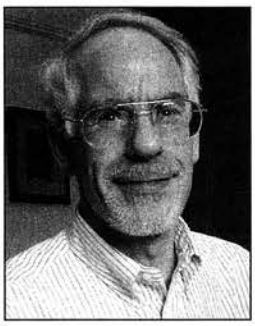
**Additional Information:** Allendoerfer Award, 1990; Board of Mathematical Sciences, National Research Council, 1995–1999; Member, American Academy of Arts and Sciences, 1998; Co-Editor-in-Chief, *Electronic Journal of Combinatorics*, 2000–2003; Co-Editor-in-Chief, *Advances in Applied Mathematics*, 2000–2004; Editor-in-Chief, *Internet Mathematics*, 2003–; Editorial boards of 12 other journals.

**Selected Publications:** 1. Diameters and eigenvalues, *J. Amer. Math. Soc.* **2** (1989), 187–196. MR **89k:**05070; 2. with R. L. Graham, Sparse quasi-random graphs, *Combinatorica* **22** (2002), 217–244. MR **2003d:**05110; 3. with L. Lu, The average distance in random graphs with given expected degrees, *Proc. Nat. Acad. Sci. USA* **99**, no. 25 (2002), 15879–15882. MR **2003k:**05124; 4. with L. Lu and V. Vu, Eigenvalues of random power law graphs, *Ann. Comb.* **7** (2003), 21–33; 5. with L. Lu and V. Vu, Spectra of random graphs with given expected degrees, *Proc. Nat. Acad. Sci. USA* **100**, no. 11 (2003), 6313–6318. MR **2004e:**05175.

**Statement:** We are today in the midst of technological revolution. Mathematics will play a vital role both in laying the foundation for this process and in making crucial contributions throughout the whole spectrum of this development. The AMS, as the major organization for fostering mathematics research, has a special responsibility to maximize the impact of mathematicians and to attact the best talent, including, in particular, women and minorities.

## Trustee

**Eric M. Friedlander**



*Henry S. Noyes Professor of Mathematics, Northwestern University.*

**Born:** January 7, 1944, Santurce, Puerto Rico.

**Ph.D.:** Massachusetts Institute of Technology, 1970.

**AMS Offices:** Board of Trustees of the AMS, 2000–.

**AMS Committees:** Committee on Summer Institutes and Special Symposia, 1985–1987; Committee on the Publication Program, 1989–1992; Committee on Science Policy, 1991–1993, 2000–; Editorial Committee of the *Bulletin of the AMS*, 1994–; Nominating Committee, 1995–1998; Editorial Committee of the AMS University Lecture Series, 2003–.

**Selected Addresses:** Invited Address, AMS sectional meeting, Columbia (Missouri), 1985; Surrogate Plenary Lecture for Andrei Suslin, International Congress of Mathematicians, Berkeley, 1986; Invited Speaker, International Congress of Mathematicians, Berlin, 1998; Plenary Address, AMS-SMM, Morelia, 2001; Plenary Address, AMS-Spain Congress, Seville, 2003.

**Additional Information:** Chair, Department of Mathematics, Northwestern University, 1987–1990, 1999–2003; Associate Dean for Science, Northwestern University, 1995–1998. *Awards:* Zabrodsky Memorial Lecturer, Jerusalem 1992; Visiting Distinguished Professor, Brown University 1994; Humboldt Prize, Heidelberg 1996–1997. *Visiting Positions:* IAS, MSRI, IHES, ETH-Zurich, University of Paris VII, MPI-Bonn, Institut Henri Poincaré, Oxford University, Cambridge University. *Editorial Committees: American Journal, Bulletin of the AMS, Journal of Pure and Applied Algebra* (co-managing editor), *K-Theory*, Oxford Mathematical Monographs, University Lecture Series of AMS.

**Selected Publications:** 1. with H. B. Lawson, Moving algebraic cycles of bounded degree, *Invent. Math.* **132** (1998), 91–119. MR **99k:**14011; 2. with V. Franjou, A. Scorichenko, and A. Suslin, General linear and functor cohomology over finite fields, *Ann. of Math.* **150** (1999), 663–728. MR **2001b:**14076; 3. with V. Voevodsky, Bivariant cycle cohomology, in *Cycles, Transfers, and Motivic Homology Theories*, Ann. of Math. Stud., vol. 143, Princeton University Press, 2000, pp. 138–187; 4. with M. Walker, Rational isomorphisms between $K$-theories and cohomology theories, *Invent. Math.* **154** (2003), 1–61; 5. with J. Pevtsova, Representation-theoretic support spaces for finite group schemes, to appear in the *American Journal.*

**Statement:** The AMS contributes a great deal to the mathematical community. Its primary focus has always been to foster research mathematics, and over the years this has been constructively interpreted quite broadly. Activities of

the AMS further the dissemination of mathematics through various publications, the generation of mathematics through meetings and conferences, and the funding of mathematics through its visible presence in Washington. In addition, the AMS encourages mathematics through efforts to promote diversity of both the research community and the students we serve, through efforts to constructively influence mathematical education, and through prizes which recognize outstanding contributions. The excellent professional leadership of the AMS has greatly solidified the financial status of the society during this period of expanding activities.

As a member of the Board of Trustees, I have nudged the AMS towards further efforts at recognition of excellence and I have raised concerns facing mathematics as an activity that knows no bounds of nationality or personal differences. I have also scrutinized AMS finances in order to try to relieve members of cost increases without jeopardizing the long-term health of the society. I would be honored to continue to serve the mathematical community as a member of the Board of Trustees with the goal of promoting mathematics and its role in the world at large.

**Philippe Tondeur**

*Professor of Mathematics, University of Illinois at Urbana-Champaign.*

**Born:** December 7, 1932, Zurich, Switzerland.

**Ph.D.:** University of Zurich, 1961.

**AMS Committees:** Committee on National Awards and Public Representation, 2004–2006.

**Selected Addresses:** Invited AMS Hour Lecture, Ann Arbor, 1976; Invited Lecture Series, ETH, 1978; Invited Lecture Series, Yale University, 1983; Invited Lecture Series, University of Rome, 1984; Argonne Distinguished Lecture Series, Emory University, 1987. Approximately 200 invited lectures in 22 countries.

**Additional Information:** Research Fellow, Lecturer, and Associate Professor at the University of Paris, Harvard University, the University of California at Berkeley and Wesleyan University, before joining the UIUC faculty in 1968. Full Professor in 1970. Held visiting positions at the Universities of Buenos Aires, Auckland, Heidelberg, Rome, Santiago de Compostela, Leuven, the Eidgenoessische Technische Hochschule in Zurich, the Ecole Polytechnique in Paris, the Max Planck Institute for Mathematics in Bonn, and Keio University in Tokyo. Was appointed twice as Associate Member in the Center for Advanced Study of the UIUC. Editor (1986–1990) and Managing Editor (1990–1994) of the *Illinois Journal of Mathematics.* Chair of the Department of Mathematics at UIUC, 1996–1999. Director of the Division of Mathematical Sciences at the National Science Foundation, 1999–2002. Recipient of a UIUC Award of Excellence in Undergraduate Teaching in 1994. Organizer of the 1995 PI Summer School at UIUC of the Institute for Mathematics and its Applications at the University of Minnesota (IMA). Recipient of a Public Service Award from the Society of Industrial and Applied Mathematics (SIAM) in 2002. Currently a member of the Board of Governors of the IMA, the National Advisory Council of the Statistical and Applied Mathematical Sciences Institute at the Research Triangle Park, North Carolina, the U.S. National Committee on Mathematics of the National Research Council, the Science Policy Committee of the MAA, the Committee on Science Policy of SIAM. Member: AAAS, AMS, EMS, MAA, SIAM, SMF, SMG. Served on numerous department, college, campus, and national organization committees.

**Selected Publications:** 1. with F. Kamber, On flat bundles, *Bull. Amer. Math. Soc.* **72** (1966), 846–849. MR **33**:6631; 2. with F. Kamber, *Flat Manifolds*, Lecture Notes in Mathematics, vol. 67, Springer-Verlag, Berlin-New York, 1968. MR **38**:6618; 3. with F. Kamber, Homomorphisme caractéristique d'un fibré principal feuilleté, *C. R. Acad. Sci. Paris Ser. A-B* **276** (1973), A1407–A1410. MR **47**:9662; 4. with F. Kamber, de Rham-Hodge theory for Riemannian foliations, *Math. Ann.* **277** (1987), 415–431. MR **89d**:53070; 5. with S. Nishikawa and M. Ramachandran, Heat conduction for Riemannian foliations, *Bull. Amer. Math. Soc. (N. S.)* **21** (1989), 265–267. MR **90i**:58189.

**Statement:** The AMS is a membership organization dedicated to the advancement of research and scholarship in mathematics. I consider this to include research at all frontiers of the discipline, as well as the interplay with other disciplines where mathematical thinking has proved or promises to be effective. As Trustee, I would feel responsible for the intellectual and financial integrity of the AMS in this mission. I would draw on my experiences in research, teaching, professional and public service, as well as my active interest in science education, science policy, governance and leadership development to serve the AMS.

## Member at Large of the Council

**Sara C. Billey**

*Associate Professor of Mathematics, University of Washington.*

**Born:** February 6, 1968, Oklahoma.

**Ph.D.:** University of California, San Diego, 1994.

**Selected Addresses:** Seminars at Northeastern, University of Wisconsin, University of Michigan, Brandeis, MIT, and Cornell in 2001; AMS Invited Address, Special Session on The Theory and Applications of Symmetric Functions, San Diego, January 2002; Formal Power Series and Algebraic Combinatorics (FPSAC), June 2004; Fall Western Section Meeting, Albuquerque, October 2004.

**Additional Information:** National Physical Science Consortium Fellow, 1990–1994; National Science Foundation Postdoctoral Fellowship in Mathematics, 1994–1998; University of California, Presidential Postdoctoral Fellowship, 1995–1997; Presidential Early Career Award for Scientists and Engineers, October 2000; Editor for *Advances in Math.*

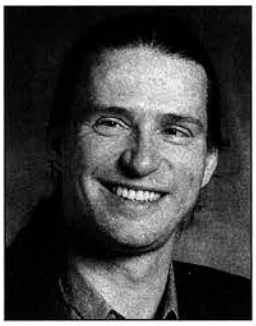
**Selected Publications:** 1. with M. Haiman, Schubert polynomials for the classical groups, *J. Amer. Math. Soc.* **8**, no. 2 (1995), 443–482. MR **98e:**05109; 2. Pattern avoidance and rational smoothness of Schubert varieties, *Adv. Math.* **139** (1998), 141–156. MR **99i:**14058; 3. Kostant polynomials and the cohomology ring for $G/B$, *Duke Math. J.* **96**, no. 1 (1999), 205–224. MR **2000a:**14060; 4. with G. Warrington, Maximal singular loci of Schubert varieties in $SL(n)/B$, *Trans. Amer. Math. Soc.* **355** (2003), 3915–3945. 5. with V. Guillemin and E. Rassart, A vector partition function for the multiplicities of $sl_k(C)$, to appear in *J. Algebra.*

**Statement:** As mathematicians, our work encompasses many tasks including research, teaching, mentoring, and connecting to other scientific pursuits. One of my greatest pleasures with this job is sharing the joy understanding mathematics with others, both the philomaths and mathophobes. I do this through teaching, mentoring graduate students and undergraduates in research, and several outreach events including F.A.S.T. at the MIT Museum and Mathday at the University of Washington.

The AMS plays a critical role in the life of our community by working with the government and private sector to obtain funding, disseminate publications, identify jobs for recent graduates, and reward achievements. The success of this role is inherently related to improving the image of mathematics in our society. By working with the AMS, I hope to extend my outreach efforts beyond my local community and contribute to the increasing appreciation of mathematics in our country.

Younger mathematicians face new challenges today than they did thirty years ago. We have been through many difficult years with a slow job market. As a member of the Council, I would be an advocate for recent graduates and work to find better ways to connect mathematicians with job opportunities both inside and outside of academia.

**Christian H. Borgs**



*Senior Researcher, Microsoft Research and Professor of Mathematics, University of Washington, Seattle.*

**Born:** April 12, 1957, Düsseldorf, Germany.

**Ph.D.:** University of Munich, 1987.

**Selected Addresses:** Paul Erdős Lecturer, Memphis, 2001; Invited session speaker, Joint Mathematics Meetings, San Antonio, 2002; Principal Lecturer, Conference Board in Mathematical Science Lecture Series, Memphis, 2003; Invited session speaker, Joint Mathematics Meetings, Baltimore, 2003; Session organizer and invited speaker, AAAS Annual Meeting, Seattle, 2004.

**Additional Information:** Postdoctoral Fellow, ETH Zurich, 1986–1989; Assistant Professor, Free University, Berlin, 1989–1993; Habilitation, Free University, Berlin, 1993; Recipient of the Karl-Scheel Prize, 1993; Heisenberg Fellow, 1993–1995; Member, Institute for Advanced Study, 1994–1995 and Winter 1997; Professor of Mathematical Physics, University of Leipzig, 1995–1997; University Council, University of Leipzig, 1996–1997; Cofounder and Co-Head, Theory Group, Microsoft Research, 1997–; Member, Board of Trustees, Institute for Pure and Applied Mathematics, 1999–.

**Selected Publications:** 1. with E. Seiler, Lattice Yang-Mills theory at nonzero temperature and the confinement problem, *Comm. Math. Phys.* **91** (1983), 329–380. MR **85k:**81147; 2. with R. Kotecký and D. Ueltschi, Low temperature phase diagrams for quantum perturbations of classical spin systems, *Comm. Math. Phys.* **181** (1996), 409–446. MR **97j:**82024; 3. with J. T. Chayes, H. Kesten, and J. Spencer, The birth of the infinite cluster: Finite-size scaling in percolation, *Comm. Math. Phys.* **224** (2001), 153–204. MR **2002k:**60199; 4. with B. Bollobás, J. T. Chayes, J. H. Kim, and D. Wilson, The scaling window of the 2-SAT transition, *Random Structures Algorithms* **18** (2001), 201–256. MR **2002a:**68052; 5. with J. T. Chayes and B. Pittel, Phase transition and finite-size scaling for the integer partitioning problem, *Random Structures Algorithms* **19** (2001), 247–288. MR **2002j:**90061.

**Statement:** Mathematics is in a period of tremendous growth, fueled both by breakthroughs in core areas and by interactions with more applied disciplines. It is the role of the AMS to support core mathematical research, to lead the way in building interdisciplinary bridges, and to recognize and foster the interplay between pure and applied sciences. In particular, the AMS should continue to partner with other professional societies to increase support for all scientific research endeavors, for education of future scientists, and for outreach to the general public. The AMS should continue to represent all mathematicians. In particular, it should actively encourage the participation of women and under-represented minorities. It should also continue to support immigration policies which allow students and more senior mathematicians of all nationalities to visit universities and research institutes in the United States.

As an interdisciplinary mathematician with experience in both academia and industry, both in the U.S. and abroad, I would be delighted to have the opportunity to serve on the AMS Council.

**Carolyn S. Gordon**

*Benjamin Cheney Professor of Mathematics, Dartmouth College.*

**Born:** December 26, 1950, Charleston, West Virginia, USA.

**AMS Committees:** Central Section Programming Committee, 1990–1992; *Notices* Editorial Committee, 1991–1994; *Forum* Editor, 1991–1993; Editorial Boards Committee, 1994–1997; National Programming Committee, 1996–1998; Joint AMS-MAA Programming Committee, chair, 1997.

**Selected Addresses:** AMS Invited Address, Lincoln, October 1987; AMS Invited Address, San Antonio, January

1993; AMS-MAA Invited Address, Providence, 1999; MAA Invited Address, Burlington, June 2001.

**Additional Information:** AMS Centennial Research Fellowship, 1990; AWM Executive Committee, 1994–1998; Chauvenet Prize (with David Webb), 2001; AWM President, 2003–.

**Selected Publications:** 1. with R. Brooks, Isospectral families of conformally equivalent Riemannian metrics, *Bull. Amer. Math. Soc. (N. S.)* **23** (1990), 433–436. MR **91a:**58188; 2. with D. Webb and S. Wolpert, One cannot hear the shape of a drum, *Bull. Amer. Math. Soc.(N. S.)* **27** (1992), 134–138. MR **92j:**58111; 3. with D. Webb and S. Wolpert, Isospectral plane domains and surfaces via Riemannian orbifolds, *Invent. Math.* **110** (1992), 1–22. MR **93h:**58172; 4. Isospectral deformations of metrics on spheres, *Invent. Math.* **145** (2001), 317–331. MR **2003d:**58052; 5. with P. Perry, Continuous families of isophasal scattering manifolds, preprint.

**Statement:** The AMS plays essential roles both in promoting the research of the mathematical community and in advocating for federal support of mathematical research. Two important aspects of promoting the long-term health of the profession are: strengthening the full participation and visibility of women and minorities at all levels and educating the public about the vitality of mathematics. Expanded public outreach can both encourage young students to pursue mathematics and enhance the public support for mathematics.

**Sheldon H. Katz**

*Professor of Mathematics and Physics, University of Illinois at Urbana-Champaign.*

**Born:** December 19, 1956, Brooklyn, New York, USA.

**Ph.D.:** Princeton University, 1980.

**AMS Committees:** Committee on the Profession, 2000–2003; AMS Council Subcommittee on Fellows, 2002–2003; AMS Fellows Program Subcommittee, 2003–2004.

**Selected Addresses:** Seven AMS Special Sessions, 1986–1994; AMS Summer Institute on Algebraic Geometry (2 lectures), Santa Cruz, 1995; Harvard-MIT-Brandeis-Northeastern Colloquium, Cambridge, 1997; AMS Invited Address, Chicago, 1998; IAS/Park City Mathematics Institute (15 lectures), Park City, 2001.

**Additional Information:** Visiting Positions: IAS, 1982–1983, University of Bayreuth, 1989, Duke University, 1991–1992, Mittag-Leffler Institute, 1997; Editorial Boards: *Pacific Journal of Mathematics*, 1995–1999, *Advances in Theoretical and Mathematical Physics*, 2003–; Honors: Southwestern Bell Professor, Oklahoma State University, 1997–1999, Regents Professor, Oklahoma State University, 1999–2002.

**Selected Publications:** 1. with D. R. Morrison, Gorenstein threefold singularities with small resolutions via invariant theory for Weyl groups, *J. Algebraic Geom.* **1** (1992), 449–530. MR **93b:**14030; 2. with P. Candelas, X. de la Ossa, A. Font, and D. R. Morrison, Mirror symmetry for two parameter models. I, *Nuclear Phys. B* **416** (1994), 481–538. MR **95k:**32020; 3. with C. Vafa, Matter from geometry, *Nuclear Phys. B* **497** (1997), 146–154. MR **98i:**81209; 4. with A. Klemm and C. Vafa, Geometric engineering of quantum field theories, *Nuclear Phys. B* **497** (1997), 173–195. MR **98h:**81097; 5. with D. A. Cox, *Mirror Symmetry and Algebraic Geometry*, Mathematical Surveys and Monographs, vol. 68, Amer. Math. Soc., Providence, RI, 1999. MR **2000d:**14048.

**Statement:** The AMS does important work to promote mathematics and mathematicians. I would consider it a privilege to serve on the AMS Council and help in this effort on behalf of our profession. I am especially interested in bolstering the long-term health of the research enterprise, including encouraging excellent research, encouraging young mathematicians, and promoting mathematics both in and out of academic institutions.

**Felix Lazebnik**

*Professor of Mathematics, University of Delaware.*

**Born:** April 30, 1953, Kiev, USSR.

**Ph.D.:** University of Pennsylvania, 1987.

**Selected Addresses:** DIMACS Workshop on Expanding Graphs and Applications, Princeton University, Princeton, NJ, May 1992; MSRI, Conference on Extremal Combinatorics, Berkeley, November 1996; International Conference on Extremal Graph Theory, Balatonlelle, Hungary, July 1997; DIMACS Mathematics Series, AT&T, Shannon Laboratory, Florham Park, NJ, October 2000; AMS Special Section on Extremal Combinatorics, University of Indiana, Bloomington, Indiana, April 2003.

**Additional Information:** High school teacher, 1975–1979; Member of the Mid-Atlantic Center for Mathematics Teaching and Learning; Managing editor of the *Electronic Journal of Combinatorics*, 1991–; Member of the executive committee of the EPADEL Section of MAA, 2002–.

**Selected Publications:** 1. Some infinite series of maximal subgroups of alternating groups, *Voprosy Teor. Grypp i Gomologicheskoi Algebri* **1** (1977), 125–135. MR **81a:**20006; 2. with R. D. Baker, J. Bonin, and E. Shustin, On the number of nowhere zero points in linear mappings, *Combinatorica* **14**, no. 2 (1994), 149–157. MR **95k:**11160; 3. with V. A. Ustimenko and A. J. Woldar, A new series of dense graphs of high girth, *Bull. Amer. Math. Soc. (N. S.)* **32** (1995), 73–79. MR **95f:**05066; 4. with A. J. Woldar, General properties of some families of graphs defined by systems of equations, *J. Graph Theory* **38** (2001), 65–86. MR **2002k:**05108; 5. with J. Verstraëte, On hypergraphs of girth five, *Electron. J. Combin.* **10**, Research Paper 25 (2003), 1–15.

**Statement:** Most of the challenges that face the AMS today remain the same—how to help its members to follow

changes in the discipline, how to attract the young and talented to the profession, how to communicate mathematics and its importance to the public, how to improve the academic job market, how to inculcate and sustain a passion for mathematics in the members it serves, etc. Nowadays, new areas of applications, changes in the American society (and in the world at large), all offer new challenges. The AMS provides a crucial forum for the promulgation of mathematical knowledge through its conferences, workshops and publications. I am indebted to the AMS in my own professional life, not only for its assistance to me in an official capacity, but also for the kindness and expertise displayed to me by many of its members. I would be honored to have the opportunity to show my gratitude by helping the AMS to state and accomplish its goals.

**Rafe Mazzeo**

*Professor, Stanford University.*
**Born:** March 21, 1961.
**Ph.D.:** Massachusetts Institute of Technology, 1986.
**AMS Committees:** Chair, Math in Moscow Scholarship Committee, 2000–2004.
**Selected Addresses:** AMS Invited Address, Caltech, November 1996; Colloque EDP, St. Jean de Monts, June 1999; Conference in Honor of H. Brezis and F. Browder, Rutgers, October 2001; Clay Summer Institute on Minimal Surfaces, MSRI, July 2002; Pan American Studies Institute, Santiago, Chile, January 2003.
**Additional Information:** NSF Postdoctoral Fellowship, 1987–1990; Sloan Foundation Postdoctoral Fellow, 1991–1995; NSF Young Investigator, 1992–1997; Co-Managing Editor, *Communications in Partial Differential Equations*, 1997–; Organizing Committee, "Spectral Geometry", MSRI, Spring Semester 2001.
**Selected Publications:** 1. with R. S. Phillips, Hodge theory on hyperbolic manifolds, *Duke Math. J.* **60** no. 2 (1990), 509–559. MR **91m:**58006; 2. Elliptic theory of differential edge operators. I, *Comm. Partial Differential Equations* **16** no. 10 (1991), 1616–1664. MR **93d:**58152; 3. with D. Pollack and K. Uhlenbeck, Moduli spaces of singular Yamabe metrics, *J. Amer. Math. Soc.* **9** no. 2 (1996), 303–344. MR **96f:**53055; 4. with N. Korevaar, F. Pacard, and R. Schoen, Refined asymptotics for constant scalar curvature metrics with isolated singularities, *Invent. Math.* **135** (1999), 233–272. MR **2001a:**35055; 5. with A. Vasy, Resolvents and Martin boundaries of product spaces, *Geom. Funct. Anal.* **12** (2002), 1018–1079. MR **2003i:**58061.
**Statement:** The AMS must continue its important work: its advocacy of young mathematicians, its outreach to the larger scientific and intellectual communities, its role as a publisher, and its recognition through prizes of outstanding mathematical achievement. I support and would work toward all of these goals. There are serious issues ahead, including the declining number of American students going into mathematics and the changing role of publishing, and we must face these even more directly than we have up to now.

**Henri Moscovici**

*Professor of Mathematics, The Ohio State University.*
**Born:** May 5, 1944, Tecuci, Romania.
**Ph.D.:** University of Bucharest, Romania, 1971.
**AMS Committees:** Central Section Program Committee, 1997–1999.
**Selected Addresses:** Collège de France Lecture Series, Paris, 1986; International Congress of Mathematicians, Kyoto, 1990; The Issai Schur Memorial Lectures, Tel Aviv, 1995; AMS Invited Address, Milwaukee, 1997; The Crafoord Prize Symposium, Lund-Stockholm, 2001.
**Additional Information:** Lady Davis Postdoctoral Fellowship, 1973; G. Tzitzeica Prize, 1975; College de France Medal, 1986; Sackler Scholar, 1995; John S. Guggenheim Fellow, 1995; Clay Mathematics Institute Scholar, 1999; Ohio State University Distinguished Scholar, 2001; Editorial Board member, *Geometric and Functional Analysis*; Founding Co-Director of the association *Friends of the IHES*.
**Selected Publications:** 1. $L^2$-index of elliptic operators on locally symmetric spaces of finite volume, in *Operator Algebras and K-Theory* (San Francisco, CA, 1981), Contemporary Mathematics, vol. 10, Amer. Math. Soc., Providence, 1982, pp. 129–137. MR **83m:**58072; 2. with A. Connes, The $L^2$-index theorem for homogeneous spaces of Lie groups, *Ann. of Math.* **115** (1982), 291–330. MR **84f:**58108; 3. with A. Connes, Cyclic cohomology, the Novikov conjecture and hyperbolic groups, *Topology* **29** (1990), 345–388. MR **92a:**58137; 4. with R. Stanton, $R$-torsion and zeta functions for locally symmetric manifolds, *Invent. Math.* **105** (1991), 185–216. MR **92i:**58199; 5. with A. Connes, Hopf algebras, cyclic cohomology and the transverse index theorem, *Comm. Math. Phys.* **198** (1998), 199–246. MR **99m:**58186.
**Statement:** Along with the mathematical truths, many of the issues now facing the mathematical community transcend geographical and political boundaries. Through my international professional experience, supplementing twenty four years of work in a national public university, I hope to bring to the Council a distinct and worthwhile point of view.

**Michael F. Singer**

*Professor of Mathematics, North Carolina State University.*
**Born:** February 25, 1950, New York, New York.
**Ph.D.:** University of California, 1974.
**Selected Addresses:** Six AMS Special Sessions and Summer Institutes, 1991–2000; Plenary Speaker, International

Symposium on Symbolic and Algebraic Computation, 1991 and 1999; E. R. Kolchin Memorial Lecture, Columbia University, 1995; AMS Invited Address, New York, 1996; Plenary Speaker, Effective Methods in Algebraic Geometry (MEGA) 1996.

**Additional Information:** Member, Institute for Advanced Study, 1978–1979 and Spring 1985; Chair, Organizing Committee of the Symbolic Computation Semester at MSRI, Fall 1998; Deputy Director of MSRI, Fall 2000 and 2001–2002; Acting Director of MSRI, 2002–2003.

**Selected Publications:** 1. Solving homogeneous linear differential equations in terms of second order linear differential equations, *Amer. J. Math.* **107** (1985), no. 3, 663–696. MR **86m:**34033; 2. Moduli of linear differential equations on the Riemann sphere with fixed Galois groups, *Pacific J. Math.* **160** (1993), no. 2, 343–395. MR **94k:**12009; 3. with R. C. Churchill and D. L. Rod, Group-theoretic obstructions to integrability, *Ergodic Theory Dynam. Systems* **15** (1995), no. 1, 15–48. MR **97i:**58049; 4. with C. Mitschi, Connected linear groups as differential Galois groups, *J. Algebra* **184** (1996), no. 1, 333–361. MR **97g:**12004; 5. with M. van der Put, *Galois Theory of Linear Differential Equations*, Grundlehren der Mathematischen Wissenschaften, vol. 328, Springer-Verlag, Berlin, 2003. MR **2004c:**12010.

**Statement:** I see the AMS (working with SIAM and the MAA) as the representative of the mathematical community in our society. As such, its role is to make people aware of the ubiquity and importance of mathematics, work to insure that society provides resources to support mathematical research and teaching, and work to attract the best minds from all parts of society into our profession. As Deputy Director and Acting Director of MSRI, I was involved in and led successful activities with precisely these goals. In addition, these positions have given me the opportunity to listen to many people in academia, government, and industry about their concerns and hopes for the future of mathematics. I feel it would be a privilege to serve on the Council and work with our community to make these goals a reality.

**Catherine H. Yan**

*Associate Professor, Texas A&M University.*

**Born:** February 14, 1972, Hebei, China.

**Ph.D.:** Massachusetts Institute of Technology, 1997.

**Selected Addresses:** Plenary Speaker, The First CombinaTexas Conference, 2000; Four AMS Special Sessions, 2000–2004; Canadian Mathematical Society Summer Meeting, 2002; Colloquium Lectures, Dalian University of Technology, China, 2002; Invited Address, The First National Conference on Combinatorics and Graph Theory, China, 2004.

**Additional Information:** Silver Medal, International Olympiad Mathematics, Germany, 1989; Alfred P. Sloan Foundation Research Fellow, 2001–2003; Invited Professor, Dalian University of Technology, China, January 2003–December 2005.

**Selected Publications:** 1. with J. Crants, The theory of commuting subalgebras of complete Heyting algebras, *Adv. Math.* **139**, no. 2 (1998), 260–292. MR **2000a:**06053; 2. The theory of commuting Boolean sigma-algebras, *Adv. Math.* **144** (1999), 94–116. MR **2000g:**06007; 3. Generalized parking functions, tree inversions, and multicolored graphs, *Adv. Appl. Math.* **27** (2001), 641–670. MR **2002m:**05020; 4. with R. Graham, J. Lagarias, C. Mallows, and A. Wilks, Apollonian circle packings: number theory, *J. Number Theory* **100**, no. 1 (2003), 1–45. MR **2004d:**11055; 5. with J. Spencer, The halflie problem, *J. Combin. Theory Ser. A* **103** (2003), 69–89. MR **2004b:**91051.

**Statement:** Having lived more than twenty years in China and ten years in United States, I am familiar with the mathematical communities and the education systems in both cultures. I believe that would help me if I serve as Member at Large. If elected, I will (i) work to make the AMS a more welcoming organization for scholars from diverse cultural backgrounds, (ii) increase the support and participation of women and underrepresented minorities in science and technology, and (iii) promote the fundamental role of mathematics in interdisciplinary research. The AMS serves as a forum for the discussion of many issues that arise in our profession. I would appreciate the opportunity to help advance the mission of our Society, and to provide better service to the mathematical community.

## Nominating Committee

**Karen L. Collins**

*Professor of Mathematics, Wesleyan University.*

**Born:** October 28, 1959, Philadelphia, Pennsylvania, USA.

**Ph.D.:** Massachusetts Institute of Technology, 1986.

**AMS Committees:** Committee on Meetings and Conferences, 1999–2002.

**Selected Addresses:** Constructions of 3-chromatic Graph Cores, at the 2002 Joint Mathematics Meetings at San Diego in the AMS special session, "The Many Lives of Lattice Theory and the Theory of Ordered Sets, with Connections to Combinatorics", run by Jonathan Farley and Stefan Schmidt.

**Additional Information:** AMS Summer Research Conference organizer, with Danny Krizanc (Wesleyan) and Alex Russell (UConn), Graph Coloring and Symmetry, Sunday, July 21–Thursday, July 25, 2002, at Mt. Holyoke College; Co-organizer with M. O. Albertson and R. Haas of the Combinatorists of New England conference series, held at Smith College, 1992–2001. Member: AWM, SIAM.

**Selected Publications:** 1. with M. O. Albertson, Homomorphisms of 3-chromatic graphs, *Discrete Math.* **54** (1985), 127–132. MR **86i:**05056; 2. with M. O. Albertson, Symmetry breaking in graphs, *Electron. J. Combin.* **3** (1996), Research Paper 18. MR **97c:**05074; 3. Circulants and sequences, *SIAM J. Discrete Math.* **11** (1998), 330–339. MR **99c:**05061; 4. with J. P. Hutchinson, Four-coloring six-regular graphs on the torus, in *Graph Colouring and Applications* (Montreal, QC, 1997), CRM Proceedings and Lecture Notes, vol. 23, Amer. Math. Soc., Providence, 1999, pp. 21–34. MR **2000k:**05109; 5. with B. Shemmer, Constructions of 3-colorable cores, *SIAM J. Discrete Math.* **16** (2002), no. 1, 74–80. MR **2004a:**05051.

**Statement:** The Nominating Committee of the AMS is charged with the important responsibility of finding mathematicians who are willing to volunteer their time and energy to make this immensely important mathematical organization run. Their efforts make a better mathematical life for us all. Finding the right people for each committee is crucial to the running of the AMS, and it is extremely important to find a slate of candidates with views and experiences that represent the whole mathematical community. Working with other mathematicians, whether to prove theorems, or, as in the case of this committee, to forward the mathematical enterprise, is what I like best about my life as a professional mathematician. I am honored to be considered for this committee.

**Robin Forman**

*Professor and Chair of the Department of Mathematics, Rice University.*

**Born:** August 26, 1959, Philadelphia, Pennsylvania.

**Ph.D.:** Harvard University, 1985.

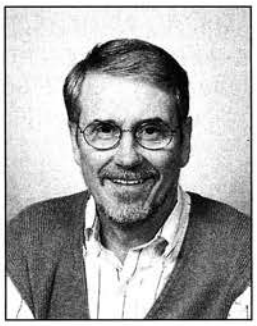
**AMS Committees:** Committee on Committees, 1996–1998; Student Mathematics Library Editorial Committee, 2004–.

**Selected Addresses:** Plenary Address, International Conference on Formal Power Series and Algebraic Combinatorics, Scottsdale, Arizona, May 2001; Invited Address, Cornell Topology Festival, Ithaca, NY, May 2001; Invited Address, Graphs and Patterns in Mathematics and Theoretical Physics, A Conference to Celebrate Dennis Sullivan's 60th Birthday, Stony Brook, NY, June 2001; Invited Address, Eastern Section meeting of the AMS, Williamstown, MA, October 2001; Eight lectures in AMS Special Sessions and Summer Workshops, 1988–2004.

**Selected Publications:** 1. Functional determinants and geometry, *Invent. Math.* **88** (1987), no. 3, 447–493. MR **89b:**58212; 2. Hodge theory and spectral sequences, *Topology* **33** (1994), no. 3, 591–611. MR **95j:**58160; 3. Morse theory for cell complexes, *Adv. Math.* **134** (1998), no. 1, 90–145. MR **99b:**57050; 4. Morse theory and evasiveness, *Combinatorica* **20** (2000), no. 4, 489–504. MR **2001k:**57006; 5. Bochner's method for cell complexes and combinatorial Ricci curvature, *Discrete Comput. Geom.* **29** (2003), no. 3, 323–374. MR **2004a:**52022.

**Statement:** We are in the midst of an exciting and very challenging time for mathematics, and the AMS, as the largest society of mathematicians in the world, has an important role to play. Founded in 1888 to foster research in mathematics, the AMS has, in recent years, expanded its mission to include a broad range of professional and political issues. It is crucial that the AMS have leaders who have earned the respect and admiration of the mathematical sciences community, have a clear vision for the future of mathematics, and have the ability to effectively articulate and act upon that vision. Just as important, the governing bodies of the AMS should reflect the diversity, in all its forms, of the mathematics community. As a member of the Nominating Committee, I would work energetically to help the Society achieve these goals.

**Phillip A. Griffith**



*Professor of Mathematics and Director of Graduate Studies, Department of Mathematics, University of Illinois at Urbana-Champaign.*

**Born:** December 29, 1940, Danville, Illinois.

**Ph.D.:** University of Houston, 1968.

**Selected Addresses:** Special Session on Algebraic Geometry and Commutative Algebra, Joint Mathematics Meetings, Washington, DC, 2000; Special Session on Commutative Algebra and Algebraic Geometry, Joint Mathematics Meetings, San Diego, 2002; Special Session on Syzygies and Hilbert Functions, Tallahassee, FL, March 12–13, 2004.

**Additional Information:** Sloan Fellow, 1971–1972.

**Selected Publications:** 1. A solution to the splitting mixed group problem of Baer, *Trans. Amer. Math. Soc.* **139** (1969), 261–269. MR **39:**317; 2. with R. Fossum, H. Foxby, and I. Reiten, Minimal injective resolutions with applications to dualizing modules and Gorenstein modules, *Inst. Hautes Études Sci. Publ. Math.* no. 45 (1975), 193–215. MR **53:**392; 3. with E. G. Evans, The syzygy problem, *Ann. of Math. (2)* **114** (1981), no. 2, 323–333. MR **83i:**13006; 4. with D. Weston, Restrictions of torsion divisor classes to hypersurfaces, *J. Algebra* **167** (1994), no. 2, 473–487. MR **95c:**13008; 5. A relative filtration index and fibers of normal primes in extensions of finite type, *Compositio Math.* **110** (1998), no. 3, 251–262. MR **99f:**13008.

**Statement:** In my lifetime I would never have thought it possible that the classification of simple groups, the proof of Fermat's "Last Theorem" and the apparent resolution of the Poincaré Conjecture were possible. That these remarkable achievements have all reached fruition in the last 30 to 50 years is even more astonishing. The importance of problem solving and theory building in the highly artistic endeavor known as mathematical research cannot be overvalued. As all who have even a passing interest in

mathematics know, it is not just the subtle and inventive solutions to far reaching classical problems that have made mathematics ever more in the lime light (read making news in the *New York Times*) but it is also the emerging interdisciplinary trends that lead to breakthroughs in such fields as software security, biology and financial mathematics. In my opinion, the role of the Nominating Committee should be to ensure, by its selection of participants, that the message of successes in mathematical research continues to receive national and international attention.

**David Jerison**

*Professor of Mathematics, Massachusetts Institute of Technology.*
**Born:** November 12, 1953, Lafayette, Indiana.
**Ph.D.:** Princeton University, 1980.
**AMS Committees:** *Transactions* and *Memoirs* Editorial Committee, 1991–1995; Editorial Boards Committee, 1998–2001; *Notices* Editorial Board Committee, 1998–2000; *Notices* Editor Search Committee, 1999; Colloquium Committee, 1999–2001.
**Selected Addresses:** AMS Invited Address, Salt Lake City, August 1987; Keeler Lectures, University of Michigan, 1988; Invited Address, International Congress of Mathematicians, Zurich, 1994; Principal Lecturer, Fabes-Riviere Conference, University of Minnesota, April 2002; Principal Lecturer, CBMS Conference, Wayne State University, May 2003.
**Additional Information:** NSF Postdoctoral Fellow, 1980–1982; Alfred P. Sloan Fellow, 1985–1987; NSF Presidential Young Investigator Award, 1985–1990; Fellow of the American Academy of Arts and Sciences (elected 1999); Chair, Pure Mathematics Committee, MIT, 2002–2004; Margaret MacVicar Faculty Fellow, 2004–2014 (MIT teaching award). Editorial Board Memberships: *Duke Mathematical Journal*, 1988–; *Journal of Geometric Analysis*, 1990–; *Current Developments in Mathematics*, 1996–; *International Mathematical Research Notes*, 1998–2000; *Inventiones Mathematicae*, 2000–.
**Selected Publications:** 1. with C. E. Kenig, Unique continuation and absence of positive eigenvalues for Schrödinger operators. With an appendix by E. M. Stein, *Ann. of Math. 2* **121** (1985), no. 3, 463–494. MR **87a:**35058; 2. Prescribing harmonic measure on convex domains, *Invent. Math.* **105** (1991), no. 2, 375–400. MR **92k:**31003; 3. The diameter of the first nodal line of a convex domain, *Ann. of Math. 2* **141** (1995), no. 1, 1–33. MR **95k:**35148; 4. A Minkowski problem for electrostatic capacity, *Acta Math.* **176** (1996), no. 1, 1–47. MR **97e:**31003; 5. with L. A. Caffarelli and C. E. Kenig, Some new monotonicity theorems with applications to free boundary problems, *Ann. of Math. 2* **155** (2002), no. 2, 369–404. MR **2003f:**35068.
**Statement:** As a member of the Nominating Committee, I will do my best to find energetic, imaginative, and thoughtful candidates for the many positions in the Society. For three years, I was a member of the Editorial Boards Committee, whose main task was to select and recruit members of the AMS editorial boards. I also participated in the 1999 search for the Editor of the *Notices*, which resulted in the selection of Harold Boas. These experiences showed me that finding excellent people who are willing to serve requires concerted effort and that the effort is worthwhile.

Mathematics has grown very large—I do not pretend to understand more than a corner of what is going on in mathematics as a profession or as a discipline. I look forward to learning from my colleagues on the committee and elsewhere. Our aim must be to adapt to changes, both good and bad, to promote access to mathematics at all levels and in cooperation with other countries, and to promote the health of the profession in general.

**Linda Keen**

*Professor, Lehman College and Graduate Center, CUNY.*
**Born:** August 9, 1940, New York, NY, USA.
**Ph.D.:** New York University, 1964.
**AMS Offices:** Member at Large of the Council, 1981–1983; Vice President, 1992–1995; Trustee, 1999–2008.
**AMS Committees:** Nominating Committee, 1983–1984 (chair 1984); COPE, 1986–1989 (chair 1988–1989); Chair, Panel to select speakers for Joint AMS-MAA meetings, 1988; Program Committee for National Meetings, 1988–1989; EBC, 1989–1992 (chair 1991); Chair, Committee to choose winner of Satter Prize, 1990; JPBM, 1992–1995; COMC, 1992–1996; Science Policy Committee, 1992–1995; Committee to write Ethical Guidelines for AMS, 1992–1996; Committee to write the National Policy Statement, 1994–1995; Ad Hoc Committee on Governance, 1994; Coordinating Editor, *Proceedings*, 1994–; Managing Editor, *Conformal Geometry and Dynamics*, 1995–2005; CPUB, 2000–2006; Long Range Planning Committee, 2002; BT Investment Committee, 2002–2005.
**Selected Addresses:** AMS Invited Hour Speaker, January 1974; MAA Invited Hour Speaker, August 1989; Emmy Noether Lecturer, January 1993; AIM conference to honor Lars Ahlfors at Stanford University, 1997; Invited Hour Speaker, Joint LMS-Irish Math Society, 1998; Invited Speaker, RIMS workshop on Complex Dynamics, 2001; Invited Speaker, Workshop on Complex Dynamics and Related Topics, Beijing, 2002.
**Additional Information:** AWM Executive Committee, 1978–1981; Charter Member, NYC Mayor's Commission on Science and Technology, 1984–1985; AWM President, 1985–1986; CBMS, 1986; Steering Committee for International Congress, 1986; USNCM, 1988–1993 (chair 1990–1993); National Science Foundation Visiting Professorship for Women, 1989–1990; AWM Long Range Planning Committee, 1992–1993; AWM Nominating Committee,

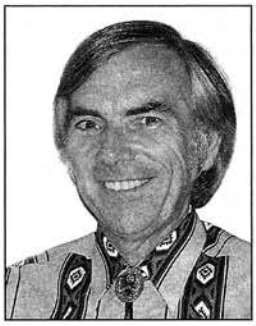
1993; Edwin S. Webster-Abby Rockefeller Mauze Award, MIT, 1990.

**Selected Publications:** 1. Intrinsic moduli on Riemann surfaces, *Ann. of Math. (2)* **84** (1966), 404–420. MR **34:**2859; 2. with L. Goldberg, The mapping class group of a generic quadratic rational map and automorphisms of the 2-shift, *Invent. Math.* **101** (1990), no. 2, 335–372. MR **91h:**30041; 3. with R. Devaney and P. Blanchard, The dynamics of complex polynomials and automorphisms of the shift, *Invent. Math.* **104** (1991), no. 3, 545–580. MR **92f:**58150; 4. with C. Series, Pleating coordinates for the Maskit embedding of the Teichmüller space of punctured tori, *Topology* **32** (1993), no. 4, 719–749. MR **95g:**32030; 5. with C. Series, Pleating invariants for quasifuchsian groups: Punctured tori, *Topology* **43** (2004), no. 2, 447–491.

**Statement:** The AMS is a multifaceted organization whose primary mission is to foster good mathematics. It does this primarily as a publisher and as a sponsor for meetings and conferences. Another very important responsibility is to deal with the recognition of mathematics as a profession by giving prizes, and by reaching outside the profession to get support. Finally, the AMS has a responsibility for encouraging all those who want to do mathematics to take part. This includes presenting ourselves and our work to the broadest possible audience.

I have been involved with the Society in many different roles over the years: as a Council member, as a member of committees such as that on professional ethics, and as an editor. I have worked hard to make the AMS effective on all fronts. As an active mathematician and AMS member for many years, I have had the opportunity to get to know many mathematicians. In my various capacities for AMS, I have learned what skills different jobs require. As a member and former President of AWM, I am well attuned to the desirability and necessity of including women, underrepresented minorities and mathematicians from a broad spectrum of colleges and universities in the activities of AMS. As a member of the Nominating Committee, I will bring this knowledge and perspective to guide me in finding nominees for various AMS elected positions.

**Robert E. Megginson**



*Deputy Director, Mathematical Sciences Research Institute and Professor of Mathematics, University of Michigan at Ann Arbor.*

**Born:** February 23, 1948, Washington, Illinois, USA.

**Ph.D.:** University of Illinois at Urbana-Champaign, 1984.

**AMS Committees:** Committee on Academic Freedom, Tenure, and Employment Security, 1996–1999 and 2002–2005; Committee on Committees, 2000–2005.

**Selected Addresses:** Keynote Address, Annual Mathematics Conference of the Syracuse University Department of Mathematics, Syracuse, NY, March 2001; University Colloquium Lecture, Washington and Lee University, Lexington, VA, November 2001; Albert Turner Bharucha-Reid Lecture, National Association of Mathematicians, Berkeley, CA, March 2003; Invited Hour Lecture, IX IASI Seminar of Applied Statistics, IMPA, Rio de Janeiro, July 2003; Mathematics Colloquium Lecture, University of Kansas, Lawrence, KS, October 2003.

**Additional Information:** Trustee, MSRI, Berkeley, 1997–1999 and 2000–2004; U.S. Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring, 1997; Ely S. Parker Award, American Indian Science and Engineering Society, 1999; University of Michigan Regents' Award for Distinguished Public Service, 1999; named to Native American Science and Engineering Wall of Fame, maintained at Southwestern Indian Polytechnic Institute, 2001; portrayed in *100 Native Americans Who Shaped American History*, Bonnie Juettner, Bluewood Books, 2002; International Scientific Advisory Board, New Zealand Institute of Mathematics and its Applications, since 2003. Member: AMS, AWM, MAA, Society for the Advancement of Chicanos and Native Americans in Science, American Indian Science and Engineering Society.

**Selected Publications:** 1. Approximative compactness in Kadec-Klee spaces, in *Geometry of Normed Linear Spaces* (Urbana-Champaign, IL, 1983), Contemporary Mathematics vol. 52, Amer. Math. Soc., Providence, 1986, pp. 109–112. MR **87j:**46036; 2. *An Introduction to Banach Space Theory*, Graduate Texts in Mathematics, vol. 183, Springer-Verlag, New York, 1998. MR **99k:**46002; 3. College-based precollege intervention projects: A model for outreach to groups underrepresented in science and mathematics, *Journal of Public Service and Outreach* **4** (Fall 1999), 7–13; 4. with P. Gavin LaRose, Implementation and assessment of on-line gateway testing, *Primus* **13** (December 2003), no. 4, 289–307; 5. Some political and practical issues in implementing reform, in *Rethinking the Road toward Calculus*, MAA Notes volume, Mathematical Association of America, Washington, to appear.

**Statement:** As the challenges and opportunities that face the AMS continue to grow, the challenges and opportunities that face the Nominating Committee grow proportionately. The Nominating Committee must seek candidates who have shown the creativity and flexibility needed to deal with issues that our profession will face that might not even be anticipated now. The Nominating Committee also needs to seek candidate pools that are representative of the increasing diversity in personal and institutional background found among those practicing our profession or studying to enter it. Some interesting new directions for the Society that reinforce its traditional mission have come through creative collaborations with other mathematical professional organizations; for example, the AMS's sponsorship of six fellows each year for the MAA's Project NExT, which will incorporate additional young mathematicians with strong research interests into that program. Society officers with solid cross-organizational ties can help further such collaborations, which should be kept in mind by the Nominating Committee when making its selections.

## Editorial Boards Committee

### Margaret Cheney

*Professor of Mathematics, Rensselaer Polytechnic Institute.*
**Ph.D.:** Indiana University, 1982.
**Selected Addresses:** Over 100 research lectures in the U.S. and Europe.
**Additional Information:** After a postdoc at Stanford University, she spent 3 years as assistant professor at Duke University before moving to RPI. She has held visiting appointments at NYU's Courant Institute (1987–1988), at the Minnesota Institute for Mathematics and Its Applications (1994–1995 and 1997), the Berkeley Mathematical Sciences Research Institute (2001), the Naval Air Warfare Center Weapons Division (2002), and the UCLA Institute for Pure and Applied Mathematics (2003). Most of her work has been on the inverse problems that arise in quantum mechanics, acoustics, and electromagnetic theory.
Cheney has received several awards, including the Office of Naval Research Young Investigator Award in 1986, a National Science Foundation Faculty Award for Women in Science and Engineering in 1990, and the Lise Meitner Visiting Professorship at Lund Institute of Technology in 2000. She was a member of the Rensselaer Impedance Imaging team that received the 1993 ComputerWorld Smithsonian award in the Medicine category. She is a member of the SIAM Board of Trustees, of the Electromagnetics Academy, and is a Fellow of the Institute of Physics. She has served as Editor-in-Chief of the *SIAM Journal of Applied Mathematics (SIAP)*; she is currently a member of the editorial boards of *SIAP* and of *Inverse Problems*. She has 4 patents and roughly 90 publications.
**Selected Publications:** 1. with C. J. Nolan, Synthetic aperture inversion for arbitrary flight paths and nonflat topography, *IEEE Trans. Image Process.* **12** (2003), no. 9, 1035–1043. MR **2006858**; 2. with B. Borden, Microlocal structure of inverse synthetic aperture radar data, *Inverse Problems* **19** (2003), no. 1, 173–193. MR **1964257**; 3. with E. Miller, M. Kilmer, G. Boverman, A. Li, and D. Boas, Feature-enhancing inverse methods for limited-view tomographic imaging problems, *Subsurface Sensing, Technology and Applications* **4** (2003), no. 4, 327–353; 4. with F. Natterer and B. Borden, Resolution for radar and x-ray tomography, *Inverse Problems* **19** (2003), no. 6, S55–S63. MR **2036521**; 5. with C. J. Nolan, Microlocal analysis of synthetic aperture radar imaging, *J. Fourier Analysis and Applications* **10** (2004), 133–148.
**Statement:** I hope I can be of help to the AMS by suggesting names from the applied math community.

### Fritz Gesztesy

*Professor of Mathematics, University of Missouri-Columbia.*
**Born:** November 5, 1953, Leibnitz, Austria.
**Ph.D.:** University of Graz, Austria, 1976.
**Selected Addresses:** Georgia Tech - UAB International Conference on "Differential Equations and Mathematical Physics", Georgia Tech, March 1992; International Conference on "Applications of Operator Theory", Institute of Industrial Mathematical Sciences (IIMS), University of Manitoba, October 1994; AMS Invited Address, Baton Rouge, April 1996; Conference on "Mathematical Results in Quantum Mechanics", Technical University of Prague, Czech Republic, June 1998.
**Additional Information:** Alexander von Humboldt Fellowship, University of Bielefeld, Germany, 1980–1981 and 1983–1984; Max Kade Fellowship, Caltech, 1987–1988; Election to the Royal Norwegian Society of Science and Letters, Norway, 2002.
**Selected Publications:** 1. with B. Simon, The xi function, *Acta Math.* **176** (1996), 49–71. MR **97e:**47078; 2. with R. Weikard, Picard potentials and Hill's equation on a torus, *Acta Math.* **176** (1996), 73–107. MR **97f:**14046; 3. with R. Weikard, A characterization of all elliptic algebro-geometric solutions of the AKNS hierarchy, *Acta Math.* **181** (1998), 63–108. MR **99k:**14052; 4. with B. Simon, A new approach to inverse spectral theory. II. General real potentials and the connection to the spectral measure, *Ann. of Math. 2* **152** (2000), 593–643. MR **2001m:**34185b; 5. with H. Holden, *Soliton Equations and Their Algebro-Geometric Solutions. Vol. I: (1 + 1)-Dimensional Continuous Models*, Cambridge Studies in Advanced Mathematics, vol. 79, Cambridge University Press, 2003.
**Statement:** Dynamic and knowledgeable editors help define the success of journals and book series. As a member of the Editorial Board I would work to ensure that the AMS maintains its fundamental role in producing top-quality publications at affordable prices to promote a wide dissemination of important mathematics. The selection of fair-minded and well-organized individuals with extensive and broad expertise of the relevant subject areas, representative of the mathematics community, would be one of my principal concerns.

### Kailash C. Misra

*Professor of Mathematics, North Carolina State University.*
**Born:** April 11, 1954, Dhenkanal, Orissa, India.
**Ph.D.:** Rutgers University, 1982.
**Selected Addresses:** Conference on "Infinite-dimensional Lie algebras and groups", Oberwolfach, Germany, April 1985; Joint Summer Research conference on "Deformation theory of algebras and

quantizations with applications to physics", Amherst, MA, June 1990; Conference on "Quantum Groups", Morelia, Mexico, March 2000; Conference on "Kac-Moody Lie algebras and applications", Ramanujan Institute, Madras, India, January 2002; AMS special session on "Lie algebras and conformal field theory", Binghamton, NY, October, 2003.

**Additional Information:** I have been serving on the editorial board of *Communications in Algebra* since January, 1995. I have co-edited Contemporary Mathematics volumes 248, 297, and 343 in 1999, 2002, and 2004, respectively.

**Selected Publications:** 1. with T. Miwa, Crystal base for the basic representation of $U_q(\widehat{s\ell}(n))$, *Comm. Math. Phys.* **134** (1990), 79–88. MR **91j**:17021; 2. with S.-J. Kang, M. Kashiwara, T. Miwa, T. Nakashima, and A. Nakayashiki, Perfect crystals of quantum affine Lie algebras, *Duke Math. J.* **68** (1992), 499–607. MR **94j**:17013; 3. with A. Kuniba, M. Okado, and J. Uchiyama, Demazure modules and perfect crystals, *Comm. Math. Phys.* **192** (1998), 555–567. MR **2000c**:17025; 4. with N. Jing, Vertex operators for twisted quantum affine algebras, *Trans. Amer. Math. Soc.* **351** (1999), 1663–1690. MR **99i**:17027; 5. with N. Jing and M. Okado, $q$-wedge modules for quantized enveloping algebras of classical type, *J. Algebra* **230** (2000), 518–539. MR **2001i**:17014.

**Statement:** AMS publications serve an important role for the mathematical community worldwide as a major source of communication on the recent developments in mathematics at a relatively low cost. Maintaining the quality and breadth of these publications is the primary responsibility of its editorial boards. As a member of the Editorial Boards Committee, I shall work to enhance the quality and breadth of the AMS publications by nominating conscientious, fair, well organized and knowledgeable representatives of the mathematical community to serve on suitable editorial committees.

**Abigail A. Thompson**
*Professor, University of California at Davis.*

**Born:** June 30, 1958, Norwalk, Connecticut.

**Ph.D.:** Rutgers University, 1986.

**AMS Offices:** Editor, *Transactions of the Amer. Math. Soc.*, 2001–2003; AMS Centennial Prize Committee, 2002–2004 (chair, 2003–2004).

**Selected Addresses:** AMS Invited Address, Louisville, 1998.

**Additional Information:** Lady Davis Fellow, Hebrew University, 1986–1987; NSF Postdoctoral Fellow, 1988–1991; Member, IAS, 1990–1991 and 2000–2001; Alfred P. Sloan Foundation Fellow, 1991–1993; AMS Ruth Lyttle Satter Prize, 2003. Member, AWM.

**Selected Publications:** 1. Knots with unknotting number one are determined by their complements, *Topology* **28** 1989, 225–230. MR **90f**:57011; 2. with M. Scharlemann, Detecting unknotted graphs in 3-space, *J. Differential Geom.* **34** 1991, 539–560. MR **93a**:57012; 3. Thin position and the recognition problem for $S^3$, *Math. Res. Lett.* **1** 1994, 615–630. MR **95k**:57015; 4. Thin position and bridge number for knots in the 3-sphere, *Topology* **36** no. 2, 1997, 505–507. MR **97m**:57013; 5. with M. Scharlemann, Surfaces, submanifolds, and aligned Fox re-imbedding in non-Haken manifolds, ArXiv math.GT/0308011, to appear in *Proc. Amer. Math. Soc.*

**Statement:** The principal obligation of the Editorial Boards Committee is to ensure the continued high quality of the Society's publications by appointing 1) excellent and 2) well-organized mathematicians to be editors. Finding people to satisfy both criteria is not a small task. While the first is not so hard, most of the people satisfying the second went into accounting where they are making twice our average salaries. In addition to this I would work to introduce some of the successful electronic practices from other journals designed to speed the time to decision on papers. That is, when we appoint someone not satisfying criterion #2 (no names will be mentioned here, except possibly my own) the journal system for processing papers should provide a back-up to prevent unnecessary delays. Famous stories about editors surrounded by stacks of papers never sent out for review are amusing only in retrospect. AMS journals must remain competitive both in quality and in efficiency with both traditional and on-line journals.

# Report on the April 2004 Council Meeting

On April 3, 2004, the AMS Council met in Washington, DC. As usual with its spring meeting, a major item of business was the nomination of candidates to stand for office in the AMS Elections, and the Council nominated people to run for the Board of Trustees, Vice President, and Member at Large of the Council in the 2004 elections. The list of those nominees for the 2004 Elections will be distributed to AMS members in September and will be published in the September issue of the *Notices*. In addition, the Council nominated James G. Glimm and Ronald J. Stern to run in 2005 as candidates for the post of AMS President Elect.

The Council also conducted some standard business by approving the establishment of one prize committee, a minor change in charge to another, and an expansion in the charge of the Human Rights Committee.

The Council reacted to a threatened embargo on papers from scientists in embargoed countries. A September 2003 ruling of the U.S. Office of Foreign Assets Control seemed to limit how American publishers could deal with scientific papers from such countries. Subsequently a number of publishers, scientific societies, and scientists expressed concern about the potential to interfere with the free exchange of science, which is a principle that is widely promoted throughout the world. During the week of the Council Meeting, the U.S. State Department gave hints that the rules limiting the publication of such papers were about to be reinterpreted in more favorable ways. Nevertheless, Council members expressed their belief in the value of reaffirming the free exchange principle, and the Council adopted the following statement:

> The American Mathematical Society believes that science is universal and that it relies on cooperation and exchange throughout the world. The Society is committed to the principle that scientists must have free access to each other and to scientific information. For these reasons, all publication programs of the Society continue to consider each submission without regard to the nationality or the national origin of its authors. We believe this is consistent both with the above principles and with current law.

As a repeat of an item initiated in April 2002, the Council devoted a portion of this meeting to a general discussion of one of the matters it oversees. This year's topic was membership, which also was the subject of the Society's focused planning effort in 2003. Resource materials were distributed prior to the meeting, and members were asked to concentrate on two primary issues: (1) how to retain nominee members and (2) whether to make some part of the archived *Notices of the AMS* a benefit available only to members. There was extensive discussion. Executive Director John H. Ewing outlined how nominee members are tracked at present and explained why accurate tracking is difficult. Council discussed proposals about various periods in which the *Notices* would be available online only to members and indicated support for having some kind of evident member benefit. No actions were taken.

Finally, Executive Director Ewing reported on the state of the AMS. His report was published in the August 2004 issue of the *Notices*, pp. 818–23.

# Mathematics Calendar

The most comprehensive and up-to-date Mathematics Calendar information is available on e-MATH at http://www.ams.org/mathcal/.

## September 2004

1-6 (REVISED) **Sixth Pan-African Congress of Mathematicians**, Institute National des Sciences Appliquees et del la Technologie (INSAT), Université 7 Novembre à Carthage, Tunis, Tunisia. (May 2003, p. 604)

**Theme**: Mathematical Sciences and the Development of Africa—Challenges for Building a Knowledge Society in Africa. The scientific program will include plenary lectures, invited lectures, contributed research papers, a symposium, and exhibitions.

**Contact**: Those interested in speaking at or participating in the congress are invited to contact: A. Boukricha, local organizing committee, Université de Tunis EL Manar Departement de Mathématiques, Faculté des Sciences De Tunis, 1060 Tunis, Tunisia; email: aboukricha@fst.rnu.tn.

**Information**: Please submit curriculum vitae and abstract to: J. Persens, Pres., African Mathematical Union, Univ. of the Western Cape, Private Bag X17, Belville 7535, South Africa; jpersens@uwc.ac.za; and copies to: J.-P. Ezin, Sec. General, African Mathematical Union, Institut de Mathematiques et de Sciences Physiques, BP613, Porto Novo, Benin; jpezin@syfed.bj.refer.org; http://www.ams.org/mathcal/info/2004_sep1-6_tunis.html.

2-4 **2nd International Conference on Soft Methods in Probability and Statistics**, Edificio Historico de la Universidad, Oviedo, Spain. (Jan. 2004, p. 64)

**Description**: The scope of SMPS 2004 is to bring together experts representing all existing approaches used in soft probability and statistics. In particular, papers (both theoretical and applied) combining probability and statistics with fuzzy logic, applications of the Dempster-Shafer theory, generalized theories of uncertainty, generalized random elements, generalized probabilities, and so on will be welcome.

**Call for Papers**: Full papers of 5-8 pages (A4) written in English should be submitted by email no later than February 15, 2004, to com2smps@correo.uniovi.es.

**Main Speakers**: L. A. Zadeh, I. S. Molchanov, H. T. Nguyen, Y. Ogura, and D. A. Ralescu.

**Organizers (general chairs)**: M. A. Gil and M. Lopez-Dîaz.

**Information**: http://web.uniovi.es/SMPS; email: smps2004@correo.uniovi.es.

7 **The DIMACS Symposium on Phylogenetics and Rapidly Evolving Pathogens**, Aotea Centre, Auckland, New Zealand. (June/July 2004, p. 686)

**Description**: This working group will build on phylogenetic methods developed by computational biologists to explore ways in which such methods can be applied and developed to shed new light on the origin, evolution, and likely future development of viruses and other pathogens. Phylogeny is now a central tool for studies into the origin and diversity of viruses such as HIV and dengue fever virus. These and other investigations have provided new insights, such as identifying the possible pattern of transfer of HIV-type viruses between primate species. Phylogenetic techniques have also proved useful in mapping the evolution of different strains of the human influenza A virus, with the goal of predicting which strain is most likely to cause future epidemics, with applications to vaccine development.

**Sponsor**: DIMACS.

**Organizers**: Allen Rodrigo, Univ. of Auckland, email: a.rodrigo@auckland.ac.nz; Mike Steel, Univ. of Canterbury, email: M.Steel@math.canterbury.ac.nz.

**This section** contains announcements of meetings and conferences of interest to some segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete list of meetings of the Society can be found on the last page of each issue.

**An announcement** will be published in the *Notices* if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in every third issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

**In general,** announcements of meetings and conferences held in North America carry only the date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the *Notices* in care of the American Mathematical Society in Providence or electronically to notices@ams.org or mathcal@ams.org.

**In order** to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the *Notices* prior to the meeting in question. To achieve this, listings should be received in Providence **eight months** prior to the scheduled date of the meeting.

**The complete listing** of the Mathematics Calendar will be published only in the September issue of the *Notices*. The March, June/July, and December issues will include, along with new announcements, references to any previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.

**The Mathematics Calendar,** as well as Meetings and Conferences of the AMS, is now available electronically through the AMS website on the World Wide Web. To access the AMS website, use the URL: http://www.ams.org/.

**Deadlines**: This meeting is by invitation only. Student posters are welcome. If you are interested in participating, please contact the organizers.
**Information**: http://dimacs.rutgers.edu/Workshops/WGPhylogeneticTrees/.

7–10 **International Conference on PDE Methods in Applied Mathematics and Image Processing**, Sunny Beach, Bulgaria. (Aug. 2004, p. 830)
**Purpose**: To bring together people interested in partial differential equations and their applications, with a special emphasis on their novel applications in image processing.
**Organizers**: Ognyan Kounchev, email: kounchev@math.bas.bg, http://www.math.bas.bg/~kounchev; Svetozar Margenov, email: margenov@parallel.bas.bg, http://parallel.bas.bg/~margenov.
**Deadline**: For submissions of abstracts is July 31, 2004.
**Information**: http://www.math.bas.bg/~kounchev/2004_conference/HomePage2004.html.

7–11 **2004 Workshop on Algebraic Geometry and Physics**, Instituto Superior Tecnico (IST), Lisbon, Portugal. (Apr. 2004, p. 460)
**Information**: http://www.math.ist.utl.pt/galg/WAGP04/.

7–11 **International Workshop on Analysis and Its Application**, Mersin University, Mersin, Turkey. (Aug. 2004, p. 830)
**Workshop Fields**: Approximation Theory, Complex Analysis, Functional Analysis, Ordinary Differential Equations, Partial Differential Equations, Theoretical Physics, Theory of Functions.
**Invited Speakers**: V. V. Andrievskii (Kent Univ., USA); H. P. Blatt (Kath. Univ. of Eichstatt, Germany); Z. Ditzian (Univ. of Alberta, Canada); V. V. Goryainov (Volgograd Univ., Russia); N. Kerimov (Baku State Univ., Azerbaijan); K. Kopotun (Univ. of Manitoba, Canada); D. Leviatan (Tel-Aviv Univ., Israel); R. Petrishin (Chernivtsi Nath. Univ., Ukraine); R. Rzayev (Baku Econ. Univ., Azerbaijan); A. M. Samoilenko (Math. Inst., Ukraine); I. A. Shevchuk (Kyiv Nath. Univ., Ukraine); A. I. Stepanets (Math. Inst., Ukraine).
**Information**: http://mathworkshop.mersin.edu.tr.

9–12 **CabriWorld 2004: Third CabriGeometry International Conference**, University of Rome "La Sapienza", Rome, Italy. (Aug. 2004, p. 830)
**Description**: The conference is dedicated to the teaching and learning of geometry through the use of dynamic geometry software and is addressed to the needs of mathematics teachers at all levels, researchers, mathematicians, and others interested in the use of new technologies in the teaching of mathematics.
**Information**: http://italia2004.cabriworld.com.

9–12 **Recent Trends in Additive Combinatorics**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 686)
**Topics**: This workshop, sponsored by AIM and the NSF, will focus on four interrelated themes: (1) Long arithmetic progressions and the Szemeredi regularity lemma; (2) the Erdös-Szemeredi sum-product conjecture, the Erdös distance set problem, and Szemeredi-Trotter type problems in various dimensions and fields; (3) Freiman's inverse theorem and sum-sets; (4) the Kakeya conjecture in finite fields, and related problems from harmonic analysis. There have been a number of recent breakthroughs in each of these fields involving new techniques, and the goal of the workshop is to popularize these new techniques with people working in neighboring fields.
**Organizers**: T. Tao and V. Vu.
**Deadline**: June 9, 2004.
**Information**: http://aimath.org/ARCC/workshops/additivecomb.html.

10–14 **International Conference of Numerical Analysis and Applied Mathematics 2004 (ICNAAM 2004)**, Chalkis, Greece. (Mar. 2004, p. 360)
**Aim**: The aim of ICNAAM 2004 is to bring together leading scientists of the international numerical and applied mathematics community and to attract original research papers of very high quality. The topics to be covered include (but are not limited to): all the research areas of numerical analysis and computational mathematics, and all the research areas of applied mathematics (see http://www.uop.gr/~icnaam/res8/aimscope.htm).
**Chairmen and Organizers**: T. E. Simos, Department of Comput. Sci. and Tech., Faculty of Sci. and Tech., Univ. of Peloponnese, Greece; and Ch. Tsitouras, Technological Educational Inst. of Chalkis, Greece. Vice-Chairman: G. Psihoyios, Anglia Polytechnic University, Cambridge, UK.
**Scientific Committee**: G. van den Berghe, Belgium; P. E. Bjorstad, Norway; J. Cash, UK; R. Cools, Belgium; A. Cuyt, Belgium; B. Fischer, Germany; R. W. Freund, USA; I. Gladwell, USA; B. Hendrickson, USA; A. Klar, Germany; W. F. Mitchell, USA; T. E. Simos, Greece; W. Sproessig, Germany; Ch. Tsitouras, Greece; G. Alistair Watson, UK.
**Information**: Secretary ICNAAM, email: icnaam@uop.gr; 26 Menelaou Street, Amfithea Paleon Faliron, GR-175 64, Athens, Greece; fax: +30210 94 20 091; http://www.uop.gr/~icnaam/.

12–17 **CR Geometry and Partial Differential Equations**, Grand Hotel Bellavista, Levico Terme, Trento, Italy. (Aug. 2004, p. 830)
**Scientific Organizers**: Marco Peloso (Polit. Torino), Dmitri Zaitsev (Trinity Coll. Dublin), Giuseppe Zampieri (Univ. Padova).
**Information**: email: michelet@science.unitn.it; http://www.science.unitn.it/cirm/; http://www.science.unitn.it/cirm/listCRGeometry.html.

13–17 **Homogenization and Shape Optimization—Summer School 2004**, University of Lisbon, Lisbon, Portugal. (May 2004, p. 575)
**Information**: http://www.ptmat.fc.ul.pt/~hso2004/.

14–16 **4th WSEAS International Conference on Simulation, Modeling and Optimization (ICOSMO 2004)**, Izmir, Turkey. (Jun/Jul. 2004, p. 686)
**Information**: http://www.wseas.org.

14–18 (REVISED) **Third International Conference on Boundary Integral Methods: Theory and Applications**, University of Reading, United Kingdom. (Nov. 2002, p. 1287)
**Description**: As well as discussing recent developments in the theory and numerical analysis of boundary integral equations, the conference will strive to encompass applications of contemporary relevance such as direct and inverse (medium and high) frequency scattering, electromagnetics and moving boundary problems in hydrodynamics. Continuing progress in key computational techniques such as multipole, wavelets and panel clustering, together with innovative algorithm design, will be an additional theme.
**Conference Organizing and Scientific Committee**: S. Amini (Univ. of Salford), S. Chandler-Wilde (Brunel Univ., chair), K. Chen (Univ. of Liverpool), P. Davies (Univ. of Strathclyde), I. Graham (Univ. of Bath), P. Martin (Colorado School of Mines).
**Information**: http://www.ima.org.uk/mathematics/boundary.htm.

16–18 **ADG 2004 (5th International Workshop on Automated Deduction in Geometry)**, University of Florida, Gainesville, Florida. (Aug. 2004, p. 830)
**Information**: http://www.math.ufl.edu/~white/ADG2004.html.

16–18 **Fluid Mechanics: A Workshop in Honor of Amable Liñán**, Fundación Euroárabe, Granada, Spain. (Aug. 2004, p. 830)
**Topics**: Fluid mechanics, combustion, turbulence, electrohydrodynamics, applied mathematics.
**Invited Speakers and Participants**: A. Barrero, A. Bermudez de Castro, L. L. Bonilla, P. Clavin, A. Crespo, I. Diaz, J. Dold, C. Dopazo, J. L. Fernandez de la Mora, A. C. Fernandez Pello, P. L. Garcia Ybarra, M. A. Herrero, J. Jimenez, G. Joulin, J. C. Lasheras, M. Martinez

Sanchez, P. Moin, N. Peters, E. Sanchez Palencia, J. R. Sanmartin, G. Sivashinsky, C. Trevino, M. G. Velarde, F. A. Williams.
**Information**: http://www.ugr.es/local/kinetic/amable; email: kinetic@ugr.es.

16–19 **Algebraic Cycles, K-Theory, and Modular Representation Theory (in Honor of the 60th Birthday of Eric Friedlander)**, Northwestern University, Evanston, Illinois. (Jun/Jul. 2004, p. 686)
**Sponsors**: The Clay Mathematics Institute, the National Security Agency, the National Science Foundation, and Northwestern University.
**Description**: The theme of the conference will be a survey of the state of the art in algebraic cycles, K-theory, and modular representation theory, in particular as influenced by the work of Eric Friedlander. The conference will feature several keynote talks that will survey the historical background, current state of development, and prospects for future progress in all of the focused areas. These talks will be particularly valuable for young researchers. Other talks will present recent developments in the focused areas.
**Speakers Include**: D. Benson (Georgia), S. Bloch (Chicago), D. Cox (Amherst), W. Dwyer (Notre Dame), B. Lawson (Stony Brook), S. Lichtenbaum (Brown), B. Mazur (Harvard), D. Nakano (Georgia), B. Parshall (Virginia), A. Suslin (Northwestern), V. Voevodsky (IAS), M. Walker (Nebraska), C. Weibel (Rutgers).
**Organizers**: C. Bendel (Wisconsin-Stout), D. Cox (Amherst), C. Haesemeyer (Illinois), R. Joshua (Ohio State), J. Pevtsova (Oregon).
**Funding**: Funding is available to support the expenses of graduate students and recent graduates. Requests for support must be received by July 31, 2004.
**Information**:http://www.math.northwestern.edu/conferences/friedlander/.

17–18 **Zirkumferenz 2004**, Aula der Mädchenrealschule des Zisterzienserinnenklosters in Waldsassen, Bavaria, Germany. (Jun/Jul. 2004, p. 686)
**Description**: An interdisciplinary dialogue on science, mathematics, philosophy, and art involving the number $\pi$.
**Organizers**: Hael Yxxs and J. V. Schmidt.
**Information**: http://www.zirkumferenz.de.

17–19 **Yamabe Symposium on "Geometry and Physics"**, University of Minnesota, Minneapolis, Minnesota. (Aug. 2004, p. 830)
**Invited Speakers**: Robert Bryant, Duke Univ.; Kefeng Liu, U.C.L.A.; Duong Phong, Columbia Univ.; Yongbin Ruan, Univ. of Wisconsin; Isadore M. Singer, M.I.T.; Karen Uhlenbeck, Univ. of Texas; Shing-Tung Yau, Harvard Univ.
**Organizers**: Robert Gulliver, Nai-Chung Leung, Tian-Jun Li, and Jiaping Wang.
**Financial Support**: We have funding to defray workshop expenses for a number of participants, with highest preference given to younger scientists (grad students, postdocs, young faculty at most five years after Ph.D.), although all active people are eligible. Women and minorities are especially encouraged to apply. Apply to the organizers at email: yamabe@math.umn.edu.
**Deadlines**: July 15, 2004, for full consideration for funding and for guaranteed hotel rooms.
**Information**: http://www.math.umn.edu/yamabe/.

18–20 **Workshop on Harmonic Analysis and Number Theory**, University of Exeter, Exeter, United Kingdom. (Jun/Jul. 2004, p. 686)
**Organizers**: Nigel Byott and Anton Deitmar.
**Speakers**: D. Bump, K. Buzzard, S. deBacker, M. Harris, G. Henniart, W. Hoffmann, R. Langlands, C. Moeglin, W. Mueller, F. Murnaghan.
**Information**: email: a.h.j.deitmar@ex.ac.uk.

19–22 **The First International Conference on Complex Systems CSIMTA 2004 (Complex Systems Intelligence and Modern Technology Applications)**, Cherbourg, France. (Oct. 2003, p. 1129)
**Aim**: The aim of this conference is to create an interdiciplinary forum for all scientists concerning complexity.
**Information**: http://www.chbg.unicaen.fr/lusac/csimta.

19–25 **7th Volterra-CIRM International School Quantum Probability and Spectral Analysis on Large Graphs**, Grand Hotel Bellavista, Levico Terme, Trento, Italy. (Aug. 2004, p. 830)
**Scientific Organizers**: L. Accardi (Roma II), A. Hora (Okayama), N. Obata (Tohoku).
**Information**: email: michelet@science.unitn.it; http://www.science.unitn.it/cirm/.

20–22 **Workshop on Elliptic Curve Cryptograpy**, Ruhr University, Bochum, Germany. (Mar. 2004, p. 360)
**Description**: ECC 2004 is the eighth in a series of annual workshops dedicated to the study of elliptic curve cryptography and related areas.
**Main Themes**: The discrete logarithm problem, efficient parameter generation and point counting, provably secure cryptographic protocols, efficient software and hardware implementation, side-channel attacks, deployment of elliptic curve cryptography.
**Goal**: It is hoped that the meeting will continue to encourage and stimulate further research on the security and implementation of elliptic curve cryptosystems and related areas, and encourage collaboration between mathematicians, computer scientists, and engineers in the academic, industry, and government sectors. There will be approximately 15 invited lectures (and no contributed talks), with the remaining time used for informal discussions. There will be both survey lectures as well as lectures on the latest research developments.
**Information**: http://www.cacr.math.uwaterloo.ca/conferences/2004/ecc2004/announcement.html.

22 **DIMACS Working Group on Reticulated Evolution**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Aug. 2004, p. 830)
**Sponsor**: DIMACS.
**Organizers**: Mel Janowitz, DIMACS, email: melj@dimacs.rutgers.edu; Randy Linder, University of Texas, email: rlinder@mail.utexas.edu; Bernard Moret, University of New Mexico, email: moret@cs.unm.edu.
**Short Description**: Species evolution has long been modeled as a branching process that can uniquely be represented by a tree topology. In such a topology, each species can only be linked to its closest ancestor, while interspecies relationships such as species hybridization or lateral gene transfer in bacteria are not allowed. With the advent of phylogenetic analysis at the molecular level, there is increasing evidence that such a model is inadequate. This workshop will explore the history and latest status of these new models of "reticulate evolution" and will be coupled with a smaller working group meeting designed to explore promising avenues for future research.
**Deadlines**: Main speakers are by invitation only. Workshop participants may submit papers by contacting one of the organizers no later than August 1, 2004.
**Information**: http://dimacs.rutgers.edu/Workshops/Reticulated/.

20–24 **2004 IEEE/WIC/ACM International Conference on Web Intelligence (WI'04)**, King Wing Hot Spring Hotel, Beijing, China. (Mar. 2004, p. 361)
**Sponsors**: IEEE Computer Society, Web Intelligence Consortium (WIC), Association for Computing Machinery (ACM).
**Information**: http://www.maebashi-it.org/WI04; http://www.comp.hkbu.edu.hk/WI04.

20–24 **12th French-German-Spanish Conference on Optimization**, University of Avignon, Avignon, France. (Jan. 2004, p. 64)
**Description**: This conference is the 12th in the series of French-German meetings which started in Oberwolfach in 1980 and was

continued in Confolant (1981), Luminy (1984), Irsee (1986), Varetz (1988), Lambrecht (1991), Dijon (1994), Trier (1996), Namur (1998), Montpellier (2000), and Cottbus (2002). Since 1998 the conference has been organized under the participation of a third European country. In 2004 the guest country will be Spain. The conference will in particular promote the contacts between researchers of the three involved countries and provide a forum for sharing recent results in theory and applications of optimization. However, scientists from other countries are also encouraged to participate.

**Organizer**: Group of Nonlinear Analysis and Optimization of the University of Avignon.

**Topics**: Smooth and nonsmooth continuous optimization problems, numerical methods for mathematical programming, optimal control and calculus of variations, differential inclusions and set-valued analysis, stochastic optimization, multicriteria optimization, game theory and equilibrium concepts, optimization models in finance and mathematical economics, optimization techniques for industrial applications. Contributions on other issues related to optimization are also welcome.

**Plenary Speakers**: A. Ben-Tal (Israel), E. Carrizosa (Spain), E. Casas (Spain), Lachand-Robert (France), J.-B. Lasserre (France), Y. Nesterov (Belgium), U. Rieder (Germany), R. Tichatschke (Germany), S. Tijs (The Netherlands), F. Troeltzsch (Germany), E. Zuazua (Spain).

**Scientific Committee**: F. Bonnans (France), J.-B. Hiriart-Urruty (France), F. Jarre (Germany), M. Lopez (Spain), J. E. Martinez-Legaz (Spain), H. Maurer (Germany), S. Pickenhain (Germany), A. Seeger (France), M. Thera (France).

**Call for Papers**: Contributions are solicited for presentation at the conference. Each accepted paper will be allotted a 30-minute talk (including discussion). The conference language is English. Besides the title of the proposed contribution, a short abstract (of at most 200 words) is also required. Deadline to propose a contribution is March 25, 2004. Acceptance or refusal notice to authors will be given by April 1, 2004.

**Information**: `http://www.fgs2004.univ-avignon.fr`; contact: A. Seeger (`alberto.seeger@univ-avignon.fr`).

20–24 **Analysis and Applied Mathematics Summer School**, Univ. Roma "La Sapienza", Roma, Italy. (Jun/Jul. 2004, p. 686)

**Organizers**: V. Chiado' Piat (Politecnico di Torino), A. Garroni (Univ. di Roma "La Sapienza",) C. Mantegazza (Scuola Normale Superiore di Pisa).

**Speakers**: Xavier Cabré (ICREA-Univ. Politecnica de Catalunya), Phase Transition Layers, Minimal Surfaces and Ground States; Giovanna Citti (Univ. di Bologna), Real Analysis in Lie Groups and Perceptual Completions; Gianni Dal Maso (SISSA, Trieste), Variational Models in Fracture Mechanics; Barbara Niethammer (Humboldt Univ., Berlin), Averaging Techniques for Models of Phase Transitions.

**Registration**: There is no registration fee, but interested people are requested to register by sending an email to Valeria Chiado' Piat at `valeria.chiadopiat@polito.it`.

**Funds**: Limited funds are available for young researchers to cover accommodations in double rooms. For information, please contact Valeria Chiado' Piat at the address above.

**Information**: Please see `http://cvgmt.sns.it/roma2004`.

20–24 **IMA Tutorial: Mathematics of Materials**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 687)

**Organizers**: M.-C. Calderer (UMN), P. J. Sternberg (Indiana).

**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: `visit@ima.umn.edu`; `http://www.ima.umn.edu/matter/`.

20–24 **The Second International Course of Mathematical Analysis in Andalucia**, Facultad de Ciencias, University of Granada, Granada, Spain. (Jun/Jul. 2004, p. 687)

**Description**: Our aim is to give an extensive overview of new directions and advances in mathematical analysis. Therefore the researcher is invited to get into topics that seem promising as guidelines for current and future research in this interesting area of mathematics. Leading researchers in the field will provide us with a nice variety of topics and open problems, showing also some tools and techniques that have been helpful in similar situations. To this goal, we offer both seminars and one-hour talks. While the one-hour talks are intended to provide an overview on a variety of current topics, the seminars will extend over several days and will therefore allow an in-depth discussion of certain specific subjects.

**Invited Speakers**: Richard M. Aron (Kent State Univ., USA), Fernando Bombal (Univ. Complutense de Madrid, Spain), José Bonet (Univ. Politécnica de Valencia, Spain), Javier Duoandikoetxea (Univ. del País Vasco, Spai), Miguel de Guzmán (Univ. Complutense de Madrid, Spain), Gilles Godefroy (Univ. Paris VI , France), William B. Johnson (Texas A&M Univ., USA), Nigel J. Kalton (Univ. of Missouri, USA), Michael Neumann (Mississippi State Univ., USA), Lawrence Narici (St. John's Univ., New York, USA), Kristian Seip (Norwegian Univ. of Sciences and Technology, Norway), Manuel Valdivia (Univ. de Valencia, Spain), Joan Verdera (Univ. Autónoma de Barcelona, Spain), Felipe Zó (Univ. Nacional de San Luis, Argentina).

**Organizing/Local Committee**: M. Dolores Acosta, Julio Becerra, Antonio Moreno, Antonio Peralta.

**Information**: `http://www.ugr.es/local/amandal`, where one can register on-line, or email: `amandal@ugr.es`.

20–30 **Stochastic Finance 2004 (StochFin2004)**, Coimbra and Lisbon, Portugal. (Mar. 2004, p. 361)

**Description**: StochFin2004 is an abbreviation for the Autumn School & International Conference on Stochastic Finance. The **Autumn School** will take place in Coimbra (Portugal) at the Observatório Astronómico de Coimbra, September 20–24, 2004. It is expected that its audience will consist of graduate students, young researchers, and people related to finance enterprises. The **International Conference** will take place in Lisbon (Portugal) at Instituto Superior de Economia e Gestão (ISEG), September 26–30, 2004.

**Goals**: (1) To present instances of interaction of finance and mathematics by means of a coherent combination of several courses, delivered by specialists in order to stimulate and reinforce the understanding of the subject; (2) to provide an opportunity for graduate students to develop some competence in financial mathematics; (3) to promote the establishment and development of interdisciplinary collaborations between researchers from different areas; (4) to bring together graduate students and specialists either from the academic or business sector, stimulating some interaction between university and business people.

**Information**: `http://pascal.iseg.utl.pt/~stochfin2004/about.html`.

22 **DIMACS Working Group on Reticulated Evolution**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2004, p. 687)

**Short Description**: Species evolution has long been modelled as a branching process that can uniquely be represented by a tree topology. In such a topology, each species can only be linked to its closest ancestor, while interspecies relationships such as species hybridization or lateral gene transfer in bacteria are not allowed. With the advent of phylogenetic analysis at the molecular level, there is increasing evidence that such a model is inadequate. This working group meeting is coupled with a workshop on the same subject. Its goal will be to initiate promising avenues of research designed to explore new models of "reticulate evolution" that are biologically meaningful and computationally feasible. Attendance will be by invitation only.

**Sponsor**: DIMACS.

**Organizers**: Mel Janowitz, DIMACS, email: `melj@dimacs.rutgers.edu`; Randy Linder, University of Texas, email: `rlinder@mail.`

utexas.edu; Bernard Moret, University of New Mexico, email: moret@cs.unm.edu.
**Deadlines**: Participation is by invitation only. If you wish an invitation, please contact one of the organizers.
**Information**: http://dimacs.rutgers.edu/Workshops/Reticulated_WG/.

23–25 **Austrian Workshop on Asset Liability Management in Insurance**, Vienna University of Technology, Vienna, Austria. (Jun/Jul. 2004, p. 687)
**Program**: Professors from universities in Vienna and experts from the industry will give an introductory crash course for those who are not yet experts in the field of asset-liability management for insurance companies, especially with respect to mathematical concepts and methods. This half-day series of lectures is held in German. The second day will feature a range of sessions with experts from the industry in Austria, Germany, and Switzerland. The sessions will be held in English in order to enable non-German speakers to take part in the discussions. The third day will feature sessions with internationally renowned academic researchers in the field of mathematical methods in insurance.
**Organizers**: M. Fulmek (Vienna University/INFORM); T. Hudetz (Financial Market Authority/INFORM); M. Jeckle (Univ. of Applied Sciences BFI Vienna); C. Krischanitz (AVOe, arithmetica); S. Pichler (WU Wien); M. Predota (Austrian Financial Market Authority); W. Schachermayer (FAM@TUWien/INFORM); H. Schicketanz (FJH); U. Schmock (FAM@TU Wien).
**Information**: http://alm.fam.tuwien.ac.at.

27–30 **9th European Conference on Logics in Artificial Intelligence**, Lisbon, Portugal. (Jun/Jul. 2004, p. 688)
**Aim and Scope**: The aim of the 9th European Conference on Logics in Artificial Intelligence, JELIA'04, is to bring together active researchers interested in all aspects concerning the use of logics in artificial intelligence to discuss current research, results, problems, and applications of both a theoretical and practical nature.
**Invited Lecturers**: F. Baader, TU Dresden, Germany; B. Nebel, Univ. Freiburg, Germany; F. Rossi, Univ. of Padova, Italy.
**Information**: Send your questions and comments to email: jelia04@di.fct.unl.pt or http://centria.di.fct.unl.pt/~jelia2004.

27-October 1 **IMA Workshop: Modeling of Soft Matter**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 688)
**Organizers**: M.-C. Calderer (UMN), E. Terentjev (Univ. of Cambridge).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/fall/softmatter.html.

27–October 1 **Recent Advances in Complex and Real Geometry**, Grand Hotel Bellavista, Levico Terme, Trento, Italy. (Aug. 2004, p. 830)
**Scientific Organizers**: V. Ancona (Firenze), P. de Bartolomeis (Firenze), and A. Silva (Roma I).
**Information**: email: michelet@science.unitn.it; http://www.science.unitn.it/cirm/.

27–October 2 **Workshop on Elliptic Cohomology and Its Relation to the Geometry of Loop Spaces**, The Fields Institute, Toronto, Ontario, Canada. (Apr. 2004, p. 460)
**Organizing Committee**: M. Ando (UIUC), H. Miller (MIT), J. Morava (Johns Hopkins).
**Information**: email: abrand@fields.utoronto.ca.

27–October 2 **Workshop on Elliptic Cohomology and Its Relation to the Geometry of Loop Spaces**, The Fields Institute, Toronto, Ontario, Canada. (Apr. 2004, p. 460)
**Organizing Committee**: M. Ando (UIUC), H. Miller (MIT), J. Morava (Johns Hopkins).
**Information**: email: abrand@fields.utoronto.ca.

28–29 **DIMACS Workshop on Applications of Order Theory to Homeland Defense and Computer Security**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Aug. 2004, p. 830)
**Short Description**: The importance of the problem of terrorism can hardly be overstated. Since the Second World War it has become clear that mathematics has an important role to play in securing victory in any global conflict. This workshop will draw renowned international researchers who bring two important fields to bear in the current war on terror: Order Theory and Reflexive Theory.
**Organizers**: Jonathan Farley, MIT; Anthony A. Harkin, Harvard Univ., email: harkin@deas.harvard.edu; Mel Janowitz, DIMACS/Rutgers Univ., email: melj@dimacs.rutgers.edu; Hector Rosario, Univ. of Puerto Rico, email: hrosario@math.uprm.edu; Stefan Schmidt, Physical Science Lab., email: schmidt@psl.nmsu.edu.
**Local Arrangements**: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
**Information**: http://dimacs.rutgers.edu/Workshops/Defense/

28–October 1 **48th Annual Conference of the Australian Mathematical Society**, RMIT University, Melbourne, Australia. (Apr. 2004, p. 460)
**Director**: K. Horadam; email: kathy.horadam@ems.rmit.edu.au.
**Information**: http://www.ma.rmit.edu.au/austms04.

29–30 **CLIMA V: Fifth International Workshop on Computational Logic in Multi-agent Systems**, Lisbon, Portugal. (Aug. 2004, p. 831)
**Purpose**: To discuss techniques, based on computational logic, for representing, programming, and reasoning about multi-agent systems in a formal way.
**Call for Papers**: We solicit unpublished papers that address formal approaches to multi-agent systems. The approaches as well as being formal must make a significant contribution to the practice of multi-agent systems.
**Organizers**: J. Leite, New Univ. of Lisbon, Portugal (jleite@di.fct.unl.pt); P. Torroni, Univ. of Bologna, Italy (ptorroni@deis.unibo.it). Please send program suggestions and inquiries to either of the organizers.
**Submission Instructions**: We welcome and encourage the submission of high-quality, original papers which are not simultaneously submitted for publication elsewhere. Please refer to the workshop webpages for further instructions concerning the submission procedures.
**Important Dates**: Submission of Abstracts: June 20, 2004. Submission of Papers: June 25, 2004. Notification of Acceptance: July 30, 2004. Final version due: September 6, 2004. CLIMA IV: September 29–30, 2004.
**Information**: http://centria.di.fct.unl.pt/~jleite/climaV/index.htm.

30 **DIMACS Working Group on Applications of Order Theory to Homeland Defense and Computer Security**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Aug. 2004, p. 831)
**Short Description**: The importance of the problem of terrorism can hardly be overstated. Since the Second World War it has become clear that mathematics has an important role to play in securing victory in any global conflict. This workshop will draw renowned international researchers who bring two important fields to bear in the current war on terror: Order Theory and Reflexive Theory.
**Organizers**: Jonathan Farley, MIT; Anthony A. Harkin, Harvard Univ., email: harkin@deas.harvard.edu; Mel Janowitz, DIMACS/Rutgers Univ., email: melj@dimacs.rutgers.edu; Hector Rosario, Univ. of Puerto Rico, email: hrosario@math.uprm.edu; Stefan Schmidt, Physical Science Lab., email: schmidt@psl.nmsu.edu.
**Local Arrangements**: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
**Participation**: This working group is by invitation only. Invitations may be obtained by contacting Mel Janowitz, email: melj@dimacs.rutgers.
edu or Hector Rosario, email: hrosario@math.uprm.edu.

**Information**: http://dimacs.rutgers.edu/Workshops/DefenseWG/.

## October 2004

2–6 **Workshop on Algebraic K-Theory 2004**, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada. (Aug. 2004, p. 831)
**Organizers**: Eric Friedlander, Dan Grayson, Rick Jardine, Manfred Kolster.
**Topics**: The topics covered at this meeting include the most recent developments in algebraic K-theory and the closely allied areas of motivic homotopy theory, algebraic cycles, and motivic cohomology theory, along with applications in other areas of mathematics.

4–8 **Mathematical Hydrodynamics: Models and Methods, Dedicated to the 70th Anniversary of Professor V. Yudovich**, Rostov State University, Rostov-on-Don, Russia. (Aug. 2004, p. 831)
**Goal**: The main goal of the conference is mathematical hydrodynamics in a broad context. The scope of the conference includes but is not limited to the following topics.
**Topics**: Mathematical theory of fluid dynamics: solvability and uniqueness; Analytical dynamics and geometric-differential methods in hydrodynamics; Stability of flows for ideal and viscous fluids; Convective flows; Asymptotics in hydrodynamics, Vibrodynamics, Parametric resonance, Boundary layers; Spectral theory in the stability problems of hydrodynamics; Qualitative and numerical methods; Bifurcation analysis, Transitions, Systems with symmetry and cosymmetry; Computer experiment methods and results.
**Organization Committee**: Rostov State Univ.: V. N. Govorukhin, L. G. Kurakin, A. B. Morgulis, M. V. Norkin, V. G. Tsybulin, O. A. Tsyvenkova.
**Information**: Secretary: S. V. Revina; Rostov State University, Mechanical Mathematical Department, Zorge St., 5, Rostov-on-Don, 344090, Russia; email: kvm@math.rsu.ru; phone: (8632)-221312; http://kvm.math.rsu.ru/conf2004/ENGLISH/.

6–9 **HYKE Conference on Complex Flows**, Centre de Recerca Matemàtica, Bellaterra, Italy. (Jun/Jul. 2004, p. 688)
**Organizer**: Centre de Recerca Matemàtica.
**Aim**: The main objective of the conference is to highlight new developments of either a numerical or analytical nature in kinetic and hydrodynamic equations. We would like to foster the interaction with applications, with special sessions devoted to two applications: granular media and astrophysical flows.
**Speakers**: E. Caglioti (Univ. di Roma I, Italy), B. Despres (Univ. Paris VI, France), L. Desvilletes (ENS Cachan, France), F. Filbet (Univ. d'Orléans, France), J. A. Font (Univ. de Valencia, Spain), A. Goldshtein (Technion Haifa, Israel), L. Gosse (IAC Bari, Italy), T. Goudon (Univ. des Sci. et Tech. Lille 1, France), C. Helzel (IAM Bonn, Germany), J. M. Ibáñez (Univ. de Valencia, Spain), P. E. Jabin (ENS Paris, France), K. H. Karlsen (Univ. of Bergen, Norway), D. Levermore (Univ. of Maryland), A. Mangeney (Inst. de Phys. du Globe de Paris, France), J. M. Marti (Univ. de Valencia, Spain), C. Mouhot (ENS Lyons, France), S. Osher (UCLA), T. Poeschel (Humboldt-Univ.-Charité, Germany), S. Rjasanow (Saarland Univ., Germany), G. Russo (Univ. di Catania, Italy), O. Sánchez (Univ. de Granada, Spain), A. Santos (Univ. de Extremadura, Spain), H. J. Schroll (Lund Univ., Sweden), S. Serna (Univ. de Valencia, Spain), B. Sjogreen (KTH Stockholm, Sweden), M. Torrillhon (ETHZ, Switzerland), G. Toscani (Univ. di Pavia, Italy), J. J. L. Velázquez (Univ. Complutense de Madrid, Spain).
**Deadlines**: Application for financial support: June 5, 2004. Title of presentation: June 6, 2004. Registration and payment: June 30, 2004.
**Information**: http://www.crm.es/ComplexFlows; email: ComplexFlows@crm.es.

6–12 **Workshop "Global and Geometric Aspects in Nonlinear PDE"**, Yerevan State University, Yerevan, Armenia. (Jun/Jul. 2004, p. 688)
**Scientific Committee**: L. Caffarelli, P. Markowich, H. Shahgholian.
**Organizing Committee**: A. Hakobyan, M. Poghosyan.
**Tentative List of Speakers**: A. Aftalion (France), I. Athanasopoulos (Greece), H. Berestycki (France), Y. Brenier (France), X. Cabre (Spain), M. Chipot (Switzerland), C. Lederman (Argentina), K. Lee (South Korea), F. Lin (USA), N. Garofalo (USA), F. Hamel (France), R. Monneau (France), L. Nirenberg (USA), S. Osher (USA), S. Salsa (Italy), S. Serfaty (USA), J. Sethian (USA), H. Mete Soner (Turkey), T. Souganidis (USA), N. Trudinger (Australia), N. Uraltseva (Russia), J. Vazquez Suarez (Spain), N. Wolanski (Argentina).
**Deadline**: June 1, 2004.
**Information**: http://math.sci.am; http://www.math.kth.se/~henriksh/armenia04.html; email: mathconf@ysu.am.

7–8 **DIMACS Workshop on Computational Issues in Auction Design**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Apr. 2004, p. 460)
**Description**: Recent advances in information technology and its rapid acceptance by the business community have allowed for expediting complex business transactions. The most prominent example involves use of auctions in corporate procurement and in government deregulation efforts. When many items with interrelated values are being sold, economic efficiency can be increased by allowing bids on combinations of items. Procedures for auctioning combinations of items have inherent computational problems to overcome, and the emergence of these issues has sparked considerable research activity in the computer science and combinatorial optimization communities. The most prominent example is combinatorial auctions in which multiple goods are auctioned and bidders have and wish to express different valuations on which goods complement each other and which goods substitute for each other. Allowing bidders to submit "all-or-nothing" bids for combinations of goods yields NP-complete allocation problems that need to be solved efficiently when proper care is given to designing an auction. Furthermore, bidders face computational and communication problems in combinatorial auctions since they might not be feasibly able to express all possible preferences for all subsets of goods. Another area of auction design that has been developing rapidly in research and in practice is short-term electricity auctions in which allowing bidders to make bids that reflect their nonconvex costs requires solving large mixed integer programming problems and finding prices that support decentralized generation and transmission operations.
**Organizers**: J. Kalagnanam, IBM Watson Lab, email: jayant@us.ibm.com; E. Maskin, Inst. for Advanced Study, email: maskin@ias.edu; D. Parkes, Harvard Univ., email: parkes@eecs.harvard.edu; A. Pekec, Duke Univ., email: pekec@duke.edu; M. Rothkopf, Rutgers Univ., email: rothkopf@rutcor.rutgers.edu.
**Local Arrangements**: M. Mercado, DIMACS Center, mercado@dimacs.rutgers.edu, 732-445-5928.
**Information**: http://dimacs.rutgers.edu/Workshops/AuctionDesign/.

12–15 **3rd WSEAS International Conference on Applied Mathematics and Computer Science (AMCOS 2004)**, Copacabana, Rio de Janeiro, Brazil. (Jun/Jul. 2004, p. 688)
**Information**: http://www.wseas.org.

13–16 **Conference on Automorphic Forms and the Trace Formula, in Honour of James Arthur on the Occasion of His 60th Birthday**, The Fields Institute, Toronto, Ontario, Canada. (Apr. 2004, p. 460)
**Information**: http://www.fields.utoronto.ca/programs/scientific/04-05/arthurconf/.

14–15 **DIMACS Workshop on Cryptography: Theory Meets Practice**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Apr. 2004, p. 460)
**Description**: Recent advances in information technology and its rapid acceptance by the business community have allowed for expediting complex business transactions. The most prominent

example involves use of auctions in corporate procurement and in government deregulation efforts. In addition to the research community, the combinatorial and optimization problems that are involved with auction design and general microeconomic considerations have generated interest from IT businesses such as IBM, industrial users of combinatorial procurement auctions such as Mars, Inc., and government agencies such as the FCC and the FERC-regulated electricity system operators PJM and NYISO (see http://www.pjm.com and http://www.nyiso.com). This workshop will bring together researchers in computer science, optimization, operations research, and economics who are working on computational aspects of auction design. The aim is to discuss the most prominent issues in auction design and try to design implementable and efficient auction procedures that allow for a large preference space while maintaining several desirable properties such as fairness, failure-freeness, and computational feasibility for all participants.
**Organizer**: D. Boneh, Stanford, dabo@cs.stanford.edu.
**Local Arrangements**: M. Mercado, DIMACS Center, mercado@dimacs.rutgers.edu, 732-445-5928.
**Information**: http://dimacs.rutgers.edu/Workshops/Practice/.

14–15 **Seventh New Mexico Analysis Seminar**, University of New Mexico, Albuquerque, New Mexico. (Jun/Jul. 2004, p. 688)
**Description**: The New Mexico Analysis Seminar is a yearly conference that runs between the University of New Mexico and New Mexico State University. The goal of the seminar is to provide an opportunity for scientific exchange and cooperation among broadly defined analysts. The centerpieces of the conference this year will be two workshops led by the keynote speakers.
**Keynote Speakers**: Patricia Bauman, Purdue University, "Analysis of Ginzburg-Landau models with applications to materials"; Luca Capogna, University of Arkansas, "Mean curvature flow in the Heisenberg group and applications".
**Lecturers**: To complement the workshops, four invited one-hour lectures will be featured: Lia Bronsard (McMaster Univ.), Donatella Danielli (Purdue Univ.), Scott Pauls (Darmouth College), and Peter Sternberg (Indiana Univ.).
**Sponsor**: NSF.
**Organizers**: Cristina Pereyra (crisp@math.unm.edu), Joseph Lakey (jlakey@nmsu.edu), Tiziana Giorgi (tgiorgi@nmsu.edu), Adam Sikora (asikora@nmsu.edu), Robert Smits (rsmits@nmsu.edu).
**Information**: http://www.math.unm.edu/colloquia/analysis_seminar.php.

16–17 **AMS Southeastern Section Meeting**, Vanderbilt University, Nashville, Tennessee. (May 2003, p. 604)
**Information**: http://www.ams.org/amsmtgs/sectional.html.

16–17 **AMS Western Section Meeting**, University of New Mexico, Albuquerque, New Mexico. (May 2003, p. 604)
**Information**: http://www.ams.org/amsmtgs/sectional.html.

18–20 **DIMACS/DIMATIA/Renyi Working Group on Extremal Combinatorics II**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Aug. 2004, p. 831)
**Short Description**: This meeting will continue the work of the working group on two general topics: extremal graph theory and extremal problems arising from combinatorial search and testing.
**Participation**: The working group will be by invitation only. If you are interested in participating, please contact the organizers.
**Sponsors**: DIMACS/DIMATIA/Renyi.
**Organizers**: Janos Komlos, Rutgers Univ., komlos@math.rutgers.edu; Endre Szemeredi, Rutgers Univ., szemered@cs.rutgers.edu.
**Local Arrangements**: Maria Mercado, DIMACS Center, mercado@dimacs.rutgers.edu, 732-445-5928.
**Information**: http://dimacs.rutgers.edu/Workshops/Extremal2/.

*21–23 **Wolfram Technology Conference 2004**, Hawthorn Suites, Champaign, Illinois.
**Host**: Wolfram Research, Inc.
**Description**: This intensive three-day event will assemble leaders from around the world in technical computing and other related fields for presentations on the latest advances in Mathematica and other Wolfram technologies. The conference will also feature tutorials, problem-solving clinics, contributed talks, an unscripted programming event, hands-on workshops, a live programming competition, and one-on-one discussion sessions with top Wolfram executives.
**Topics**: Scientific computing, algorithm development, distributed computing, visualization, educational technology, modeling and simulation, experimental mathematics, technical business analysis, web technologies, symbolic document processing, programming methodologies, user interface technology, biocomputing, computer-assisted art.
**Information and Registration**: http://www.wolfram.com/techconf2004.Contact: phone: 1-800-WOLFRAM (965-3726) or +1-217-398-0700; email: conference-info@wolfram.com.

22–23 **Twenty-Fourth Annual Southeastern-Atlantic Regional Conference on Differential Equations** (Aug. 2004, p. 831), University of Tennessee at Chattanooga, Chattanooga, Tennessee.
**Principal Speakers**: Ravi P. Agarwal (Florida Institute of Technology), Recent Trends in Singular Boundary Value Problems for Ordinary Differential Equations; Johnny Henderson (Baylor Univ., Texas), Topological Transversality and Boundary Value Problems on Time Scales; Peter Kuchment (Texas A&M Univ.), Differential Operators on Graphs and Their Applications; David R. Russell (Virginia Tech), Spline Interpolation and Approximation as a Discrete Dynamical System.
**Information**: In addition to the principal speakers, there will also be sessions of twenty-minute contributed talks. Pending funding from the National Science Foundation, travel support funds will be available for advanced graduate students and recent Ph.D. recipients. Women and minority participants are especially encouraged to participate in this conference and to apply for support. Please go to the conference website, http://www.utc.edu/Academic/Mathematics/searcde-04/index.html, to get instructions on registration, lodging, submission of abstracts, and application for support; or send email to Boris-Belinskiy@utc.edu; phone: 423-425-4748.

23–24 **AMS Central Section Meeting**, Northwestern University, Evanston, Illinois. (Feb. 2004, p. 279)
**Information**: http://www.ams.org/amsmtgs/sectional.html.

24–30 **Partial Differential Equations in Mathematical Physics, in Memory of Olga A. Ladyzhenskaya**, Grand Hotel Bellavista, Levico Terme, Trento, Italy. (Aug. 2004, p. 831)
**Scientific Committee**: H. Beirao da Veiga (Pisa), G. Seregin (St. Petersburg), V. Solonnikov (Ferrara), N. Uraltseva (St. Petersburg), A. Valli (Trento).
**Information**: email: michelet@science.unitn.it; http://www.science.unitn.it/cirm/;http://www.science.unitn.it/cirm/Ladylecture.html.

24–31 **The Tenth International Conference in Modern Group Analysis (MOGRAN X)**, Larnaca, Cyprus. (Mar. 2004, p. 361)
**Description**: The aim of the meeting is to bring together leading scientists in group analysis and mathematical modelling. The main emphasis of the conference will be on applications of group methods in investigating nonlinear wave and diffusion phenomena; mathematical models in biology; integrable systems; as well as the classical heritage, historical aspects and new theoretical developments in group analysis. The conference will also highlight educational aspects.
**Organizing Committee**: N. H. Ibragimov, C. Sophocleous, P. A. Damianou.

**Information**: http://www.ucy.ac.cy/~mogran10.

25-29 **IMA Workshop: Singularities in Materials**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 688)
**Organizers**: F. Lin (NYU), J. Rubinstein (Indiana), P. J. Sternberg (Indiana).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/fall/singularities.html.

27-29 **DIMACS/LAMSADE Workshop on Computer Science and Decision Theory**, University Paris Dauphine, France. (Jun/Jul. 2004, p. 689)
**Short Description**: The workshop focuses on modern computer science applications of methods developed by decision theorists, in particular methods involving consensus and associated order relations. The broad outlines concern connections between computer science and decision theory, development of new decision-theory-based methodologies relevant to the scope of modern CS problems, and investigation of their applications to problems of computer science and also to problems of the social sciences which could benefit from new ideas and techniques. For more details see the DIMACS/LAMSADE partnership.
**Main Themes**: Preference modelling, social choice, knowledge extraction, fusion of information, issues involving AI, large databases and inference, computational intractability, of consensus functions, axiomatics: approaches and algorithms for consensus functions, order relations and revealed preferences.
**Sponsor**: DIMACS/LAMSADE PARTNERSHIP, National Science Foundation, and CNRS.
**Organizers**: Mel Janowitz, DIMACS, email: melj@dimacs.rutgers.edu; Fred Roberts, DIMACS, email: froberts@dimacs.rutgers.edu; Alexis Tsoukias, LAMSADE, email: tsoukias@lamsade.dauphine.fr.
**Information**: http://dimacs.rutgers.edu/Workshops/DecisionTheory/.

27-29 **SEM Fall Conference—MEMS**, Sheraton Springfield Hotel, Springfield, Massachusetts. (May 2004, p. 576)
**Organizer**: Society for Experimental Mechanics, Inc., 7 School Street, Bethel, CT 06801.
**Abstracts due**: June 28, 2004.
**Information**: Phone: 203-790-6373; fax 203-790-4472; email: sem@sem1.com; http://www.sem.org.

*30-31 **70th birthday celebration conference in honor of John W. Neuberger**, Environmental Education, Science and Technology (ENV/EESAT) building on the University of North Texas Campus, Dallas-Fort Worth, Texas.
**Information**: Title and abstract deadline October 1, 2004, to Joseph Iaia at email: iaia@unt.edu.

## November 2004

1-4 **ICDM '04: The Fourth IEEE International Conference on Data Mining**, Brighton, United Kingdom. (Mar. 2004, p. 361)
**Topics**: Topics related to the design, analysis, and implementation of data mining theory, systems, and applications are of interest.
**Sponsor**: IEEE Computer Society.
**Deadline**: June 1, 2004.
**Information**: R. Rastogi, Room 2B-301, 700 Mountain Avenue, Murray Hill, NJ 07974; phone: +1-908-582-3728; fax: +1-908-582-1239; email: rastogi@research.bell-labs.com; http://icdm04.cs.uni-dortmund.de.

1-5 **Recent Developments in Spectral Geometry**, Blossin (near Berlin), Germany. (Jun/Jul. 2004, p. 688)
**Description**: The workshop will be devoted to recent aspects in index, scattering, and spectral theory of geometric operators (Laplace, Dirac) on Riemannian manifolds.
**Organizers**: C. Bär (Potsdam), Th. Friedrich (Berlin), D. Schüth (Berlin).
**Invited Lecturers**: W. Ballmann, Bonn; T. Branson, Iowa; U. Bunke, Göttingen; G. Carron, Nantes; J. Dodziuk, New York; R. Mazzeo, Stanford; W. Müller, Bonn; P. Perry, Kentucky; St. Zelditch, Baltimore.
**Information**: http://www-irm.mathematik.hu-berlin.de/~pahlisch/Blossin-2004.html.

3-5 (NEW DATE) **DIMACS Workshop on Mobile and Wireless Security**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2004, p. 689)
**Short Description**: The rapid growth of both voice and data wireless communications has resulted in several serious security problems in both the voice and data spaces. Unfortunately, many of the early security mistakes made with wireless voice communications were repeated with data communications. This workshop will focus on addressing the many outstanding issues that remain in wireless cellular and WLAN networking such as (but not limited to): Management and monitoring, ad hoc trust establishment, secure roaming between overlay networks, availability and denial of service mitigation, and network and link layer security protocols. We will seek to extend work on ad hoc networking from a nonadversarial setting, assuming a trusted environment, to a more realistic setting in which an adversary may attempt to disrupt communication. We will investigate a variety of approaches to securing ad hoc networks, in particular ways to take advantage of their inherent redundancy (multiple routes between nodes), replication, and new cryptographic schemes such as threshold cryptography.
**Organizer**: Bill Arbaugh, University of Maryland, email: waa@cs.umd.edu.
**Local Arrangements**: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
**Information**: http://dimacs.rutgers.edu/Workshops/MobileWireless/.

6-7 **AMS Eastern Section Meeting**, University of Pittsburgh, Pittsburgh, Pennsylvania. (Sept. 2003, p. 1009)
**Information**: G. Alsfeld; email: gma@ams.org; http://www.ams.org/amsmtgs/sectional.html.

7-9 **Constructive Functions Tech-04**, Georgia Institute of Technology, Atlanta, Georgia. (Feb. 2004, p. 1443)
**Description**: The conference, in honour of the sixtieth birthday of Ed Saff, will focus on all areas of constructive function theory, and their applications. In particular, there will be a focus on orthogonal polynomials, potential theory, approximation theory, numerical analysis, wavelets, and Riemann-Hilbert methods.
**Invited Speakers**: S. Aptekarev (Russ. Acad. of Sci.); J. Baik (Ann Arbor, Michigan); L. Baratchart (INRIA, France); W. Dahmen (Aachen, Germany); R. DeVore (Columbia, South Carolina); A. Kuijlaars (Leuven, Belgium); A. Martinez-Finkelshtein (Almeria, Spain); E. Levin (Open Univ., Israel); H. Mhaskar (California State Univ., Los Angeles); I. Pritsker (Stillwater, Oklahoma); A. Ron (Madison, Wisconsin); B. Simon (Caltech); I. Sloan (Univ. of New South Wales, Australia); H. Stahl (TFH, Berlin, Germany); N. Stylianopoulos (Univ. of Cyprus); V. Totik (Bolyai Institute, Hungary); R. Varga (Kent State Univ. ); Y. Xu (Eugene, Oregon).
**Organizing Committee**: L. Baratchart, R. DeVore, J. Geronimo, A. Kroo, X. Li Eli Levin, D. Lubinsky, N. Papamichael, I. Pritsker, S. Ruscheweyh, V. Totik, R. Varga.
**Information**: Preliminary registration can be completed online (without payment) at http://www.math.gatech.edu/news/conferences/at04/.Further information is available there, and will be updated periodically.

8-10 **Models of Financial Market Microstructure**, MIT, Cambridge, Massachusetts. (Aug. 2004, p. 832)

**Program**: This is a special session at the 2nd IASTED International Conference on Financial Engineering and Applications.
**Topics**: The goal of this session is to draw together researchers across disciplinary boundaries whose work and interests span the spectrum from methodological innovations (e.g. agent-based models on evolving interaction networks), empirical investigations (e.g. simulations and statistical analyses of high-frequency transaction data) to policy implications (e.g. optimal design of auctions and related market mechanisms). A unifying theme for the session is the risk management of equity market making and its effects on the global network of financial interactions.
**Organizer**: Ted Theodosopoulos, Drexel Univ.
**Deadlines**: Contributed paper submission: June 28, 2004. Notification of acceptance: July 15, 2004. Final manuscripts due: September 10, 2004. Registration: September 15, 2004.
**Information**: http://www.iasted.org/conferences/2004/cambridge/fea-specsess.htm.

13 **Graph Theory Day 48**, Mount Saint Mary College, Newburgh, New York.
**Invited Speakers**: Jeff Dinitz (University of Vermont), Designing schedules for sports leagues and tournaments; Steven B. Horton (United States Military Academy), Some problems related to domination in graphs.
**Description**: The Program will include time for informal exchange of graph theory information and contributions to a "Graph Theory Notes" Session. Written contributions will be considered for inclusion in "Graph Theory Notes of New York".
**Information**: Mike Daven, email: daven@msmc.edu, 845-569-3265; Lee Fothergill, email: fothergi@msmc.edu, 845-569-3347.
**Organizing Committee**: Mike Daven (MSMC), Lee Fothergill (MSMC), Naomi Russo (Stevens Institute of Technology), John W. Kennedy (Queens College, CUNY), and Louis V. Quintas (Pace University).

14–17 **Multiscale Rheological Models for Fluids**, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada. (Aug. 2004, p. 832)
**Organizer**: C. Le Bris (Cermics, ENPC, Paris).
**Description**: This workshop will address the multiscale modeling of non-Newtonian fluids. Models for such systems could be built via constitutive laws, but those are typically very difficult to obtain and validate rigorously. An alternative strategy is to use kinetic theory to simulate the micro-structures that govern the fluid behaviour. (For polymeric fluids, those micro-structures would be polymer chains; for other fluids, it could be particles in suspension.) One then couples this microscopic description with macroscopic continuum equations for the fluid. This workshop will be an opportunity to discuss recent developments along these lines.

15–17 **5th WSEAS International Conference on Acoustics and Music: Theory and Applications (AMTA 2004)**, Tehran, Iran. (Apr. 2004, p. 461)
**Other Conferences**: Mathematics and Computers in Biology and Chemistry (MCBC'04), Mathematics and Computers in Business and Economics (MCBE'04), Automation & Information (ICAI'04).
**Information**: http://www.wseas.org.

15–17 **Coxeter Lecture Series**, The Fields Institute, Toronto, Ontario, Canada. (Jun/Jul. 2004, p. 689)
**Organizer**: N. Hitchin, Mathematical Institute, Oxford.
**Information**: email: abrand@fields.utoronto.ca.

18–20 **IMA Workshop: Future Challenges in Multiscale Modeling and Simulation**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 689)
**Organizers**: T. Y. Hou (Caltech), M. Luskin (UMN).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/fall/challenges.html.

19–23 **International Conference of Computational Methods in Sciences and Engineering 2004 (ICCMSE 2004)**, Vravrona, Attica, Greece. (Apr. 2004, p. 461)
**Description**: In the past decades many significant insights have been made in several areas of computational methods in sciences and engineering. New problems and methodologies have appeared. There is permanently a need in these fields for the advancement of information exchange. This undoubtedly beneficial practice of interdisciplinary and multidisciplinary interactions should be expressed by an interdisciplinary and multidisciplinary conference on computational methods in sciences and engineering. ICCMSE 2004 aims to play the above role, and for this reason the aim of the conference is to bring together computational scientists and engineers from several disciplines in order to share methods, methodologies, and ideas.
**Information**: Secretary ICCMSE 2004 (E. Ralli-Simou), email: iccmse@uop.gr; 26 Menelaou Street, Amfithea Paleon Faliron, GR-175 64, Athens, Greece; fax: +30210 94 20 091; http://www.uop.gr/~iccmse/.

19–23 **Workshop on Mirror Symmetry**, The Perimeter Institute, Waterloo, Ontario, Canada. (Jun/Jul. 2004, p. 689)
**Organizing Committee**: D. Auroux, M. Gross, K. Hori, N. Yui.
**Information**: email: abrand@fields.utoronto.ca.

24–January 23 **Program Announcement on Nanoscale Material Interfaces: Experiment, Theory and Simulation**, Institute for Mathematical Sciences, National University of Singapore, Singapore. (Aug. 2004, p. 832)
**Program**: This is a program of the Institute for Mathematical Sciences at the National University of Singapore. The main objectives of the program are to (i) review the recent development in the research on material surfaces and interfaces, from experiment to theory to stimulation; (ii) identify critical scientific issues in the understanding of the fundamental principles and basic mechanisms of interfacial dynamics in different kinds of materials systems, particularly those that are characterized by fluctuation, multiscale, and nonequilibrium; and (iii) accelerate the interaction of applied mathematics and computational science with physics and materials science, and promote the highly interdisciplinary research on new material interface problems with emerging applications.
**Activities**: The program will consist of a tutorial and two workshops, with ample opportunities for collaborative research among local and international participants in areas of physics, materials science, applied mathematics, and computational science. The tutorial lectures will be given by distinguished researchers on topics closely related to the main themes of the program in materials physics, computational materials science, and applied mathematics. The first workshop will focus on basic properties of material interfaces in nanoscale systems, while the second workshop will focus more on the mathematical and computational aspects of the underlying researches.
**Registration**: Registration forms for participation in the tutorial or workshop are available at http://www.ims.nus.edu.sg/Programs/nanoscale/index.htm. Completed forms should be received by the institute at least one month before commencement of each activity. Registration is free of charge. Institute membership is not required for participation.
**Institute Membership**: Membership application for visiting the institute under the program is also available from the website above. Members of the Institute do not need to register for specific activities.
**Contacts**: For general enquiries, please email ims@nus.edu.sg, while for enquiries on scientific aspects of the program, please email Jian-Guo Liu at jliu@math.umd.edu. More information about the program is available at the website http://www.ims.nus.edu.sg/Programs/nanoscale/index.htm.

26–29 **Foundations of the Formal Sciences V: Infinite Games**,

Mathematisches Institut, Rheinische Friedrich-Wilhelms-Universität Bonn, Bonn, Germany. (Aug. 2004, p. 832)
**Topics**: Infinite Games in Algebraic Logic, Infinite Games in Higher Set Theory, Infinite Games in Set-Theoretic Topology, Infinite Games & Computer Science, Infinite Games in Philosophy, Infinite Evolutionary Games.
**Invited Speakers**: S. Abramsky (Oxford, UK), A. Andretta (Torino), N. Dobrinen (State College, PA), I. Hodkinson (London, UK), K. Kelly (Pittsburgh, PA), H. Sabourian (Cambridge, UK), M. Scheepers (Boise, ID), B. Skyrms (Irvine, CA).
**Organizers**: Stefan Bold (Bonn/Denton, TX), Boudewijn de Bruin (Amsterdam), Peter Koepke (Bonn), Benedikt Löwe (Amsterdam/Bonn, coordinator), Thoralf Räsch (Potsdam), Johan van Benthem (Amsterdam).
**Deadline**: Submission of Papers: September 15, 2004.
**Information**: `http://www.math.uni-bonn.de/people/fotfs/V/`; email: `fotfs@math.uni-bonn.de`.

*29–December 1 **Partial Differential Equations and Functional Analysis**, Technische Universiteit Delft, Delft, the Netherlands.
**Information**: See `http://fa.its.tudelft.nl/philippe/` for information.

## December 2004

5–16 **International Workshop on Nonlinear Partial Differential Equations**, IPM, Tehran, Iran. (Aug. 2003, p. 850)
**Scope**: New trends and activities in the theory and applications of nonlinear partial differential equations. Topics include free boundary problems, applications of nonlinear pde's in fluids and geometry, inverse problems in pde's, stochastic and kinetic pde's, fully nonlinear pde's.
**Sponsors**: Institute for Studies in Theoretical Physics and Mathematics (IPM) (`http://www.ipm.ir`), Tehran, Iran; Wolfgang Pauli Institute (WPI) (`http://www.wpi.ac.at`), Vienna, Austria.
**Organizers**: P. A. Markowich (WPI), M. Shahshahani (IPM).
**Scientific Committee**: H. W. Engl (Linz, Austria), P. A. Markowich (WPI, Vienna), H. Shahgholian (KTH, Sweden), M. M. Shahshahani (IPM, Tehran), S. Tahvildarzadeh (Rutgers, USA), N. Uraltseva (St. Petersburg, Russia).
**Call for Papers**: Papers will be accepted for presentation at the workshop subject to approval by the Scientific Committee. Please send submissions (extended abstract) electronically (preferably in PDF format) to one of the organizers at an email address listed below.
**Contact**: M. M. Shahshahani (`mehrdads@ipm.ir`); P. A. Markowich (`wittgenstein.mathematik@univie.ac.at`).

6–10 **III Joint Meeting Japan-Mexico in Topology and Its Applications**, Oaxaca, Mexico. (Jun/Jul. 2004, p. 690)
**Description**: The purpose of this international meeting is to gather topologists from around the world. All areas of topology will be covered. This is the third in a series of meetings organized by Japanese and Mexican topologists. The first one took place in Morelia, Mexico, in July 1999, and the second one in Matsue, Japan, in June 2002. The academic program of the conference will consist of 11 plenary lectures, invited talks, and contributed talks. We encourage all participants to present contributed talks in parallel sections.
**Organizing Committee**: Mexican Committee: Chairman: M. Eudave-Munoz (IMUNAM), D. Juan-Pineda (Algebraic Topology, IMUNAM-Morelia), S. Antonyan (Geometric Topology, Fac. Ciencias, UNAM), V. Nunez (Knot Theory, CIMAT), M. Hrusak (Set-Theory, IMUNAM-Morelia), S. Garcia-Ferreira (Set-Theoretic Topology, IMUNAM-Morelia), and I. Puga (Continuum Theory, Fac. Ciencias, UNAM). Japanese Committee: Chairman: A. Kono (Kyoto Univ.), N. Iwase (Algebraic Topology, Kyushu Univ.), A. Koyama (Geometric Topology, Osaka Kyoiku Univ.), A. Kawauchi (Knot Theory, Osaka City Univ.), S. Kamo (Set-Theory, Osaka Prefecture Univ.) and T. Nogura (Set-Theoretic Topology, Ehime Univ.).
**Main Speakers**: M. Asaoka (Kyoto Univ.), R. Cauty (Univ. de Paris VI, Pierre et Marie Curie), A. Dranishnikov (Univ. of Florida at Gainesville), J. Gonzalez (CINVESTAV), A. Illanes (IMUNAM), S. Kamada (Hiroshima Univ.), Y. Kamiyama (Ryukyu Univ. of Japan), K. Yamazaki (Tsukuba Univ.), M. Neumann-Coto (IMUNAM), M. G. Tkachenko (Univ. Autonoma Metropolitana-Iz).
**Information**: `http://www.cimat.mx/~victor/jamex`. There you will be able to register, submit an abstract, and find updated information about the conference; or email: `jamex@matmor.unam.mx`.

6–10 **Compact Moduli Spaces and Birational Geometry**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 690)
**Topics**: This workshop, sponsored by AIM and the NSF, will be devoted to the study of compact moduli spaces, especially those inspired by the minimal model program. Perhaps the first example is the Deligne/Mumford compactification of the moduli space of stable curves, where the limiting curves are dictated by the structure of canonical models for surfaces fibered over curves. This was extended to surfaces by Kolár/Shepherd-Barron and Alexeev, which led to work of Corti, Hacking, Tevelev/Keel, Alexeev, and others, where birational geometry inspired the choice of limiting objects and sometimes played a role in constructing moduli spaces.
**Goals**: The main goals of this workshop are: to promote cross-fertilization by bringing together specialists in birational geometry and moduli theory; to make the techniques of the field more widely known and accessible; and to identify concrete, tractable questions for young researchers entering the area.
**Organizers**: Brendan Hassett and Sándor Kovács.
**Deadline**: September 6, 2004.
**Information**: `http://aimath.org/ARCC/workshops/birational.html`.

9–11 **Discrete Mathematics and Its Applications**, Amrita Vishwa Vidyapeetham, Ettimadai, Coimbatore, Tamil Nadu, India. (Aug. 2004, p. 832)
**Description**: Discrete mathematics is a vibrant branch of the mathematical sciences in both theory and its applications. Its application areas include pure and applied mathematics such as computational algebra, number theory, graphs and combinatorial optimisation, coding theory, cryptography, topology, geometry, as well as biology. Probabilistic coding theory, efficient representations of elements of finite fields for VLSI design of cryptographic hardware, and the study of properties of various nonlinear pseudorandom number generators are some of the emerging interdisciplinary areas which are posing new challenges to discrete mathematicians.
**Some Themes**: Discrete mathematics, graph theory, coding theory, cryptology.
**Cosponsor**: Ramanujan Mathematical Society.
**Invited Speakers**: B. D. Acharya (Advisor, DST), R. Balakrishnan (Bharathidasan Univ.), R. Balasubramanian (Matscience), Bimal Roy (ISI Kolkata), S. A. Choudam (IIT Chennai), K. D. Joshi (IIT Bombay), Navin Singhi (TIFR), C. Pandu Rangan (IIT Chennai), K. R. Parthasarathi (IIT Chennai), S. B. Rao (ISI Kolkata), E. Sampathkumar (Univ. of Mysore), R. K. Shyam Sundar (TIFR), B. Sundar Rajan (IISc), T. Thrivikraman (Cochin Univ. of Sci. & Tech., and C. E. Veni Madhavan (IISc).
**Important Dates**: Submission of abstracts: August 15, 2004; Notification of decision: September 15, 2004; Receipt of full papers: November 15, 2004.
**Contact**: M. Sethumadhavan, Organising Secretary, National Conference on Discrete Mathematics and Its Applications, Department of Mathematics, Amrita Institute of Technology, Amrita Vishwa Vidyapeetham, Ettimadai, Coimbatore-641 105, Tamil Nadu, India; email: `dma@amrita.edu`; `http://www.amrita.edu`.

13–17 **The 9th Asian Technology Conference in Mathematics (ATCM2004)**, National Institute of Education, Singapore. (Apr. 2004,

p. 461)
**Program**: This annual conference will cover a broad range of topics on the application and use of technology in mathematics research and teaching. Researchers, mathematicians, educators, and teachers are invited to share their knowledge in the area of using technology to engage learners and empower teachers of mathematics or to enable research in any field of mathematics.
**Organizers**: National Institute of Education, Singapore; ATCM Inc.
**Deadlines**: Submission of abstracts: June 15, 2004. Submission of full papers: July 15, 2004. Early-bird registration: October 15, 2004.
**Information**: http://math.nie.edu.sg/atcm or http://www.atcminc.com; email: atcm2004@nie.edu.sg or wyang@radford.edu.

13–17 **Recent Advances in Core Model Theory**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 690)
**Organizers**: John Steel and Ernest Schimmerling.
**Topics**: This workshop, sponsored by AIM and the NSF, will be devoted to important recent results in core model theory due to Hugh Woodin, results whose proofs are not widely known and have not been published. One of these is Woodin's refutation of the Cofinal Branches Hypothesis (CBH). Another is his identification of HOD computed inside a model of AD+ with a new kind of inner model constructed from extenders and iteration strategies.
**Lecturer**: Hugh Woodin has agreed to be the primary lecturer. John Steel and possibly one or two others will exposit parts of Hugh Woodin's work or the material on which it rests. We hope that the wider dissemination of these developments will lead to further advances in one of the central programs in pure set theory: extending inner model theory to stronger large cardinal hypotheses.
**Deadline**: September 13, 2004.
**Information**: http://aimath.org/ARCC/workshops/coremodel.html.

13–18 **Joint Conference: The 2004 NZIMA Conference in Combinatorics and Its Applications and The 29th Australasian Conference in Combinatorial Mathematics and Combinatorial Computing (29th ACCMCC)**, Copthornes-Manuels, Lake Taupo, New Zealand. (Jun/Jul. 2004, p. 690)
**Topics**: Graph Theory, Matroid Theory, Design Theory, Coding Theory, Enumerative Combinatorics, Combinatorial Optimization, Combinatorial Computing and Theoretical Computer Science, Combinatorial Matrix Theory.
**Organizing Committee**: NZIMA: Paul Bonnington, email: p.bonnington@auckland.ac.nz; Geoff Whittle, email: geoff.whittle@vuw.ac.nz. ACCMCC: Brendan McKay, email: bdm@cs.anu.edu.au; Ian Wanless, email: imw@cs.anu.edu.au.
**Plenary Speakers**: Dan Archdeacon (Univ. of Vermont), Richard Brualdi (Univ. of Wisconsin), Darryn Bryant (Univ. of Queensland), Peter Cameron (Queen Mary, Univ. of London), Bruno Courcelle (Bordeaux Univ.), Catherine Greenhill (Univ. of New South Wales), Bojan Mohar (Univ. of Ljubljana), Bruce Richter (Univ. of Waterloo), Neil Robertson (Ohio State Univ.), Paul Seymour (Princeton Univ.), Robin Thomas (Georgia Inst. of Tech.), Carsten Thomassen (Tech. Univ. of Denmark), Mark Watkins (Univ. of Syracuse), Dominic Welsh (Oxford Univ.).
**Registration Deadline**: November 14, 2004.
**Information**: Visit http://www.nzima.auckland.ac.nz/combinatorics/conference.html.

15–17 **Arithmetic, Geometry and Topology, Conference on the Occasion of Larry Breen's Sixtieth Birthday**, Institut Galilée, Université Paris 13, France. (Jun/Jul. 2004, p. 690)
**Information**: http://www-math.univ-paris13.fr/~lb2004/.

16–19 **International Conference on History and Heritage of Mathematical Sciences**, Govt. Model Autonomous Holkar Science College, Indore, India. (Jun/Jul. 2004, p. 690)
**Focus**: The conference will cover all aspects of the history of mathematical sciences, including mathematics, statistics, operations research, and computer science. In particular the conference will focus on the following areas: General Histories, Source Books and Biographies of Mathematicians; Mathematics and Indigenous Cultures of the World; Ancient Indian Mathematics; Jaina Mathematics; The Origin of Mathematics; Mathematics in 15th to 18th Centuries, Renaissance; 19th and 20th Centuries Mathematics and Mathematical Sciences; History of Mathematics as A Subject in Educational Curricula; Future Prospects. The academic sessions will consist of invited plenary talks and contributed paper presentations.
**Organizers**: The Indian Society for History of Mathematics; Govt. Model Autonomous Holkar Science College, Indore; Kundakunda Jnanapitha, Indore, and other institutions.
**Call for Papers**: Papers covering topics pertaining to the above areas are invited for the conference. Authors are requested to submit the full version of their papers in publishable form by October 1, 2004, along with the abstract. The proceedings of the conference will be published.
**Information**: email: bsyadav@indianshm.com (program, talks, papers); email: anupamjain3@rediffmail.com or kundkund@sancharnet.in (registration, accommodations, etc.).

17–19 **4th WSEAS International Conference on Signal Processing, Computational Geometry & Artificial Vision (ISCGAV'04)**, Puerto De La Cruz, Tenerife, Canary Islands, Spain. (Jun/Jul. 2004, p. 691)
**Other Conference**: Systems Theory and Scientific Computation (ISTASC'04).
**Information**: http://www.wseas.org.

17–19 **International Conference on Smarandache Algebraic Structures**, Indian Institute of Technology, IIT Madras, Chennai, Tamil Nadu, India. (Aug. 2003, p. 850)
**Description**: A Smarandache $n$-structure on a set $S$ means a weak structure $w_0$ on $S$ such that there exists a chain of proper subsets $P_{n-1} \subset P_{n-2} \subset \ldots \subset P_2 \subset P_1 \subset S$ whose corresponding structures verify the inverse chain $w_{n-1} \succ w_{n-2} \succ \ldots \succ w_2 \succ w_1 \succ w_0$, where $\succ$ signifies "strictly stronger" (i.e., structure satisfying more axioms).
**Program**: (1) Smarandache-type groupoids, semigroups, rings, fields; (2) Smarandache-type k-modules, vector spaces, linear algebra, fuzzy algebra.
**Organizer**: W. B. Vasantha Kandasamy.
**Speakers**: R. Padilla, M. Khoshnevisan, M. Popescu.
**Deadline**: November 30, 2004.
**Information**: http://www.gallup.unm.edu/~smarandache/eBooks-otherformats.htm.

17–22 **The Third International Congress of Chinese Mathematicians**, The Chinese Univ. of Hong Kong, Shatin, Hong Kong, P. R. China. (Dec. 2003, p. 1443)
**Description**: The triennial Congress is hosted by institutions in Mainland China, Taiwan, Hong Kong, and Singapore in a rotating basis. The first two ICCM's were held in 1998 and 2001 with great success.
This third congress, ICCM 2004, will have both plenary and invited talks by distinguished researchers in every major fields, as well as contributed talks and poster sessions. Contributed papers on all major areas of mathematics are solicited. To make the congress a true worldwide gathering, all presentations will be given in English.
**Information**: ICCM2004, Department of Mathematics. Chinese University of Hong Kong , Shatin, NT, Hong Kong, fax: (852) 2603-5154; tel: (852) 2609-7989; email: iccm2004@math.cuhk.edu.hk; http://www.math.cuhk.edu.hk/conference/iccm2004.

18–20 **Recent Advances in Mathematics & Its Applications (ISRAMA 2004)**, Kolkata (Calcutta), India. (Jun/Jul. 2004, p. 691)
**Topics**: Algebra, Discrete Mathematics & Theoretical Computer Science; Analysis & Topology and their Applications; Geometry and its Applications; Dynamical Systems, Chaos and Fractals; Continuum Mechanics; Plasma Physics; Control Theory and Optimization Theory; Bio-mechanics; Applications of Mathematics to Environmental

Problems; History and Philosophy of Physical Science; Quantum Information Theory; Relativity and Its Applications.
**Information**: Prof. M. R. Adhikari, Secretary, Calcutta Mathematical Society, AE-374, Sector-1, Salt Lake City, India; email: cms@cal2.vsnl.net.in.

20–23 **Sharp Thresholds for Mixing Times**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 691)
**Topics**: This workshop, sponsored by AIM and the NSF, will address basic questions about the mixing times of Markov chains. The mixing times of Markov chains are fundamental parameters that encode key geometric information about the chain and at the same time have a wide variety of applications. In the last twenty years, computer scientists and probabilists have brought new perspectives and methods to this study. By bringing together experts on a variety of different techniques, we hope that perhaps some of them can be combined or modified to obtain the necessary insights into the problems.
**Organizers**: Amir Dembo, Yuval Peres, and David Revelle.
**Deadline**: September 20, 2004.
**Information**:http://aimath.org/ARCC/workshops/mixingtimes.html.

29–31 **6th WSEAS International Conference on Mathematical Methods and Computational Techniques in Electrical Engineering (MMACTEE 2004)**, Vouliagmeni, Athens, Greece. (Jun/Jul. 2004, p. 691)
**Other Conferences**: Nonlinear Analysis, Nonlinear Systems and Chaos (NOLASC 2004), Wavelet Analysis and Multirate Systems (WAMUS 2004).
**Information**: http://www.wseas.org.

## January 2005

5–8 **Joint Mathematics Meetings**, Hyatt Regency Atlanta & Atlanta Marriott Marquis, Atlanta, Georgia. (Sept. 2002, p. 1001)
**Information**: http://www.ams.org/amsmtgs/national.html.

7–8 **2004–05 ASL Winter Meeting (with Joint Mathematics Meetings)**, Atlanta, Georgia. (Jun/Jul. 2004, p. 691)
**Program Committee**: R. Jin, A. Kanamori (chair), and A. Shlapentokh.
**Deadline**: Abstracts: September 17, 2004 at the ASL Business Office.
**Information**: email: asl@vassar.edu.

8–15 **Geometry: Interactions with Algebra and Analysis**, Napier, New Zealand. (May 2004, p. 576)
**Sponsor**: The New Zealand Institute of Mathematics. It will run from January-June, 2005.
**Topics**: Discrete groups; Algebraic groups; Geometric group theory. Low-dimensional topology and hyperbolic geometry; Geometric function theory; Analysis and PDEs.
**Speakers**: B. Andrews (Canberra), C. Evans (Berkeley), M. Liebeck (Imperial College), A. Lubotzky (Jerusalem), P. Sarnak (Princeton).
**Organizers**: E. O'Brien, email: obrien@math.auckland.ac.nz; G. Martin, email: martin@math.auckland.ac.nz.
**Information**: http://www.math.auckland.ac.nz/Conferences/2005/geometry-program/.

9–11 **2005 Hawaii International Conference on Statistics, Mathematics and Related Fields**, Sheraton, Waikiki Hotel, Honolulu, Hawaii. (Aug. 2004, p. 832)
**Topic Areas**: All areas of statistics and/or mathematics are invited. For more information about submissions, see http://www.hicstatistics.org/cfp_stats05.htm.
**Sponsors**: American Statistical Association, Hawaii Chapter; East West Council for Education; Center of Asian Pacific Studies of Peking Univ.
**information**: email: statistics@hicstatistics.org; http://www.hicstatistics.org/index05.htm.

10–14 **Braid Groups, Clusters and Free Probability**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 691)
**Topics**: This workshop, sponsored by AIM and the NSF, will be devoted to deciphering the mysterious connections between the following objects: Garside monoid structures for Coxeter and braid groups, and the associated "lattices of noncrossing partitions"; the cluster algebras of Fomin and Zelevinsky, and the associated polytopes known as "generalized associahedra"; ad-nilpotent ideals within Borel subalgebras of semisimple Lie algebras or, equivalently, subsets of pairwise incomparable positive roots.
**Organizers**: Jon McCammond, Alexandru Nica, and Victor Reiner.
**Deadline**: October 10, 2004.
**Information**:http://aimath.org/ARCC/workshops/braidgroups.html.

10–14 **Workshop on Topological Strings**, The Fields Institute, Toronto, Ontario, Canada. (Apr. 2004, p. 461)
**Topics**: Emphasis on Gromov-Witten invariants and open-closed duality.
**Organizing Committee**: E. Getzler, K. Hori, S. Katz.
**Information**: email: abrand@fields.utoronto.ca.

12–14 **Second Joint IMS/ISBA International Conference**, Bormio, Italy (Italian Alps). (Aug. 2004, p. 833)
**Program**: A central theme of the conference will be Markov chain Monte Carlo (MCMC) and related methods and applications in the 15 years since the publication of Gelfand and Smith (1990, JASA), the paper that introduced these methods to mainstream statisticians. The conference will also feature 3 plenary speakers and 6 invited sessions from internationally known experts covering a broad array of current and developing statistical practice: molecular biology, spatial and spatiotemporal methods, bio-informatics/genetics, MCMC algorithms/software, statistical data mining, modern nonparametrics.
**Information**: http://www.eco.uninsubria.it/IMS-ISBA-05/.

17–July 15 **Model Theory and Applications to Algebra and Analysis**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Apr. 2003, p. 500)
**Description**: **Pure model theory**. We expect further developments in the use of stability theory techniques in unstable contexts (simple theories, algebraically closed valued fields) and in nonelementary classes.
**Model theory of fields with operators, and connections with arithmetic geometry**. The model theory of differentially closed fields and of other fields with operators has been at the centre of model-theoretic proofs of results in arithmetic geometry. The Zil'ber programme of pseudo-analytic functions is also expected to have some interesting consequences.
**O-minimality and related topics**. O-minimality is a property of ordered structures, yielding results akin to traditional real analytic results, such as the classical finiteness theorems for subanalytic sets (cell decompositions, Whitney stratifications, etc.). Mathematically central, new examples of o-minimal structures have emerged, and the logical theory has had applications to Lie theory, to asymptotics, and to neural networks.
**Henselian fields**. Model theory of Henselian fields, and in particular of $p$-adic fields and Arc spaces. Connections with algebraic and analytic geometry. Study of cohomology theories and motives, aiming at uniformity results. Study of compact complex manifolds and uses of stability.
**Model theory of groups**. We plan to have a workshop on groups of finite Morley rank, a topic connected to the classification of finite simple groups via its techniques and its aims. The recent (and very exciting) developments in the model theory of nonabelian free groups should also be studied, depending on its degree of maturity.
**Organizers**: Z. Chatzidakis (Paris), A. Pillay (Illinois), A. Wilkie (Oxford).

**Information**: Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 OEH UK; tel: +44 (0) 1223 335999; fax: +44 (0) 1223 330508; email: info@newton.com.ac.uk; http://www.newton.cam.ac.uk/.

24–July 22 **Developments in Quantitative Finance**, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK. (Aug. 2004, p. 833)
**Description**: The field of mathematical finance is comparatively young, and the modern theory can be traced back to the Black-Scholes-Merton solution of the problem of how to price a call option, a financial security whose payoff is contingent on the behaviour of an underlying asset. Over the past three decades the explosive growth in trading of financial derivatives has been reflected in a commensurate growth in the study of financial mathematics, which in turn has helped to support the increasing sophistication of financial markets.

As a branch of mathematics, finance is extremely diverse, and the subject has attracted the interest of, and generated research problems for, researchers from a broad spectrum of mathematical disciplines. The theory is based on stochastic models, and there are obvious applications from statistical analysis, but there have also been significant contributions from functional and convex analysis. There are also strong connections with numerical analysis and computational methods, not least because many of the equations which arise have long been studied by applied mathematicians. The healthy development of the subject also needs input from economists and industry professionals.

The major themes of this programme are asset price modelling and inference for financial models, market imperfections and derivative pricing in incomplete markets, insurance applications and the modelling and quantification of credit events, computational finance, and financial economics and agent interactions. The aim is that researchers from all related disciplines—from economics, physics, and finance, as well as pure and applied mathematics and statistics—should meet and interact to share their knowledge and advance their understanding.
**Organizers**: D. Duffie (Stanford), D. Hobson (Bath), C. Rogers (Cambridge), J. Scheinkman (Princeton).
**Information**: Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk; http://www.newton.cam.ac.uk/programmes/DQF/.

26–30 **Front Propagation and Nonlinear Stochastic PDEs for Combustion and Other Applications**, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada. (Aug. 2004, p. 833)
**Organizers**: A. Bourlioux (Montréal) and P. Souganidis (Texas).
**Description**: The development of efficient large-scale models for the numerical simulation of turbulent premixed flames requires a good understanding of the mathematical principles governing the dynamics of self-propagating fronts. One of the most challenging issues is the analysis of the complex interactions, at small scales, between advection, reaction and diffusion, including stochastic effects due to the media or the advective flow randomness. This workshop will be an opportunity for interaction between mathematicians at the forefront of this area and scientists involved in the design of models and numerical methods for various applications, in particular, turbulent combustion.

27–29 **IMAC-XXIII Preconference Courses**, Rosen Plaza Hotel, Orlando, Florida. (May 2004, p. 576)
**Topics**: Modal Analysis: Theory, & Application, Nonlinear Systems Techniques & Application.
**Organizer**: Society for Experimental Mechanics, Inc., 7 School Street, Bethel, CT 06801.
**Information**: phone: 203-790-6373; fax 203-790-4472; email: sem@sem1.com; http://www.sem.org.

31–February 3 **IMAC-XXIII: A Conference on Structural Dynamics**, Rosen Plaza Hotel, Orlando, Florida. (May 2004, p. 576)
**Organizer**: Society for Experimental Mechanics, Inc., 7 School Street, Bethel, CT 06801.
**Deadline**: Abstracts due: June 14, 2004.
**Information**: phone: 203-790-6373; fax 203-790-4472; email: sem@sem1.com; http://www.sem.org.

## February 2005

3–4 (NEW DATE) **DIMACS Workshop on Markets as Predictive Devices (Information Markets)**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2004, p. 691)
**Description**: For decades economists have studied an astonishing "side effect" of financial and wagering markets: their ability to serve as highly accurate forecasting devices. This workshop aims to explore the use of markets as a substitute for, or complement to, more traditional forecasting tools. We will examine how information flows from traders to the market and back again, how market mechanisms process information, how market prices communicate information and forecasts, and what mechanisms best foster accurate and statistically testable predictions. The workshop will bring together researchers and practitioners from a variety of relevant fields, including economics, finance, computer science, and statistics, in both academia and industry, to discuss the state of the art today and the challenges and prospects for tomorrow. As part of the workshop, one or more tutorials are planned for the benefit of students and other newcomers to the field; little or no background knowledge will be assumed.
**Organizers**: R. Hanson, George Mason Univ., email: rhanson@gmu.edu; J. Ledyard, Calif. Inst. of Tech., email: jledyard@hss.caltech.edu; D. Pennock, Overture Services, email: David.Pennock@overture.com.
**Local Arrangements**: M. Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.
**Information**: http://dimacs.rutgers.edu/Workshops/Markets/.

7–9 **IMA Tutorial/Workshop: Where Mathematics Meets Industry**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 691)
**Organizers**: G. Milton (Utah).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/.

14–18 **Geometry: Interactions with Algebra and Analysis**, University of Auckland, Auckland, New Zealand. (May 2004, p. 576)
**Sponsor**: The New Zealand Institute of Mathematics. It will run at The University of Auckland from January-June, 2005.
**Topics**: (1) Discrete groups; (2) Algebraic groups; (3) Geometric group theory.
**Speakers**: Marston Conder (Auckland), Rob Howlett (Sydney), William Kantor (Oregon), Laci Kovacs (Canberra), Gus Lehrer (Sydney), Martin Liebeck (Imperial College), Gunter Malle (Kassel), Colin Maclachlan (Aberdeen), Chuck Miller (Melbourne), Cheryl Praeger (University of Western Australia), Peter Schmid (Tuebingen), Akos Seress (Ohio State University), Aner Shalev (Jerusalem).
**Organizers**: E. O'Brien, email: obrien@math.auckland.ac.nz; G. Martin, email: martin@math.auckland.ac.nz.
**Information**: http://www.math.auckland.ac.nz/Conferences/2005/geometry-program/.

15–17 **International Symposium on Stochastic Models in Reliability, Safety, Security and Logistics (SMRSSL'05)**, Negev Academic College of Engineering (NACE), Beer Sheva, Israel. (Apr. 2004, p. 461)
**Description**: The SMRSSL'05 will serve as a forum for discussing different issues of stochastic models and methods in reliability, safety, security and logistics with respect to their applications. The

idea of this symposium is to assemble researchers and practitioners from universities, institutions, industries and government working in these fields all over the world. Common methods and models used in reliability, safety, security and logistics will be considered from a general point of view. Theoretical, modeling, computational and case study contributions will range from academic considerations to industrial applications. There will be invited talks, plenary sessions, parallel sessions, posters, and exhibitions. The symposium will pose an opportunity to Ph.D. students to participate and present their works. The talks will be selected by the Scientific Program Committee and will be included in the symposium proceedings. Selected papers after review and revision will be published in special issues of *International Journal of Reliability, Quality and Safety Engineering, Journal of Air Transportation, Transport and Telecommunication, Computer Modeling and New Technologies, Technological and Economic Development of Economy, and Communications in Dependability and Quality Management.*

**Information**: I. B. Frenkel, Industrial Engineering and Management Department, Negev Academic College of Engineering (NACE), Bialik/Bazel Sts., P.O. Box 45, Beer Sheva, 84100, Israel; tel: +972-8-6475642; fax: +972-8-6475643; email: SMRSSL05@nace.ac.il; http://www.nace.ac.il/extra/SMRSSL05/.

## March 2005

1–2 **DIMACS Short Course: A Field Guide to GenBank and NCBI Molecular Biology Resources**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2004, p. 692)

**Short Description**: The National Center for Biotechnology Information (NCBI) presents "A Field Guide to GenBank and NCBI Molecular Biology Resources", a lecture and hands-on computer workshop on GenBank and related databases covering effective use of the Entrez databases and search service, the BLAST similarity search engine, genome data and related resources. Further information about NCBI may be found at http://www.ncbi.nlm.nih.gov.

**Sponsors**: The National Center for Biotechnology Information, the Department of Genetics at Rutgers University, DIMACS, and the BIOMAPS Institute for Quantitative Biology.

**Organizers**: Paul Ehrlich, BIOMAPS Institute, email: pehrlich@biomaps.rutgers.edu; Mel Janowitz, DIMACS, email: melj@dimacs.rutgers.edu; Tara Matise, Rutgers University, email: matise@biology.rutgers.edu.

**Local Arrangements**: Maria Mercado, DIMACS Center, email: mercado@dimacs.rutgers.edu, 732-445-5928.

**Information**: http://dimacs.rutgers.edu/Workshops/NCBI/.

2–5 **Representing Unresolved Degrees of Freedom for the Atmosphere and Ocean**, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada. (Aug. 2004, p. 833)

**Organizer**: A. J. Majda (Courant).

**Description**: A central problem in attempts to understand and predict the evolution of atmospheric or oceanic flows is how best to represent the unresolved scales in these flows. In the jargon of dynamic meteorology or physical oceanography, this is called the parameterization problem, while in the jargon of turbulence it is called the closure problem. The most pertinent areas of analysis and applied mathematics are homogenization theory, probability, and nonlinear stochastic PDEs. The purpose of this workshop is to explore two complementary issues that arise in the context of the parameterization problem: (1) the extent to which modern techniques in applied mathematics can be brought to bear on its formulation and partial solution, and (2) the extent to which problems in the representation of atmospheric and oceanic flows create fertile new areas of mathematical inquiry.

*3–5 **International Conference on Environmental Fluid Mechanics (ICEFM'05)**, Indian Institute of Technology Guwahati, Guwahati, India.

**Program**: Program will include three/four key-note addresses, invited talks, contributed paper presentation, poster session.

**Deadlines**: Extended Abstract Submission: September 15, 2004; Notification of Acceptance: October 15, 2004; Submission of Camera-ready Full Paper: November 30, 2004; Acceptance of Papers after Revision: January 15, 2005; Registration: December 20, 2004; Late Registration: January 15, 2005.

**Conference Topics**: Atmospheric and oceanic flows; Flow over complex terrains, e.g. hills, wind breaks etc.; Two and multiphase flows; Flow in porous media; Flow in continental water bodies, e.g. lakes, rivers, reservoirs etc.; and any other topic related to environmental fluid mechanics.

**Organizers**: D. C. Dalal, S. N. Bora.

**Information**: http://www.iitg.ernet.in/scifac/maths/public_html/conference/index.htm.

7–9 **DIMACS Working Group on Order Theoretic Aspects of Epidemiology**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2004, p. 692)

**Short Description**: Many practical epidemiological problems involve the comparison of one or more quantities. Most often the quantities are rates or proportions leading to a measure of effect or association, but they may also involve distances, exposure categories, job titles, etc. Often the actual values in question are not important, only whether one value is smaller than or larger than a second, i.e., their order. This working group will study how fundamental order-theoretic concepts of TCS and DM such as semiorders, interval orders, general partial orders, and lattices can be used to improve the results of epidemiological investigations. We will give epidemiological concepts a careful definition in the language of partial orders and explore the use of visualization of order-theoretic concepts in epidemiologic studies. The latter will involve issues such as how best to visualize a poset through clever presentation of its Hasse diagram, an issue of great interest in the field of TCS known as graph drawing.

**Sponsor**: DIMACS.

**Organizers**: David Ozonoff, Boston University, email: dozonoff@bu.edu; Melvin Janowitz, Rutgers University, email: melj@dimacs.rutgers.edu; Fred Roberts, Rutgers University, email: froberts@dimacs.rutgers.edu.

**Information**: http://dimacs.rutgers.edu/Workshops/WGOrder/.

7–11 **Third International Conference on Pattern Avoiding Permutations**, University of Florida, Gainesville, Florida. (Jun/Jul. 2004, p. 692)

**Organizer**: Miklos Bona, email: bona@math.ufl.edu.

**Deadline**: For submitting 6-page extended abstracts: December 1, 2004.

**Keynote Speaker**: Doron Zeilberger (Rutgers University).

**Information**: email: bona@math.ufl.edu.

18–19 **AMS Southeastern Section Meeting**, Western Kentucky University, Bowling Green, Kentucky. (May 2004, p. 576)

**Information**: http://www.ams.org/amsmtgs/sectional.html.

19–22 **2005 ASL Annual Meeting**, Stanford, California. (Jun/Jul. 2004, p. 692)

**Program Committee**: J. Mitchell, M. Rathjen, S. Shapiro, R. Solomon, P. Speissegger, and J. Steel (chair).

**Organizing Committee**: A. Arana, S. Feferman, G. Mints, J. Mitchell, and R. Sommer (chair).

**Information**: email: asl@vassar.edu.

*21–25 **Extensions of Hilbert's Tenth Problem**, AIM Research Conference Center, Palo Alto, California.

**Workshop topics**: This workshop, sponsored by AIM and the NSF, will be devoted to extensions of Hilbert's Tenth Problem and related questions in Number Theory and Geometry. The main topics for the workshop are

1. HTP over rings and fields of algebraic numbers (in particular HTP over rational numbers, Mazur's Conjectures, elliptic curve methods)

2. HTP over function fields of arbitrary characteristic, elementary equivalence versus isomorphism problem for function fields.

3. HTP for rings and fields of meromorphic functions (both complex and p-adic).

**Organizers**: Bjorn Poonen, Alexandra Shlapentokh, Xavier Vidaux, and Karim Zahidi.
**Deadline**: November 1, 2004.
**Information**: http://aimath.org/ARCC/workshops/hilberts10th.html.

21–25 **Workshop on N=1 Compactifications**, The Fields Institute, Toronto, Ontario, Canada. (Mar. 2004, p. 361)
**Organizers**: M. Douglas, K. Hori, S. Sethi.
**Information**: email: abrand@fields.utoronto.ca.

24–27 **Geometric Representation Theory**, University of Arizona, Tucson, Arizona. (Aug. 2004, p. 833)
**Goal**: To gather leading specialists in representation theory as well as beginning researchers and advanced graduate students to create a forum where participants can exchange new ideas, communicate recent advances, and assist younger participants in developing successful research strategies. Women and minority participants are especially encouraged to apply.
**Principal Speakers**: S. Evens (Notre Dame), D. Gaitsgory (Chicago), V. Ginzburg (Chicago, TBC), S. Kumar (North Carolina), J. Millson (Maryland), I. Mirkovic (Amherst), K. Vilonen (Northwestern), D. Vogan (MIT).
**Organizing Committee**: P. Bressler, P. Foth, and K. Joshi (all from Arizona).
**Information**: http://math.arizona.edu/~foth/grt.html.

28–30 **IMA Tutorial/Workshop: New Paradigms in Computation**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 692)
**Organizer**: R. V. Kohn (NYU).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/spring/paradigms.html.

28–April 1 **Generalized Kostka Polynomials**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 692)
**Topics**: This workshop, sponsored by AIM and the NSF, concerns Kostka polynomials and their connections to various areas of mathematics. Kostka polynomials and their generalizations have arisen in numerous ways, such as in the context of symmetric functions, combinatorics, representation theory, quantum groups and crystal bases, statistical mechanics, algebraic geometry, and Kazhdan-Lusztig theory. The goal of this workshop is to bring together mathematicians who have studied Kostka polynomials from different points of view, state the various connections and open conjectures, and work towards their proofs.
**Organizers**: M. Kleber, A. Schilling, and M. Vazirani.
**Deadline for Applications**: January 28, 2005.
**Information**: http://aimath.org/ARCC/workshops/kostka.html.

28–April 1 **Workshop on String Phenomenology**, The Perimeter Institute, Waterloo, Ontario, Canada. (Apr. 2004, p. 461)
**Organizers**: J. Louis, R. Myers, G. Shiu.
**Information**: email: abrand@fields.utoronto.ca.

## April 2005

1–July 8 **Special Semester on "Modern Methods of Time-Frequency Analysis"**, Erwin Schroedinger Institute (ESI) for Mathematical Physics, Vienna, Austria. (Apr. 2004, p. 461)
**Description**: The special semester will bring together 100 scientists from mathematics, engineering, and physics to explore new directions in time-frequency analysis. The ESI offers an ideal environment for research and interaction. In addition, the program will contain four specialized workshops and a big conference on "Progress in Time-Frequency Analysis" (May 23–28, 2005).
**Main Topics**: (a) Non-orthogonal expansions and representation theory, (b) Combined phase space methods: Between Gabor and wavelets, (c) Non-linear approximation theory and computational harmonic analysis, (d) Time-frequency methods and pseudodifferential operators.
**Organizers**: H. G. Feichtinger (Univ. of Vienna), K. Groechenig (GSF Research Center, Munich), J. J. Benedetto (Univ. of Maryland).
**Information**: http://www.univie.ac.at/NuHAG/ESI05, http://www.esi.ac.at; email: hans.feichtinger@univie.ac.at, email: karlheinz.groechenig@gsf.de.

2–3 **AMS Eastern Section Meeting**, University of Delaware, Newark, Delaware. (May 2004, p. 576)
**Information**: http://www.ams.org/amsmtgs/sectional.html.

6–10 **Extracting Macroscopic Information from Molecular Dynamics**, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada.
**Organizers**: P. F. Tupper (McGill), A. M. Stuart (Warwick).
**Description**: Models used in molecular dynamics are high-dimensional dynamical systems (or stochastic dynamical systems) with multiple time-scales. A major challenge for computational mathematics is the extraction of accurate macroscopic information at minimal cost. This workshop will concentrate on two topics: (1) the analysis and development of standard time-stepping algorithms in the context of molecular dynamics, with the purpose of the indirect calculation of macroscopic information; and (2) the design of new algorithms aimed at extracting macroscopic information directly.

8–10 **AMS Central Section Meeting**, Texas Tech University, Lubbock, Texas. (May 2004, p. 576)
**Information**: http://www.ams.org/amsmtgs/sectional.html.

11–15 **IMA Workshop: Atomic Motion to Macroscopic Models: The Problem of Disparate Temporal and Spatial Scales in Matter**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 692)
**Organizers**: R. D. James (UMN), M. Luskin (UMN), J. Maddocks (Swiss Fed. Inst. of Tech.), C. Schütte (Freie Univ. Berlin).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/spring/atomic.html.

14–15 **DIMACS Workshop on Intellectual Property Protection**, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Jun/Jul. 2004, p. 692)
**Short Description**: We have reached the point where there is enough bandwidth on the Internet and enough computing and storage power on client machines that most digital goods can be easily shared and utilized by many. Peer-to-peer networks make it easy for users to find music and other files and to download them from a nearby computer. Existing copyright laws developed to deal with exchanges that are based on physical media or paper are evolving to laws dealing with electronic exchanges, but these laws need to be developed in tandem with new technologies for digital rights management. Technologies for protecting intellectual property have been developed in the research community, but no perfect solution exists. There is need to develop such technologies that reflect both protection of the rights holder and the "public good" resulting from exchange of ideas. This workshop aims to explore the problem of protecting soft goods and managing digital rights. A major goal is to explore the limits of what can be

accomplished in software and to consider the minimal hardware required for solutions to work.
**Sponsor**: DIMACS.
**Organizers**: D. Dean, SRI Internat., email: ddean@csl.sri.com; M. Jakobsson, RSA Labs, email: mjakobsson@rsasecurity.com.
**Information**: http://dimacs.rutgers.edu/Workshops/Intellectual/.

16-17 **AMS Western Section Meeting**, University of California, Santa Barbara, California. (May 2004, p. 576)
**Information**: http://www.ams.org/amsmtgs/sectional.html.

18-July 13 **Time at Work**, Institut Henri Poincaré, Paris, France. (Aug. 2004, p. 833)
**Description**: A trimester on asymptotic properties of dynamical systems courses, minicourses, lectures throughout the trimester; also a one-week workshop on each of the main topics (details on http://www.math.jussieu.fr/~baladi/ihp.html): extended systems, Hamiltonian systems, SRB measures and their asymptotic properties, dynamical zeta functions, and quantum chaos.
**Organizers**: V. Baladi, J. Bricmont, P. Collet, F. Ledrappier, and C. Liverani.
**Information**: http://www.ihp.jussieu.fr.

27-May 1 **Multiscale Modeling in Solids**, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada. (Aug. 2004, p. 834)
**Organizers**: Weinan E (Princeton), E. Vanden-Eijnden (Courant).
**Description**: This workshop will focus on energetic and kinetic issues associated with defects, cross-slip, grain boundary migration, and phase boundary dynamics in solids. The objective is to develop mathematical models for complex multiscale phenomena such as crystal plasticity, nucleation and reconstruction of stepped surfaces, and the behaviour of nano-materials in general.

*28-30 **Barrett Lectures: New Developments in Nonlinear Partial Differential Equations**, University of Tennessee, Knoxville, Tennessee.
**Program**: Invited lectures.
**Principal Speaker**: Sergiu Klainerman (Princeton).
**Organizers**: Grozdena Todorova todorova@math.utk.edu, Jochen Denzler denzler@math.utk.edu.
**Information**: http://www.math.utk.edu/barrett/.

## May 2005

2-6 **IMA Workshop: Experiments in Physical Biology, Part I**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 693)
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/spring/biology.html.

2-6 **Workshop on Gravitational Aspects of String Theory**, The Fields Institute, Toronto, Ontario, Canada. (Apr. 2004, p. 461)
**Organizers**: C. Johnson, P. Kraus, D. Marolf, A. Peet.
**Information**: email: abrand@fields.utoronto.ca.

6-9 **Statistical Inferences on Shape Manifolds**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 693)
**Topics**: This workshop, sponsored by AIM and the NSF, will be devoted to algorithmic and computational shape analysis. It will bring together researchers in the field of shape analysis to identify and discuss outstanding issues in algorithmic shape representation, statistical inferences on shape manifolds, and applications to areas such as medical imaging, homeland security, and military target recognition. Algorithmic shape analysis has a multidisciplinary nature, so the workshop will seek to promote interaction and foster the development of new collaborations among researchers with expertise in mathematics, statistics, and image analysis.
**Deadline**: February 6, 2005.
**Information**: Visit http://aimath.org/ARCC/workshops/shapemanifolds.html.

11-15 **Integrative Multiscale Modeling and Simulation in Materials Science, Fluids and Environmental Science**, Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada. (Aug. 2004, p. 834)
**Organizer**: T. Y. Hou (Caltech).
**Description**: Multiscale modeling and simulation have already impacted many scientific and engineering disciplines. Numerous developments have been scattered in various disciplines, and there is a great need to integrate isolated efforts. This workshop will recapitulate previous activities, focus on the interdisciplinary interaction among these related fields, and try to develop new tools that combine mathematical analysis, multiscale modeling, and computational analysis in an integrative way.

14-15 **Conference in Honor of Heydar Radjavi's 70th Birthday**, Hotel Golf, Bled, Slovenia. (Aug. 2004, p. 834)
**Motivation**: The conference will consist of invited and contributed talks related to Heydar Radjavi's work. Radjavi's many important contributions to linear algebra and to operator theory include his seminal characterization of self-commutators of operators on Hilbert space and his definitive trace condition for simultaneous triangularizability of semigroups of matrices, which was the culmination of work on this topic by several generations of distinguished algebraists. Heydar has obtained numerous other results of broad interest on invariant subspaces, simultaneous triangularizability, products of involutions, semigroups of matrices, and many other topics. As he approaches 70, his research productivity is increasing with his age. It is hoped that this conference will reflect the breadth and influence of his research.
**Deadline**: Those interested in attending should register by January 15, 2005.
**Organizers**: M. Brešar, L. Grunenfelder, T. Košir, M. Omladič, P. Rosenthal, P. Šemrl.
**Invited Speaker**: P. Rosenthal.
**Invited Participants**: E. A. Azoff (USA), R. Bhatia (India), P. Binding (Canada), L. Grunenfelder (Canada), R. Guralnick (USA), D. Hadwin (USA), J. Holbrook (Canada), T. J. Laffey (Ireland), C. K. Li (USA), L. Livshits (USA), R. Loewy (Israel), V. Lomonosov (Canada), G. MacDonald (Canada), B. Mathes (USA), M. Mathieu (Germany), R. Meshulam (Israel), V. Muller (Czech Republic), J. Okninski (Poland), M. Radjabalipour (Iran), H. Radjavi (Canada), L. Rodman (USA), B. A. Sethuraman (USA), V. Shulman (Russia), A. Sourour (Canada), Y. Turovskii (Azerbaijan), J. Zemanek (Poland).
**Information**: http://www.law05.si/hrc/.
**Secretary of the Conference**: Damjana Kokol Bukovšek, Institute of Mathematics, Physics and Mechanics, Jadranska 19, 1000 Ljubljana, Slovenia; phone: +386-1-476-65-50, fax: +386-1-251-72-81, email: Damjana.Kokol@FMF.Uni-Lj.SI.

15-21 **ICMI Study 15: The Professional Education and Development of Teachers of Mathematics**, Águas de Lindóia, São Paulo, Brazil. (Jun/Jul. 2004, p. 693)
**Scope and Purpose**: The premise of this study, the fifteenth to be organized by the International Commission on Mathematical Instruction (ICMI), is that the education and continued development of teachers is key to students' opportunities to learn mathematics. What teachers of mathematics know, care about, and do is a product of their experiences and socialization, both prior to and after entering teaching, together with the impact of their professional education. The study focuses on the initial and continuing education of teachers of mathematics at the primary and secondary levels. It is organized in two main strands: Teacher Preparation Programs and the Early Years of Teaching; and Professional Learning for and

in Practice. The study conference will be a working meeting, where every participant will be expected to be active, and participation is by invitation only, based on submitted proposals. The Program Committee welcomes contributions from individuals from a variety of backgrounds, including mathematicians, teacher educators, and school practitioners.
**Program Committee**: Deborah Loewenberg Ball, email: dball@umich.edu (USA), and Ruhama Even, email: ruhama.even@weizmann.ac.il (Israel), cochairs; Romulo Lins, email: romlins@rc.unesp.br (Brazil), chair; Jo Boaler (USA), Chris Breen (South Africa), Frédéric Gourdeau (Canada), Marja van den Heuvel-Panhuizen (Netherlands), Barbara Jaworski (Norway), Gilah Leder (Australia), Shiqi Li (China), João Filipe Matos (Portugal), Hiroshi Murata (Japan), Jarmila Novotna (Czech Republic), Aline Robert (France), Bernard R. Hodgson (Canada), and Hyman Bass (USA), ex officio, ICMI Executive Committee.
**Deadline for Submissions**: October 15, 2004.
**Information**: http://www-personal.umich.edu/~dball/icmistudy15.html.

16–20 **IMA Workshop: Experiments in Physical Biology, Part II**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 693)
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/spring/biology.html.

17–20 **Graph Theory with Altitude**, University of Colorado at Denver, Denver, Colorado. (Jun/Jul. 2004, p. 693)
**Description**: Graph theory conference in honor of Joan P. Hutchinson on the occasion of her 60th birthday.
**Topics**: Chromatic and topological graph theory, visibility graphs, graph algorithms, and combinatorics.
**Organizers**: Ellen Gethner, Mike Jacobson, Arta Doci, and John Clark.
**Plenary Speakers**: Mike Albertson, Fan Chung, Ron Graham, Carsten Thomassen, Doug West, Sue Whitesides, and Herb Wilf.
**Information**: http://carbon.cudenver.edu/~egethner/JoanHutchinson60.html.

*19–21 **CTS Conference on Combinatorics and Its Applications in Honor of Frank K. Hwang's 65th Birthday**, National Chiao Tung University (NCTU), Hsin Chu, Taiwan.
**Sponsoring Organization**: National Center of Theoretical Sciences (CTS), Hsin Chu, Taiwan; http://math.cts.nthu.edu.tw/Mathematics/index.html.
**Organizers**: Chiu-Yuan Chen (NCTU), email: cychen@math.nctu.edu.tw; Ding-Zhu Du (Univ. of Minnesota), email: ddu@nsf.gov; Hung-Lin Fu (NCTU) email: hlfu@math.nctu.edu.tw.
**Program Committee**: Hung-Lin Fu (NCTU, chair), Gerard J. Chang (NTU, co-chair), Chiu-Yuan Chen (NCTU), Ding-Zhu Du (Univ. of Minnesota), Chin-Mei K. Fu (Tamkang Univ.), Hua-Ming Huang (NCU), Tayuan Huang(NCTU), Ko-Wei Lih(Acadernia Sinica), Chi-Wen Weng (NCTU), Xuding Zhu (NSYSU).
**Invited Speakers**: Bela Bollobas (The University of Memphis), Gerard J. Chang (National Taiwan University), Chin-Sui Cheng (Academia Sinica), Charles Colbourn (Arizona St. University), Ding-Zhu Du (University of Minnesota), Genhua Fan (Foochou University), Fan Chung Graham (University of California at San Diego), Jerry Griggs (University of South Carolina), Chris Rodger (Auburn University), Uri Rothblum (Technion University), Neal Sloane (Bell Labs), Joel Spencer (Courant Institute).
**Information**: http://www.math.nctu.edu.tw.

## June 2005

1–5 **Stochastic Modeling in Financial Mathematics** (joint with SAMSI), Centre de Recherches Mathématiques, Université de Montréal, Montréal, Québec, Canada. (Aug. 2004, p. 834)
**Organizers**: R. Sircar (Princeton), J.-P. Fouque (North Carolina State).
**Description**: The theme of this workshop is emerging directions in financial mathematics, with emphasis on stochastic modeling of market uncertainties, theoretical and numerical approximations to pricing, hedging and portfolio optimization control problems, and data estimation issues. The goal is to bring together researchers in a variety of disciplines (mathematics, engineering, operations research, and economics, for example) to emphasize different techniques and approaches.

6–8 **SEM Annual Conference & Exposition on Experimental and Applied Mechanics**, Marriott Portland Downtown, Portland, Oregon. (May 2004, p. 576)
**Organizer**: Society for Experimental Mechanics, Inc., 7 School Street, Bethel, CT 06801.
**Deadline**: Abstracts due: October 15, 2004.
**Information**: Phone: 203-790-6373; fax 203-790-4472; email: sem@sem1.com; http://www.sem.org.

6–10 **Moduli Spaces of Properly Embedded Minimal Surfaces**, AIM Research Conference Center, Palo Alto, California. (Jun/Jul. 2004, p. 693)
**Topics**: This workshop, sponsored by AIM and the NSF, will be devoted to advancing the understanding of properly embedded minimal surfaces in three-space, a subject whose roots go back to Euler and Lagrange. New examples discovered in an explosion of activity in the 1980s have gradually focused the subject on the problem of classification. Recently, several new approaches and techniques have been developed which together begin to suggest that it might be possible to organize these examples into families and indeed to describe the structure of the space of properly embedded minimal surfaces. This workshop will be tightly focused on a few specific questions which are fundamental for this classification effort. These problems are linked to a confluence of attention from mathematicians with different points of view and by the prospect that real progress might be made by approaches using several different methods simultaneously.
**Organizers**: Michael Wolf, David Hoffman, and Matthias Weber.
**Deadline**: March 6, 2005 .
**Information**: Visit http://aimath.org/ARCC/workshops/minimalsurfaces.html.

8–11 **IMA Workshop: Effective Theories for Materials and Macromolecules**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 693)
**Organizers**: Weinan E (Princeton), R. D. James (UMN), R. V. Kohn (NYU), C. Le Bris (ENPC), M. Luskin (UMN).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/matter/spring/theories.html.

*12–24 **Foliations 2005**, Lodz, Poland.
**Desription**: The conference is the fourth in a series devoted to the theory of foliations. The previous three took place in 1990 (Lodz), 1995 and 2000 (Warszawa, both). The main purpose of the conference is to interchange new ideas in all aspects of foliation theory and related topics: contact and symplectic structures, confoliations, Engel and Goursat structures, groups and pseudogroups of action on manifolds, holonomy groups and pseudogroups of foliations etc.
**Format**: 2 mini-courses, invited lectures and contributed talks.
**Invited speakers**: V. Kaimanovich (mini-course), S. Matsumoto (mini-course), J. Alvarez Lopez, M. Asaoka, S. Fenley, V. Grines, X. Gomes Mont, J. Heitsch, Y. Kordyukov, H. Minakawa, K. Richardson, E. Zhuzhoma. Confirmation of speakers is in progress, see the conference web site http://fol2005.math.uni.lodz.pl.
**Organizers**: Katedra Geometrii Uniwersytetu Lodzkiego (Lodz), Banach Centre (Warszawa).

**Organizing Committee**: S. Hurder (Chicago), R. Langevin (Dijon), T. Tsuboi (Tokyo), P. Walczak (Lodz) and M. Czarnecki (Lodz)–secretary.
**Grants**: Several EU grants for young mathematicians will probably be available.
**Information**: http://fol2005.math.uni.logz.pl; email: fol2005@math.uni.lodz.pl.

13–18 **Computational Methods and Function Theory (CMFT 2005)**, Joensuu, Finland. (Feb. 2004, p. 279)
**Description**: The general theme of the meeting concerns various aspects of interaction of complex variables and scientific computation, including related topics from function theory, approximation theory, and numerical analysis.
**Program**: The program consists of invited one-hour lectures, invited and contributed 25-minute talks, and poster sessions.
**Organizing Committee**: St. Ruscheweyh (Würzburg), E. B. Saff (Nashville), O. Martio (Helsinki), and I. Laine (Joensuu).
**Remark**: Limited funds available for partial support of travel/local expenses of participants from developing countries.
**Contact**: email: cmft@joensuu.fi.
**Information**: http://www.joensuu.fi/cmft/.

13–25 **CIMPA Summer School AGAHF 2005—Arithmetic and Geometry around Hypergeometric Functions**, Galatasaray University, Ortakoy, Istanbul, Turkey. (Aug. 2004, p. 834)
**Objectives**: The aim of the school is the presentation of hot topics in the field in a form accessible to research students, and revival of the interest in the field by highlighting possible new research directions. There will be minicourses on hypergeometric differential equations and related topics, such as discrete groups in the automorphism groups of complex balls, ball quotients, orbifolds and corresponding moduli problems of algebraic geometry.
**Organizers**: Ceyhan (MPIfM, Bonn), L. Chaumard (GSU, Istanbul), Ozgur Kisisel (METU, Ankara) A. M. Uludag (GSU, Istanbul), A. Ulus (GSU, Istanbul).
**Scientific Advisory Board**: F. Hirzebruch, R.P. Holzapfel, M. Yoshida, E. Looijenga, M. Jambu, L. D. Trang, P. Cohen, I. Dolgachev, S. Kondo.
**Registration**: October 2004–March 2005.
**Information**: Details will soon be available on the website of the school, which is under preparation.

16–19 **Second Joint International Meeting with the Deutsche Mathematiker-Vereinigung (DMV) and the Oesterreichische Mathematische Gesellschaft (OMG)**, Mainz, Germany. (May 2004, p. 576)
**Information**: http://www.ams.org/amsmtgs/internmtgs.html.

20–24 **Second Conference on Self-Similarity and Applications**, INSA Toulouse, Toulouse, France. (Aug. 2004, p. 834)
**Scientific Committee**: M. Ledoux, A. Benassi, A. Estrade, P. Flandrin, J. Istas, S. Jaffard, J. Lévy-Véhel, M. Taqqu.
**Information**: http://www.lsp.ups-tlse.fr/Autosim05/indexa.html.

20–25 **Asymptotic and Probabilistic Methods in Geometric Group Theory**, Geneva, Switzerland. (Jun/Jul. 2004, p. 693)
**Organizers**: Goulnara N. Arzhantseva, Laurent Bartholdi, Alexander Yu. Ol'shanskii, Mark Sapir, and Efim Zelmanov.
**Invited Speakers**: Werner Ballmann (RFWU, Bonn), Mladen Bestvina (Utah), Marc Burger (ETH, Zürich), Peter Buser (EPFL, Lausanne), Jim Cannon (Utah), Mikhael Gromov (IHES, Paris), Pierre de la Harpe (Geneva), David Kazhdan (HUJI, Jerusalem), Alex Lubotzky (HUJI, Jerusalem) Grigori Margulis (Yale), Shahar Mozes (HUJI, Jerusalem).
**Information**: http://mad.epfl.ch/apg/.

20–August 15 **Computational Prospects of Infinity**, Institute for Mathematical Sciences, National University of Singapore, Singapore. (Jun/Jul. 2004, p. 693)
**Program**: This two-month program will focus on recent developments in set theory and recursion theory, which are two main branches of mathematical logic. Topics for set theory will include issues related to Cantor's Continuum Hypothesis (CH), with special attention paid to the importance of the conjecture, while topics for recursion theory will include recursive enumerability and randomness.
**Organizing Committee**: Cochairs: Chi Tat Chong (National Univ. of Singapore), Qi Feng (National Univ. of Singapore and Chinese Acad. of Sci., China), Theodore A. Slaman (Univ. of California at Berkeley), and W. Hugh Woodin (Univ. of California at Berkeley).
**Activities**: The program will consist of two tutorials and seminars. The tutorials will provide background material on topics such as $\Omega$-logic, fine structure, recursive enumerability, and effective randomness. Seminars on recent and up-to-date results related to the core themes of the programs will also be conducted.
**Registration**: Registration forms for participation in the tutorials are available at http://www.ims.nus.edu.sg/Programs/infinity/index.htm. Completed forms should be received by the institute at least one month before commencement of each activity. Registration is free of charge. Institute membership is not required for participation.
**Information**: For general enquiries, please email ims@nus.edu.sg, while for enquiries on scientific aspects of the program, please email Qi Feng at matfq@nus.edu.sg. More information about the program is available at http://www.ims.nus.edu.sg/Programs/infinity/index.htm.

21–24 **MAM 5—Fifth International Conference on Matrix Analytic Methods in Stochastic Models**, Pisa, Italy.
**Scope**: The conference will provide an international forum for: presenting recent results on theory, algorithms and applications concerning matrix-analytic methods in stochastic models; discussing methodologies and the related algorithmic analysis; improving collaborations among researchers in applied probability, engineering and numerical analysis; tracing the current state of the art and the lines of future research, pointing out the main topics of interest.
**Organizing Committee**: D. A. Bini (chair), Univ. of Pisa, Italy; G. Latouche, Univ. Libre de Bruxelles, Belgium; and B. Meini, Univ. of Pisa, Italy.
**Important Dates**: Full paper submission: September 13, 2004; Notification of acceptance/revision/rejection: January 10, 2005; Revised version due: March 14, 2005; Final notification for papers with delayed decision: April 4, 2005.
**Information**: http://www.dm.unipi.it/~mam5; email: mam5@dm.unipi.it.

26–July 1 **ERLOGOL-2005: Intermediate Problems of Model Theory and Universal Algebra**, State Technical University/Mathematics Institute, Novosibirsk, Russia. (Jun/Jul. 2004, p. 694)
**Organizers**: Algebra department of Novosibirsk State Technical University and Mathematics Institute of Russian Academy of Sciences.
**Information**: Information about previous meetings is on the following sites: 1995–2001: http://www2.nstu.ru/deps/algebra/erlogol/; 2003: http://www.nstu.ru/science/conf/erlogol-2003. Pay attention to the http://www2 in the first address! You may send email to: algebra@nstu.ru, ponom@online.sinor.ru, knp1958@yahoo.com.

26–July 1 **30th Conference on Stochastic Processes and Their Applications**, University of California at Santa Barbara (UCSB), Santa Barbara, California. (Jun/Jul. 2004, p. 694)
**Information**: http://www.pstat.ucsb.edu/projects/spa05/.

## July 2005

2–7 **SRTL-4: The Fourth International Research Forum on Statistical Reasoning, Thinking, and Literacy**, The University of Auckland, Auckland, New Zealand. (Jun/Jul. 2004, p. 694)

**Theme**: Reasoning about Distribution.
**Deadline**: Submission of Interest deadline: June 1, 2004.
**Information**: Maxine Pfannkuch, Department of Statistics, The University of Auckland, New Zealand; phone: 64 9 373 7599; ext. 88794; fax: 64 9 373 7018; email: m.pfannkuch@auckland.ac.nz; or see http://www.stat.auckland.ac.nz/srtl4/.

*3–9 **XXIVièmes Journées Arithmétiques**, Marseilles, France.
**Topics**: All branches of Number Theory.
**Invited Talks**: 12 plenary talks Contributed Talks: All participants are invited to present a contributed talk (20 minutes).
**Organizers**: Pierre Liardet, Stephane Louboutin; email: ja2005@cmi.univ-mrs.fr.
**Scientific Committee**: Christine Bachoc, Univ. de Bordeaux 1; Jean Marc Couveignes, Univ. Toulouse II; John Friedlander , Univ. of Toronto at Scarborough; Laurent Habsieger, Univ. Claude Bernard Lyon 1; Yuri V. Nesterenko, Moscow State Univ.; Damien Roy, Univ. of Ottawa; Imre Ruzsa, Hungarian Acad. of Sci.; Per Salberger, Göteborg Univ.; René Schoof, Univ. di Roma "Tor Vergata"; Michael Stoll, Internat. Univ. Bremen.
**Deadlines**: September 15, 2004: Second announcement. Opening Web pages. January 15, 2005: Third announcement. Submission of abstracts for contributed talks. April 30, 2005: early registration, higher rates apply after this date. May 31, 2005: Deadline for submission of abstracts of contributed talks. June 15, 2005: Last day for registration.
**Information**: http://www.latp.univ-mrs.fr/ja2005.

9–11 **Joint Meeting of the Chinese Society of Probability and Statistics (CSPS) and the Institute of Mathematical Statistics (IMS)**, Beijing, China. (Aug. 2004, p. 834)
**Deadline**: Submissions of contributed papers are invited to the conference website until January 20, 2005.
**Information**:http://math.bnu.edu.cn/statprob/CSPS-IMS2005/index.html.

10–14 **12th International Conference on Mathematical Modelling and Applications (ICTMA12)**, City University, London, England. (Jan. 2004, p. 64)
**Description**: ICTMA12's purpose is the research, teaching, and practice of mathematical modelling; this meeting will have a strong focus on transitions from the real world to the mathematical model. Mathematicians; engineers and scientists; modellers in industry, government, and finance; and teachers and researchers in schools, colleges, and universities will be attracted by the conference themes.
**Information**: The first announcement is now available on the ICTMA12 website: http://www.city.ac.uk/conted/research/ictma12/index.htm, or contact ictma12@city.ac.uk.

*10–15 **20th British Combinatorial Conference**, University of Durham, United Kingdom.
**Description**: The programme will comprise invited talks and parallel sessions of contributed talks covering all aspects of combinatorics. The invited talks will be published by Cambridge University Press in the London Mathematical Society Lecture Note series. Arrangements are also planned for the publication, subject to refereeing, of papers corresponding to the contributed talks.
**Organizers**: N. Martin (Durham), M. J. Grannell, T. S. Griggs, F. C. Holroyd, K. A. S. Quinn and B. S. Webb (Open University).
**Co-Organizers**: The 20th in this series of biennial conferences is being co-organized on behalf of the British Combinatorial Committee by staff at the University of Durham and at the Open University.
**Invited Speakers**: B. Green (Trinity College, Cambridge), O. H. King (Newcastle), P. Östergård (Helsinki), T. Penttila (Western Australia), A. D. Scott (University College, London), O. Serra (Catalunya), P. D. Seymour (Princeton), A. D. Sokal (New York), and A. Steger (Zürich).
**Information**: http://mcs.open.ac.uk/bcc2005/.

10–23 **Cornell Summer School in Probability**, Cornell University, Ithaca, New York. (Aug. 2004, p. 834)
**Primary Speakers**: R. Durrett (Cornell), J.-F. Le Gall (DMA-École Normale Superieure de Paris), R. Lyons (Indiana).
**Organizer**: G. Lawler, email: lawler@math.cornell.edu.
**Information**: http://www.math.cornell.edu/~lawler/sum2005.html.

25–29 **IMA Workshop: Mixed Integer Programming**, University of Minnesota, Minneapolis, Minnesota. (Jun/Jul. 2004, p. 694)
**Organizers**: A. Atamturk (Berkeley), D. Bienstock (Columbia), S. Dash (IBM), A. Letchford (Lancaster Univ.), J. Linderoth (Lehigh Univ.).
**Information**: Contact: Institute for Mathematics and its Applications, University of Minnesota, 207 Church St., SE, 400 Lind Hall, Minneapolis, MN 55455; tel: 612-624-6066; email: visit@ima.umn.edu; http://www.ima.umn.edu/hot-topics/2005/W7.25-29.05.html.

## August 2005

1–December 23 **Pattern Formation in Large Domains**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 834)
**Organizers**: J.H.P. Dawes (Cambridge), M. Golubitsky (Houston), P.C. Matthews (Nottingham), A.M. Rucklidge (Leeds).
**Information**: http://www.newton.cam.ac.uk/programmes/PFD/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

8–December 23 **Global Problems in Mathematical Relativity**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 834)
**Description**: General relativity has been around for a long time as a physical theory and an object of mathematical study. It was a subject of intense interest in the 1960s and 1970s, when advances included the discovery of the Kerr solution, the study of black holes and singularity theorems, and the introduction of asymptopia as a framework for studying asymptotic properties, including gravitational radiation. At the same time there were many mathematical problems that resisted mathematical analysis. In recent years there have been significant advances in our understanding of the topological, geometrical, and PDE aspects of general relativity; and progress is once again becoming rapid. New results are being obtained, and older results re-proved in greater generality.
**Themes**: This programme will be structured around four themes: Elliptic aspects of general relativity: new methods of solving the constraint equations, developments from the solution of the Riemannian Penrose inequality, the study of static and stationary solutions including black holes. Hyperbolic aspects of general relativity: local and global evolution problems, Cosmic Censorship conjecture, and the nature of singularities. Global Lorentzian geometry: global techniques and asymptotic structure, splitting theorems and extendibility. New methods in general relativity: inverse scattering and boundary-value problems, scattering theory for linear field equations, new methods from Riemannian geometry. While all four themes will be worked on throughout the programme—and indeed it would be neither possible nor desirable to keep them rigidly separate—there will be periods of more focus on each. The overall emphasis will be on mathematical results and global properties of solutions of the Einstein equations, but it is worth noting that there is a clear motivation from physics to deepen our understanding of general relativity at a time when gravitational wave detectors around the world have started collecting data.
**Organizers**: P.T. Chrusciel (Tours), H. Friedrich (Golm), P. Tod (Oxford).
**Information**: http://www.newton.cam.ac.uk/programmes/GMR/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson

Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

## January 2006

9–June 30 **Principles of the Dynamics of Non-Equilibrium Systems**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)

**Description**: The collective behaviour of nonequilibrium systems is poorly understood compared to systems in thermal equilibrium, for which statistical mechanics provides a well-established theory. By nonequilibrium systems we refer both to systems held far from thermal equilibrium by an external driving force and the complimentary situation of systems relaxing towards thermal equilibrium. Such systems display a broad range of phenomena, such as phase transitions and slow collective dynamics, which one would like to understand at a deeper level. The study of nonequilibrium systems has arisen in many different contexts, such as reaction-diffusion processes, interacting particle systems, driven diffusive systems, and the slow dynamics of glassy systems. In recent years progress has been made towards better understanding these systems. Mathematical tools have been developed, and some exact results pertaining to specific systems have been derived. These developments bring us closer to the point where one can address fundamental questions of generality, both of techniques and results. It is anticipated that bringing together the different communities of physicists and mathematicians working in this diverse field will foster the emergence of new directions and outlooks.

**Focus**: Driven diffusive systems of interacting particles; coarsening and persistence; glassy, constrained dynamics and ageing. Although all three of these areas will be explored throughout the programme, it is intended that there will be periods of focus on each, centered around topical workshops.

**Organizers**: M.R. Evans (Edinburgh), S. Franz (ICTP, Trieste), C. Godreche (SPEC, Saclay), D. Mukamel (Weizmann Inst.).

**Information**: http://www.newton.cam.ac.uk/programmes/PDS/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

16–July 7 **Logic and Algorithms**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)

**Description**: Theoretical computer science is broadly divided into disciplines dealing with logic, semantics and formal methods on the one hand, and algorithmics and computational complexity on the other. The programme will focus on active areas of research that cut across this divide, dealing with algorithmic and complexity aspects of logic as well as logical methods in complexity. Among the areas of focus are computer-aided verification, specifically dealing with algorithms and structures for verifying properties of computing system and the logical, combinatorial, and algebraic methods deployed in their study. **Finite Model Theory:** This draws on logic and combinatorial methods to study the expressive power of logical languages in the finite. Along with connections with complexity, the programme will explore applications in database theory, constraint satisfaction, proof complexity and process logics. **Proof Complexity:** At the interface of logic and complexity theory, the study of proof complexity, both in terms of lengths of proofs and complexity of inference steps, provides powerful methods for complexity lower bounds. **Constraint Satisfaction:** This describes a class of combinatorial search problems that arise in a wide variety of areas of computer science and that have been the focus of sustained research, drawing on a rich variety of techniques from algebra, logic, and graph theory.

**Games**: While two-player games are used as a tool in many of the areas mentioned above, an emerging theory combines games with automata and logic into a powerful tool for the analysis of sytems. Fundamental questions concern the algorithmic complexity of determining a winner or constructing a winning strategy, given a game and a winning condition.

**Organizers**: A. Dawar (Cambridge), M.Y. Vardi (Rice).

**Information**: http://www.newton.cam.ac.uk/programmes/LAA/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

## July 2006

2–7 **ICOTS 7, Working Cooperatively in Statistics Education**, Salvador (Bahia), Brazil. (Mar. 2004, p. 361)

**Topics**: (1) Working cooperatively in statistics education: L. Cordani (Brazil), lisbethk@terra.com.br; M. Shaughnessy (USA), mike@mth.pdx.edu; (2) Statistics Education at the School Level: D. Ben-Zvi (Israel), dbenzvi@univ.haifa.ac.il; L. Pereira (Singapore), lpereira@nie.edu.sg; (3) Statistics Education at the Post Secondary Level: M. Aliaga (USA), aliaga@umich.edu; E. Svensson (Sweden), elisabeth.svensson@esi.oru.se; (4) Statistics Education/Training and the Workplace: P. Silva (Brazil), pedrosilva@ibge.gov.br; P. Martĭn (Spain), pilar.guzman@uam.es; (5) Statistics Education and the Wider Society: B. Phillips (Australia), bphillips@groupwise.swin.edu.au; P. Boland (Ireland), Philip.J.Boland@ucd.ie; (6) Research in Statistics Education: C. Reading (Australia), creading@metz.une.edu.au; M. Pfannkuch (New Zealand), pfannkuc@scitec.auckland.ac.nz; (7) Technology in Statistics Education: A. Blejec (Slovenia), andrej.blejec@uni-lj.si; C. Konold (USA), konold@srri.umass.edu; (8) Other Determinants and Developments in Statistics Education: T. Chadjipadelis (Greece), chadji@polsci.auth.gr; B. Carlson (USA), bcarlson@eclac.cl; (9) An International Perspective on Statistics Education: D. North (South Africa), delian@icon.co.za; A. S. Haedo (Argentina), haedo@qb.fcen.uba.ar; (10) Contributed Papers: J. Engel (Germany), Engel_Joachim@ph-ludwigsburg.de; A. Mc Lean (Australia), alan.mclean@buseco.monash.edu.au; (11) Posters: C. E. Lopez (Brazil), celilopes@directnet.com.br.

**Information**: C. Batanero, batanero@ugr.es; http://www.maths.otago.ac.nz/icots7.

17–August 11 **Spectral Theory and Partial Differential Equations**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)

**Organizers**: M. van den Berg (Bristol), B. Helffer (Orsay), A. Laptev (Stockholm), A.V. Sobolev (Sussex).

**Information**: http://www.newton.cam.ac.uk/programmes/STP/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

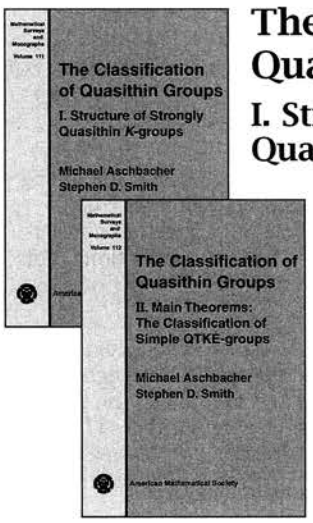
24–December 22 **Noncommutative Geometry**, Isaac Newton Institute for Mathematical Sciences, Cambridge, England. (Aug. 2004, p. 835)

**Organizers**: A. Connes (IHES), S. Majid (Queen Mary), A. Schwarz (UC Davis).

**Information**: http://www.newton.cam.ac.uk/programmes/NCG/; Isaac Newton Institute for Mathematical Sciences, 20 Clarkson Road, Cambridge, CB3 0EH, U.K.; tel.: +44 1223 335999, fax.: +44 1223 330508; email: info@newton.cam.ac.uk.

# New Publications Offered by the AMS

## Algebra and Algebraic Geometry




### The Classification of Quasithin Groups

### I. Structure of Strongly Quasithin *K*-groups

### II. Main Theorems: The Classification of Simple QTKE-groups

**Michael Aschbacher**, *California Institute of Technology, Pasadena,* and **Stephen D. Smith**, *University of Illinois at Chicago*

Around 1980, G. Mason announced the classification of a certain subclass of an important class of finite simple groups known as "quasithin groups". The classification of the finite simple groups depends upon a proof that there are no unexpected groups in this subclass. Unfortunately Mason neither completed nor published his work. In the Main Theorem of this two-part book (Volumes 111 and 112 in the AMS series, Mathematical Surveys and Monographs) the authors provide a proof of a stronger theorem classifying a larger class of groups, which is independent of Mason's arguments. In particular, this allows the authors to close this last remaining gap in the proof of the classification of all finite simple groups.

An important corollary of the Main Theorem provides a bridge to the program of Gorenstein, Lyons, and Solomon (Volume 40 in the AMS series, Mathematical Surveys and Monographs) which seeks to give a new, simplified proof of the classification of the finite simple groups.

Part I (Volume 111) contains results which are used in the proof of the Main Theorem. Some of the results are known and fairly general, but their proofs are scattered throughout the literature; others are more specialized and are proved here for the first time.

Part II of the work (Volume 112) contains the proof of the Main Theorem, and the proof of the corollary classifying quasithin groups of even type.

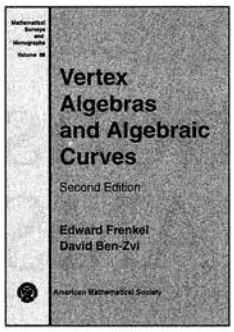
The book is suitable for graduate students and researchers interested in the theory of finite groups.

**Contents:** *Volume I: Structure of strongly quasithin $\mathcal{K}$-groups:* Introduction to volume I; Elementary group theory and the known quasithin groups; Basic results related to failure of factorization; Pushing-up in SQTK-groups; The $qrc$-lemma and modules with $\hat{q} \leq 2$; Generation and weak closure; Weak BN-pairs and amalgams; Various representation-theoretic lemmas; Parameters for some modules; Statements of some quoted results; A characterization of the Rudvalis group; Modules for SQTK-groups with $\hat{q}(G,V) \leq 2$; *Bibliography and index:* Background references quoted (Part 1: also used by GLS); Background references quoted (Part 2: used by us but not by GLS); Expository references mentioned; Index.
**Contents:** *Volume II: Main theorems; the classification of simple QTKE-groups:* Structure of QTKE-groups and the main case division; Structure and intersection properties of 2-locals; Classifying the groups with $|\mathcal{M}(T)| = 1$; Determining the cases for $L \in \mathcal{L}_f^*(GT)$; Pushing up in QTKE-groups; *The treatment of the generic case:* The generic case: $L_2(2^n)$ in $\mathcal{L}_f$ and $n(H) > 1$; Reducing $L_2(2^n)$ to $n = 2$ and V orthogonal; *Modules which are not FF-modules:* Eliminating cases corresponding to no shadow; Eliminating shadows and characterizing the $J_4$ example; Eliminating $\Omega_4^+(2^n)$ on its orthogonal module; *Pairs in the FSU over $F_{2^n}$ for $n > 1$:* The case $L \in \mathcal{L}_f^*(G,T)$ not normal in $M$; Elimination of $L_3(2^n), Sp_4(2^n)$, and $G_2(2^n)$ for $n > 1$; *Groups over $F_2$:* Larger groups over $F_2$ in $\mathcal{L}_f^*(G,T)$; Mid-size groups over $F_2$; $L_3(2)$ in the FSU, and $L_2(2)$ when $\mathcal{L}_f(G,T)$ is empty; *The case $\mathcal{L}_f(G,T)$ empty:* The case $\mathcal{L}_f(G,T) = \emptyset$; *The even type theorem:* Quasithin groups of even type but not even characteristic; *Bibliography and index:* Background references quoted (Part 1: also used by GLS); Background references quoted (Part 2: used by us but not by GLS); Expository references mentioned; Index.

**Mathematical Surveys and Monographs**

Volume 111
August 2004, approximately 496 pages, Hardcover, ISBN 0-8218-3410-X, 2000 *Mathematics Subject Classification*: 20D05; 20C20, **All AMS members $79**, List $99, Order code SURV/111N

Volume 112
August 2004, approximately 800 pages, Hardcover, ISBN 0-8218-3411-8, 2000 *Mathematics Subject Classification*: 20D05; 20C20, **All AMS members $103**, List $129, Order code SURV/112N




# Vertex Algebras and Algebraic Curves

## Second Edition

For Classroom Use

**Edward Frenkel**, *University of California, Berkeley*, and **David Ben-Zvi**, *University of Chicago*

***From a review of the first edition:***

*The authors give a deep new insight into the theory of vertex algebras ... many original results, important new concepts and very nice interpretations of structural results in the theory of vertex algebras ... provides a natural link with earlier approaches to vertex algebras ... The authors also present an excellent introduction to the theory of Wakimoto modules and $\mathcal{W}$-algebras ... contains many new concepts and results that are important for the modern theory of vertex algebras.*

***—Mathematical Reviews, Featured Review***

Vertex algebras are algebraic objects that encapsulate the concept of operator product expansion from two-dimensional conformal field theory. Vertex algebras are fast becoming ubiquitous in many areas of modern mathematics, with applications to representation theory, algebraic geometry, the theory of finite groups, modular functions, topology, integrable systems, and combinatorics.

This book is an introduction to the theory of vertex algebras with a particular emphasis on the relationship with the geometry of algebraic curves. The notion of a vertex algebra is introduced in a coordinate-independent way, so that vertex operators become well defined on arbitrary smooth algebraic curves, possibly equipped with additional data, such as a vector bundle. Vertex algebras then appear as the algebraic objects encoding the geometric structure of various moduli spaces associated with algebraic curves. Therefore they may be used to give a geometric interpretation of various questions of representation theory.

The book contains many original results, introduces important new concepts, and brings new insights into the theory of vertex algebras. The authors have made a great effort to make the book self-contained and accessible to readers of all backgrounds. Reviewers of the first edition anticipated that it would have a long-lasting influence on this exciting field of mathematics and would be very useful for graduate students and researchers interested in the subject.

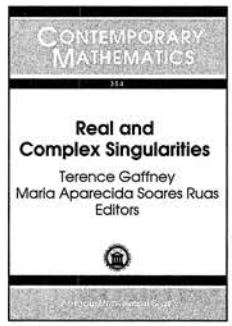
This second edition, substantially improved and expanded, includes several new topics, in particular an introduction to the Beilinson-Drinfeld theory of factorization algebras and the geometric Langlands correspondence.

The book is suitable for graduate students and research mathematicians interested in representation theory, algebraic geometry, and mathematical physics.

**Contents:** Definition of vertex algebras; Vertex algebras associated to Lie algebras; Associativity and operator product expansion; Applications of the operator product expansion; Modules over vertex algebras and more examples; Vertex algebra bundles; Action of internal symmetries; Vertex algebra bundles: Examples; Conformal blocks I; Conformal blocks II; Free field realization I; Free field realization II; The Knizhnik-Zamolodchikov equations; Solving the KZ equations; Quantum Drinfeld-Sokolov reduction and $\mathcal{W}$-algebras; Vertex Lie algebras and classical limits; Vertex algebras and moduli spaces I; Vertex algebras and moduli spaces II; Chiral algebras; Factorization; Appendix; Bibliography; Index; List of frequently used notation.

**Mathematical Surveys and Monographs**, Volume 88

August 2004, 400 pages, Softcover, ISBN 0-8218-3674-9, LC 2004051904, 2000 *Mathematics Subject Classification*: 17B69; 81R10, 81T40, 17B65, 17B67, 17B68, 14D20, 14D21, 14H10, 14H60, 14H81, **All AMS members $55**, List $69, Order code SURV/88.RN




# Real and Complex Singularities

**Terence Gaffney**, *Northeastern University, Boston, MA*, and **Maria Aparecida Soares Ruas**, *Instituto de Ciências Matemáticas e de Computação, São Carlos, São Paulo, Brazil*, Editors

The Workshop on Real and Complex Singularities is held every other year at the Instituto de Ciências Matemáticas e de Computação (São Carlos, Brazil) and brings together specialists in the vanguard of singularities and its applications. This volume contains articles contributed by participants of the seventh workshop.

The included papers reflect Fields Medalist René Thom's original vision of singularities and represent all branches of the subject: equisingularity of sets and mappings, the geometry of singular complex analytic sets, singularities of mappings and their elimination, characteristic classes, applications to differential geometry, differential equations, and bifurcation theory.

The book is suitable for graduate students and researchers interested in singularity theory.

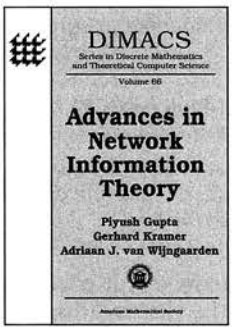
**Contents: J. W. Bruce, G. J. Fletcher**, and **F. Tari**, Zero curves of families of curve congruences; **A. Dimca** and **A. Némethi**, Hypersurface complements, Alexander modules and monodromy; **D. Dreibelbis**, Invariance of the diagonal contribution in a bitangency formula; **E. Esteves** and **S. L. Kleiman**, Bounds on leaves of foliations of the plane; **L. Fehér** and **R. Rimányi**, Calculation of Thom polynomials and other cohomological obstructions for group actions; **A. C. G. Fernandes** and **C. H. Soares, Jr.**, On the bilipschitz triviality of families of real maps; **J.-E. Furter** and **A. M. Sitta**, A note on the path formulation for $(\mathbb{O}(2), \mathbb{SO}(2))$ $-forced symmetry breaking bifurcation; **T. Gaffney**, Polar methods, invariants of pairs of modules and equisingularity; **I. S. Labouriau** and **C. M. S. G. Rito**, Stability of equilibria in equations of Hodgkin-Huxley type; **A. Libgober**, Isolated non-normal crossings; **A. Némethi**, Invariants of normal surface singularities; **R. D. S. Oliveira**, Families of pairs of Hamiltonian vector fields in the plane; **A. A. du Plessis** and **C. T. C. Wall**, Topology of unfoldings of singularities in the $E, Z$ and $Q$ series; **M. C. Romero-Fuster**, Semiumbilics and geometrical dynamics

on surfaces in 4-spaces; **D. Siersma** and **M. Tibăr**, On the vanishing cycles of a meromorphic function on the complement of its poles; **J. Stevens**, Some adjacencies to cusp singularities; **A. Szűcs**, Elimination of singularities by cobordism.

**Contemporary Mathematics**, Volume 354

September 2004, 324 pages, Softcover, ISBN 0-8218-3665-X, LC 2004040314, 2000 *Mathematics Subject Classification*: 32Sxx, 58Kxx, 37G10, 37G40, 53A05, **All AMS members $71**, List $89, Order code CONM/354N

# Applications




## Advances in Network Information Theory

**Piyush Gupta, Gerhard Kramer**, and **Adriaan J. van Wijngaarden**, *Bell Laboratories, Lucent Technologies, Murray Hill, NJ*, Editors

This book is a collection of articles written by leading researchers in information theory stemming from the DIMACS Workshop on Network Information held at Rutgers University (Piscataway, NJ). The articles focus on problems concerning efficient and reliable communication in multi-terminal settings. Information theory has recently attracted renewed attention because of key developments spawning challenging research problems.

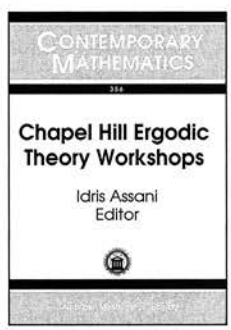
The material is divided into four parts: "Information Theory for Sources", which concentrates on network source coding problems; "Information Theory for Channels", where channels, rather than sources, are central to the problem; "Information Theory for Sources and Channels", which addresses both source and channel coding; and "Coding", which deals with more practical issues. Mathematicians using applications such as wireless cellular and LAN data services, ad hoc networks and sensor networks will benefit from the developments outlined in these sections. The book is suitable for graduate students and research mathematicians interested in communications and network information theory.

**Contents:** *Part I. Information theory for sources:* **A. Faridi, K. Sayrafian-Pour, M. Alasti**, and **A. Ephremides**, Source coding and parallel routing; **S. A. Savari**, Compressing a representation of events in a concurrent system; **P. Viswanath**, Sum rate of a class of multiterminal Gaussian source coding problems; **F. M. J. Willems** and **T. Kalker**, Coding theorems for reversible embedding; *Part II. Information theory for channels:* **A. S. Cohen** and **R. Zamir**, Unbounded loss in writing on dirty paper is possible; **R. J. La** and **V. Anatharam**, A game-theoretic look at the Gaussian multiaccess channel; **X. Liu** and **R. Srikant**, Bounds on the sum timing capacity of single-server queues with multiple input and output terminals; **S. Raj, E. Telatar**, and **D. Tse**, Job scheduling and multiple access; **D. Tuninetti** and **S. Shamai (Shitz)**, Fading Gaussian broadcast channels with state information at the receivers; **L.-L. Xie** and **P. R. Kumar**, Wireless network information theory; **W. Yu**, The structure of least-favorable noise in Gaussian vector broadcast channels; *Part III. Information theory for sources and channels:* **J. Barros** and **S. D. Servetto**, Coding theorems for the sensor reachback problem with partially cooperating nodes; **M. Effros, M. Médard, T. Ho, S. Ray, D. Karger, R. Koetter**, and **B. Hassibi**, Linear network codes: A unified framework for source, channel, and network coding; **M. Gastpar**, On source-channel communication in networks; **S. S. Pradhan** and **K. Ramchandran**, Duality in multi-user source and channel coding; *Part IV. Coding:* **G. Caire, S. Shamai**, and **S. Verdú**, Noiseless data compression with low-density parity-check codes; **S. N. Diggavi, N. Al-Dhahir**, and **A. R. Calderbank**, Diversity embedding in multiple antenna communications; **E. Erkip, A. Sendonaris, A. Stefanov**, and **B. Aazhang**, Cooperative communication in wireless systems; **E. Soljanin, R. Liu**, and **P. Spasojevic**, Hybrid ARQ with random transmission assignments; **J. K. Wolf**, An information-theoretic approach to bit-stuffing for network protocols.

**DIMACS: Series in Discrete Mathematics and Theoretical Computer Science**, Volume 66

September 2004, 339 pages, Hardcover, ISBN 0-8218-3467-3, LC 2004051900, 2000 *Mathematics Subject Classification*: 94A15, 94A17, 94A40, 94A05, 94A29, 94A24, 94B35, 94-06, **All AMS members $79**, List $99, Order code DIMACS/66N

# Differential Equations




## Chapel Hill Ergodic Theory Workshops

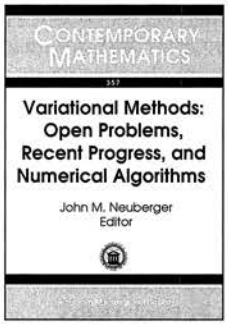
**Idris Assani**, *University of North Carolina, Chapel Hill*, Editor

This volume grew out of two ergodic theory workshops held at the University of North Carolina at Chapel Hill. These events gave young researchers an introduction to active research areas and promoted interaction between young and established mathematicians. Included are research and survey articles devoted to various topics in ergodic theory. The book is suitable for graduate students and researchers interested in these and related areas.

**Contents: E. Akin**, Why is the $3x + 1$ problem hard?; **E. Akin**, Lectures on Cantor and Mycielski sets for dynamical systems; **I. Assani**, Duality and the one-sided ergodic Hilbert transform; **J. Auslander** and **K. Berg**, Rigidity conditions in topological dynamics related to a theorem of George Sell; **G. Cohen, R. L. Jones**, and **M. Lin**, On strong laws of large numbers with rates; **C. Demeter** and **R. L. Jones**, Besicovitch weights and the necessity of duality restrictions in the weighted ergodic theorem; **R. L. Jones**, Strong sweeping out for lacunary sequences; **I. Kornfeld**, Some old and new Rokhlin towers.

**Contemporary Mathematics**, Volume 356

September 2004, 169 pages, Softcover, ISBN 0-8218-3313-8, LC 2004046326, 2000 *Mathematics Subject Classification*: 11K55, 28D05, 37A30, 37B20, 42A16, 47A35, 60F15, **All AMS members $47**, List $59, Order code CONM/356N




## Variational Methods: Open Problems, Recent Progress, and Numerical Algorithms

**John M. Neuberger**, *Northern Arizona University, Flagstaff*, Editor

This volume contains the proceedings of the conference on Variational Methods: Open Problems, Recent Progress, and Numerical Algorithms. It presents current research in variational methods as applied to nonlinear elliptic PDE, although several articles concern nonlinear PDE that are nonvariational and/or nonelliptic. The book contains both survey and research papers discussing important open questions and offering suggestions on analytical and numerical techniques for solving those open problems.

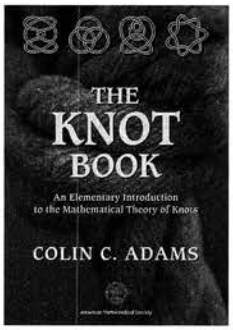
It is suitable for graduate students and research mathematicians interested in elliptic partial differential equations.

**Contents: A. Castro**, Semilinear equations with discrete spectrum; **G. Chen, Y. Deng, W.-M. Ni**, and **J. Zhou**, Semilinear elliptic boundary value problems with nonlinear oblique boundary conditions, a boundary element monotone iteration approach; **G. Chen, Z. Ding, C.-R. Hu, W.-M. Ni**, and **J. Zhou**, A note on the elliptic Sine-Gordon equation; **G. Chen, B. G. Englert**, and **J. Zhou**, Convergence analysis of an optimal scaling algorithm for semilinear elliptic boundary value problems; **J. W. Neuberger** and **R. J. Renka**, Sobolev gradients: Introduction, applications, problems; **D. G. Costa** and **H. Tehrani**, Unbounded perturbations of resonant Schrodinger equations; **J. Čepička, P. Drábek**, and **P. Girg**, Quasilinear boundary value problems: Existence and multiplicity results; **P. Drábek** and **S. B. Robinson**, Eigenvalue problems, resonance problems and open problems; **P. Padilla**, Variational, dynamic and geometric aspects of some nonlinear problems; **V. L. Shapiro**, The perturbed $p\$$-Laplacian and quadratic growth; **I. Knowles**, Variational methods for ill-posed problems; **J. M. Neuberger**, GNGA: Recent progress and open problems for semilinear elliptic PDE; **F. Catrina**, Critical nonlinearities and symmetric solutions; **J. A. Iaia**, Non-convergent radial solutions of a semilinear elliptic equation in $\mathbb{R}^N$; **Z. Feng**, Traveling wave solutions to nonlinear evolution equations.

**Contemporary Mathematics**, Volume 357

September 2004, 285 pages, Softcover, ISBN 0-8218-3339-1, LC 2004049919, 2000 *Mathematics Subject Classification*: 35Axx, 35Jxx, 35J20, 35J60, 65K10, 65Nxx, 65N25, 65N30, 65N38, **All AMS members $63**, List $79, Order code CONM/357N

# Geometry and Topology




## The Knot Book

For Classroom Use

### An Elementary Introduction to the Mathematical Theory of Knots

**Colin C. Adams**, *Williams College, Williamstown, MA*

***From reviews of the first edition:***

*Amazingly understandable ... After reading it twice, I still pick it up and scan it ... this book belongs in every mathematical library.*

***—Charles Ashbacher, Book Reviews Editor, Journal of Recreational Mathematics***

*Throughout the book there are lots of exercises of various degrees of difficulty. Many "unsolved questions" provide opportunity for further research. I liked reading this book.*

***—Zentralblatt MATH***

Knots are familiar objects. We use them to moor our boats, to wrap our packages, to tie our shoes. Yet the mathematical theory of knots quickly leads to deep results in topology and geometry. *The Knot Book* is an introduction to this rich theory, starting with our familiar understanding of knots and a bit of college algebra and finishing with exciting topics of current research.

*The Knot Book* is also about the excitement of *doing* mathematics. Colin Adams engages the reader with fascinating examples, superb figures, and thought-provoking ideas. He also presents the remarkable applications of knot theory to modern chemistry, biology, and physics.

This is a compelling book that will comfortably escort you into the marvelous world of knot theory. Whether you are a mathematics student, someone working in a related field, or an amateur mathematician, you will find much of interest in *The Knot Book.*

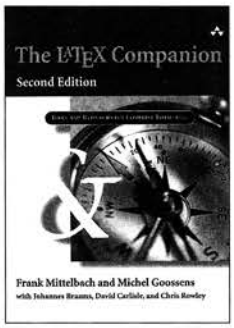
Colin Adams received the Mathematical Association of America (MAA) Award for Distinguished Teaching and has been an MAA Polya Lecturer and a Sigma Xi Distinguished Lecturer.

**Contents:** Introduction; Tabulating knots; Invariants of knots; Surfaces and knots; Types of knots; Polynomials; Biology, chemistry, and physics; Knots, links, and graphs; Topology; Higher dimensional knotting; Knot jokes and pastimes; Appendix; Suggested readings and references; Index; Corrections to the 2004 AMS printing.

August 2004, 307 pages, Softcover, ISBN 0-8218-3678-1, LC 2004054429, 2000 *Mathematics Subject Classification*: 57-01, 57Mxx, 57M25, 57M27, 57M50, **All AMS members $23**, List $29, Order code KNOTN

# New AMS-Distributed Publications

## General and Interdisciplinary




### The LaTeX Companion, Second Edition

#### Tools and Techniques for Computer Typesetting

**Frank Mittelbach**, *University of Mainz, Germany*, **Michel Goossens**, *European Organization for Nuclear Research, CERN, Genève, Switzerland*, **Johannes Braams**, *Royal KPN N V, The Hague, Netherlands*, **David Carlisle**, *NAG, Ltd., Oxford, England*, and **Chris Rowley**, *Open University, Milton Keynes, England*

*The LaTeX Companion* has long been the essential resource for anyone using LaTeX to create high-quality printed documents. This completely updated edition brings you all the latest information about LaTeX and the vast range of add-on packages now available—over 200 are covered! Full of new tips and tricks for using LaTeX in both traditional and modern typesetting, this book will also show you how to customize layout features to your own needs—from phrases and paragraphs to headings, lists, and pages.

**Inside you'll find:**

- Expert advice on using LaTeX's basic formatting tools to create all types of publications—from memos to encyclopedias
- In-depth coverage of important extension packages for tabular and technical typesetting, floats and captions, multicolumn layouts—including reference guides and discussions of the underlying typographic and TeXnical concepts
- Detailed techniques for generating and typesetting contents lists, bibliographies, indexes, etc.
- Tips and tricks for LaTeX programmers and systems support

**New to this edition:**

- Nearly 1,000 fully tested examples that illustrate the text and solve typographical and technical problems—all ready to run!
- An additional chapter on citations and bibliographies
- Expanded material on the setup and use of fonts to access a huge collection of glyphs and to typeset text from a wide range of languages and cultures
- Major new packages for graphics, "verbatim" listings, floats, and page layout
- Full coverage of the latest packages for all types of documents—mathematical, multilingual, and many more
- Detailed help on all error messages, including those troublesome low-level TeX errors

Like its predecessor, this book is an indispensible reference for anyone wishing to use LaTeX productively.

All of the authors have over ten years of varied experience working with LaTeX-related software systems. All but one are active members of the LaTeX3 Project Team, developing and maintaining the core LaTeX system.

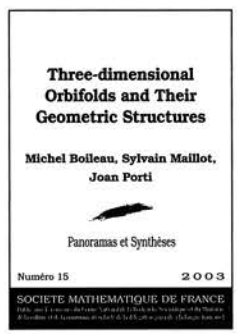
The book comes with an accompanying CD-ROM which has complete plug-and-play LaTeX installation, including all the packages and examples featured in the book.

Published by Addison-Wesley. Distributed non-exclusively worldwide by the American Mathematical Society.

**Contents:** Introduction; The structure of a LaTeX document; Basic formatting tools; The layout of the page; Tabular material; Mastering floats; Fonts and encodings; Higher mathematics; LaTeX in a multilingual environment; Graphics generation and manipulation; Index generation; Managing citations; Bibliography generation; LaTeX package documentation tools; A LaTeX overview for preamble, package, and class writers; Tracing and resolving problems; LaTeX software and user group information; TLC2 TeX CD; Bibliography; Index of commands and concepts; People; Biographies; Production notes.

April 2004, 1087 pages, Softcover, ISBN 0-201-36299-6, 2000 *Mathematics Subject Classification*: 00–XX; 00A20, 68N15, **Individual member $54**, List $59.99, Order code LATEXCN

## Geometry and Topology




### Three-dimensional Orbifolds and Their Geometric Structures

**Michel Boileau**, *Université Paul Sabatier, Toulouse, France*, **Sylvain Maillot**, *Université Louis Pasteur, Strasbourg, France*, and **Joan Porti**, *Universitat Autónoma de Barcelona, Bellaterra, Spain*

Orbifolds locally look like quotients of manifolds by finite group actions. They play an important role in the study of proper actions of discrete groups on manifolds. This monograph presents recent fundamental results on the geometry and topology of 3-dimensional orbifolds, with an emphasis on their geometric properties. It is suitable for graduate students and research mathematicians interested in geometry and topology.

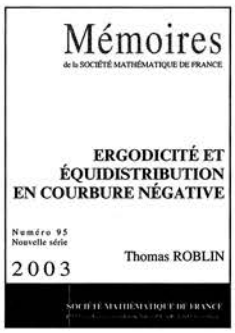
A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

**Contents:** Introduction; Thurston's eight geometries; Orbifolds; Decompositions of orientable 3-orbifolds; Haken orbifolds; Seifert orbifolds; Hyperbolic orbifolds; Varieties of representations; Volumes and hyperbolic Dehn filling; The Orbifold Theorem; Bibliography; Index.

**Panoramas et Synthèses**, Number 15

May 2004, 167 pages, Softcover, ISBN 2-85629-152-X, 2000 *Mathematics Subject Classification*: 57M50; 20F69, 53C23, 57M60, **Individual member $32**, List $36, Order code PASY/15N

## New AMS-Distributed Publications




# Ergodicité et équidistribution en courbure négative

**Thomas Roblin**, *Université de Paris, France*

In this book, the author considers a discrete isometry group acting on a CAT(−1) space and successively establishes, by new and elementary methods, an ergodicity theorem for the associated horospherical foliation, then mixing of the geodesic flow, orbital equidistribution of the group, with first asymptotic for the orbital counting function, equidistribution of primitive closed geodesics with, in the geometrically finite case, asymptotic counting. Finally, he proves a general unique ergodicity theorem for the horospherical foliation for groups with finite Bowen-Margulis-Sullivan measure. Those various results are new in their generality. Text is in French.

A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

**Contents:** Introduction; Préliminaires; Ergodicité du feuilletage horosphérique; Mélange du flot géodésique; Dénombrement et équidistribution asymptotique des orbites; Équidistribution asymptotique des géodésiques fermées primitives; Moyennes horosphériques et classification des mesures invariantes; Bibliographie.

**Mémoires de la Société Mathématique de France**, Number 95

April 2004, 96 pages, Softcover, ISBN 2-85629-147-3, 2000 *Mathematics Subject Classification*: 37D40, 37F35, **Individual member $32**, List $36, Order code SMFMEM/95N

# Classified Advertisements

*Positions available, items for sale, services available, and more*

## CALIFORNIA

### HARVEY MUDD COLLEGE
### Department of Mathematics

Harvey Mudd College invites applications for a tenure-track position in statistics, biostatistics, or related statistical fields. The rank will be at the assistant or associate professor level. Excellence in teaching is essential, as is evidence of a strong and ongoing research program. Preference will given to candidates familiar with modern data analysis techniques with cross-disciplinary interests. Candidates must be willing to supervise undergraduate research, and work with others in departmental programs, such as the recently created mathematical biology major or the industrial projects-based clinic program.

Harvey Mudd College is a highly selective undergraduate institution of science, engineering and mathematics; the median SAT score is about 1470, a quarter of our students are National Merit Scholars, and one year of high school calculus is required for admission. Each year there are about 25 graduates in mathematics, CS/math, and mathematical biology with approximately half going to graduate school. Over 40 alumni from HMC have entered Ph.D. programs. The college enrolls about 700 students and is a member of the Claremont College consortium, which consists of four other undergraduate colleges, the Claremont Graduate University, and the Keck Graduate Institute of Applied Life Sciences, forming together an academic community of about 5,000 students. There is an active and vital research community of over 40 mathematicians and statisticians in the consortium.

Claremont is situated approximately 35 miles east of downtown Los Angeles, at the foot of the San Gabriel mountains. The community is known for its tree-lined streets and village charm. It is an easy drive from Claremont to the cultural attractions of the greater Los Angeles area, as well as the ocean, mountains, and deserts of Southern California.

Applicants should send a curriculum vitae, a description of their teaching philosophy and experience, a description of their current research program, undergraduate and graduate transcripts, and arrange to have three letters of recommendation sent to the address that appears below. Further information about the college and department may be found at `http://www.math.hmc.edu/`. Preference will be given to applications completed by December 17, 2004.

Harvey Mudd College is an Equal Opportunity Employer and is committed to the recruitment of applicants historically underrepresented on college faculties.

Address for applications:
Professor Francis E. Su
Chair, Search Committee
Department of Mathematics
Harvey Mudd College
Claremont, CA 91711-5990

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## FLORIDA

### COMPUTERS

High Performance Database Research Center at FIU seeks specialist in Applied Mathematics for Internet data mining research project. Skills req: mathematical modeling, data analysis, DBMS, SQL, GIS, Java/C++ prgmg. Bach. Deg. in Applied Math or related field. 2 yrs exp. Fax resume to 305-348-1705.

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**Suggested** uses for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

**The 2004 rate is** $100 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional text of 1/2 inch or more will be charged at the next inch rate. No discounts for multiple ads or the same ad in consecutive issues. For an additional $10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Headlines will be centered in boldface at no extra charge. Ads will appear in the language in which they are submitted.

There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified ads.

**Upcoming deadlines** for classified advertising are as follows: October 2004 issue–July 28, 2004; November 2004 issue–August 27, 2004; December 2004 issue–September 28, 2004; January 2005 issue–October 28, 2004; February 2005 issue–November 22, 2004; March 2005 issue–December 29, 2005

**U.S. laws prohibit** discrimination in employment on the basis of color, age, sex, race, religion, or national origin. "Positions Available" advertisements from institutions outside the U.S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U.S. laws. Details and specific wording may be found on page 1373 (vol. 44).

**Situations wanted advertisements** from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. and Canada or 401-455-4084 worldwide for further information.

**Submission:** Promotions Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940; or via fax: 401-331-3842; or send email to classads@ams.org . AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 20904. Advertisers will be billed upon publication.

## ILLINOIS

### UNIVERSITY OF CHICAGO
### Department of Mathematics

The University of Chicago Department of Mathematics invites applications for the following positions:

1. L.E. Dickson Instructor: This is open to mathematicians who have recently completed or will soon complete a doctorate in mathematics or a closely related field,and whose work shows remarkable promise in mathematical research and teaching. The appointment typically is for two years, with the possibility of renewal for a third year. The teaching obligation is up to four one-quarter courses per year. For applicants who are U.S. citizens or permanent residents, there is the possibility of additional resources for summer support and travel from the department's VIGRE grant.

2. Assistant Professor: This is open to mathematicians who are further along in their careers, typically two or three years past the doctorate. These positions are intended for mathematicians whose work has been of outstandingly high caliber. Appointees are expected to have the potential to become leading figures in their fields. The appointment is generally for three years, with a teaching obligation of three one-quarter courses per year.

Applicants will be considered for any of the positions above which seem appropriate. Complete applications consist of (a) cover letter, (b) a curriculum vitae, (c) three or more letters of reference, one of which addresses teaching ability, and (d) a description of previous research and plans for future mathematical research, including a brief (200 words or less) summary of your research interests. Applicants are strongly encouraged to include a statement describing your teaching experience and philosophy and an AMS cover sheet. If you have applied for an NSF Mathematical Sciences Postdoctoral Fellowship, please include that information in your application, and let us know how you plan to use it if awarded. Applications should be sent to:

Appointments Secretary
Department of Mathematics
University of Chicago
5734 S. University Avenue
Chicago, IL 60637

Applications may also be submitted online through www.mathjobs.org. We will begin screening applications on November 29, 2004. Screening will continue until all available positions are filled. The University of Chicago is an Equal Opportunity/Affirmative Action Employer.

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## KANSAS

### KANSAS STATE UNIVERSITY
### Department of Mathematics

Subject to budgetary approval, applications are invited for tenure-track and visiting positions commencing August 14, 2005; rank and salary commensurate with qualifications. The department seeks candidates whose research interests mesh well with current faculty. The department has research groups in the areas of analysis, algebra, geometry/topology, and differential equations. Applicants must have strong research credentials as well as strong accomplishment or promise in teaching. Letter of application, current vita, description of research, and at least three letters of reference evaluating research should be sent to:

Louis Pigno
Department of Mathematics
Cardwell Hall 138
Kansas State University
Manhattan, KS 66506

The department also requires that the candidate arrange for letters to be submitted evaluating teaching accomplishments and potential. Offers may begin by December 1, 2004, but applications for positions will be reviewed until February 1, 2005, or until positions are closed. AA/EOE

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## MASSACHUSETTS

### WILLIAMS COLLEGE
### Department of Mathematics and Statistics

The Williams College Department of Mathematics and Statistics invites applications for one tenure-track position in mathematics, beginning fall 2005, at the rank of assistant professor (in an exceptional case, a more advanced appointment may be considered). We are seeking a highly qualified candidate who has demonstrated excellence in teaching and research, and who will have a Ph.D. by the time of appointment.

Williams College is a private, residential, highly selective liberal arts college with an undergraduate enrollment of approximately 2,000 students. The teaching load is two courses per 12-week semester and a winter term course every other January. In addition to excellence in teaching, an active and successful research program is expected.

To apply, please send a vita and have three letters of recommendation on teaching and research sent to the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Teaching and research statements are also welcome. Evaluations of applications will begin on or after November 15 and will continue until the position is filled. Williams College is dedicated to providing a welcoming intellectual environment for all of its faculty, staff and students; as an EEO/AA employer, Williams especially encourages applications from women and minorities. For more information on the Department of Mathematics and Statistics, visit `http://www.williams.edu/Mathematics`.

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### WILLIAMS COLLEGE
### Department of Mathematics and Statistics

The Williams College Department of Mathematics and Statistics invites applications for one tenure-track position in statistics, beginning fall 2005, at the rank of assistant professor (in an exceptional case, a more advanced appointment may be considered). We are seeking a highly qualified candidate who has demonstrated excellence in teaching and research, and who will have a Ph.D. by the time of appointment.

Williams College is a private, residential, highly selective liberal arts college with an undergraduate enrollment of approximately 2,000 students. The teaching load is two courses per 12-week semester and a winter term course every other January. In addition to excellence in teaching, an active and successful research program is expected.

To apply, please send a vita and have three letters of recommendation on teaching and research sent to the Hiring Committee, Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267. Teaching and research statements are also welcome. Evaluations of applications will begin on or after November 15 and will continue until the position is filled. Williams College is dedicated to providing a welcoming intellectual environment for all of its faculty, staff and students; as an EEO/AA employer, Williams especially encourages applications from women and minorities. For more information on the Department of Mathematics and Statistics, visit `http://www.williams.edu/Mathematics`.

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## MICHIGAN

### MICHIGAN STATE UNIVERSITY
### East Lansing, MI 48824
### proMSc Program in Industrial Mathematics

Direct your students toward one of the professional M.Sc. programs. Industry needs business-savvy mathematicians. See `http://www.sciencemasters.com/`.

000001

## NEW YORK

### NEW YORK UNIVERSITY
### The Courant Institute of Mathematical Sciences

The Courant Institute of Mathematical Sciences anticipates having a small number of faculty positions in mathematics to begin in September 2005. Appointments may be made at either a junior or senior level. These positions will be in a range of areas in computational, applied and pure mathematics; some may be multidisciplinary appointments that are joint with a science department from the Faculty of Arts and Sciences. Applications should be addressed to: Appointments Committee, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, NY 100123.

The Courant Institute at New York University is an Equal Opportunity/Affirmative Action Employer.

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### NEW YORK UNIVERSITY
### The Courant Institute of Mathematical Sciences

The Courant Institute is a center for advanced training and research in the mathematical sciences. It has long been an international leader in mathematical analysis, differential geometry, probability theory, applied mathematics, and scientific computation, with special emphasis on partial differential equations and their applications. Its scientific activities include an extensive array of research seminars and advanced graduate courses.

Each year a limited number of Courant Institute Instructorships in the Department of Mathematics are awarded to postdoctoral scientists. These appointments carry a light teaching load of one course per semester and ordinarily are for a three-year term. These positions are primarily for recent Ph.D's and candidates must have a degree in mathematics or some affiliated field.

For an application and further information please visit Courant's website at `http://www.cims.nyu.edu/information/brochure/visiting.html`. You may also write for information to: Visiting Membership Committee, Courant Institute of Mathematical Sciences, 251 Mercer Street, New York, NY 10012-1185. In addition, forms may be obtained directly by sending e-mail to `vm-apply@cims.nyu.edu`. Applications and supporting documents are due by December 15th for appointments to begin the following academic year.

The Courant Institute at New York University is an Equal Opportunity/Affirmative Action Employer.

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## RHODE ISLAND

### BROWN UNIVERSITY
### Division of Applied Mathematics
### Position in Probability and Statistics

The Division of Applied Mathematics seeks applicants for a position at the tenure-track (Assistant Professor) or tenured (Associate or Full Professor) level, in the general areas of probability and statistics. The starting date for the position is July 1, 2005. Preference will be given to applicants who combine research in probability and statistical theory with important applications to science, who add distinct new dimensions to the Division's current research and who bridge current activities in the Division. At the Assistant Professor level, preference will be given to individuals with postdoctoral experience. Applicants at the Associate and Full Professor levels should have achieved international recognition for first-class contributions in their specialties. Additionally, candidates for Full Professor are expected to be acknowledged leaders and should be prepared to assume a leadership role in probability and/or statistics at Brown. Good communication and teaching skills are required. Applicants should submit curriculum vitae, representative preprints and reprints, and a concise description of research interests and goals to:

Attn: Probability and Statistics Search
Professor Chi-Wang Shu
Division of Applied Mathematics
Brown University
PO BOX F
Providence, Rhode Island 02912 USA

Applicants for Assistant Professor should arrange to have at least three letters of recommendation sent directly to the Search Committee at the same address. Applicants for Associate or Full Professor should arrange to have at least five letters of recommendation sent directly to the Search Committee and should provide the names and contact information for the references at the time of application. To receive full consideration, complete applications should be received by November 30, 2004. This position is being offered contingent upon the approval of the Brown University administration. Brown University is an affirmative-action/equal-opportunity employer. Women and minorities are encouraged to apply.

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## TENNESSEE

### VANDERBILT UNIVERSITY
### Department of Mathematics
### 1326 Stevenson Center
### Nashville, TN 37240

We invite applications for two non-tenure-track assistant professor positions in the areas of noncommutative geometry/topology and operator algebras beginning Fall 2005. These are three-year appointments at the non-tenure-track assistant professor level with a 1-1 teaching load, a summer stipend and an award for research related travel. The positions are supported by a Research Training Group (RTG) grant from the National Science Foundation. They are intended for recent Ph.D.'s who are U.S. citizens or residents with demonstrated research potential and a strong commitment to excellence in teaching.

Submit your application and supporting materials to the attention of the "Noncommutative Geometry Hiring Committee". These materials should include a vita, a publication list, a research summary and the American Mathematical Society Cover Sheet. Please include an email address and fax number if available. Applicants should also arrange to have four letters of recommendation sent to the hiring committee, including one that discusses the candidate's teaching qualifications. Evaluation of the applications will commence on November 1, 2004, and continue until the position is filled. For information about the research group in noncommutative geometry and operator algebras at Vanderbilt University please consult the web at `http://www.math.vanderbilt.edu/~ncgoa/`.

Vanderbilt University is an Affirmative Action/Equal Opportunity Employer.

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## TEXAS

### THE UNIVERSITY OF TEXAS AT ARLINGTON

The Department of Mathematics at The University of Texas at Arlington invites applications for tenure-track or tenured positions at all levels beginning Fall 2005, pending budgetary approval. The positions are open to all fields of mathematics. Applicants should have a Ph.D. in mathematics, a strong commitment to teaching at all levels, and for tenured positions an internationally recognized record of research with a strong history of external funding and/or strong potential for external funding.

Applications should include a resume detailing research interests and funding record, if applicable, and three letters of recommendation. Use of the standard AMS application cover sheet is recommended. Screening of applicants will begin on August 31, 2004. Applications will be accepted until the positions are filled.

Applications should be sent to:

J. Su, Chair
Faculty Search Committee
Department of Mathematics
The University of Texas at Arlington

Box 19408
Arlington, TX 76019-0408

For more information about the department, see http://www.uta.edu/math.

The University of Texas at Arlington is an Equal Opportunity and Affirmative Action Employer.

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### UNIVERSITY OF TEXAS ARLINGTON
### Department Chair Position

The Mathematics Department at The University of Texas-Arlington invites applications for the position of department chairman, a tenured full professor position. The appointment begins September 1, 2005, and is subject to the availability of funding.

Applicants should have an outstanding record of research and external funding, commensurate with appointment at the level of full professor. Special consideration will be given to candidates with a major research initiative compatible with the research interests of the faculty, and with administrative experience. The successful applicant will be committed to both graduate and undergraduate education, and will be an effective communicator with faculty, students and upper administration.

The University of Texas-Arlington, located in the Dallas/Fort Worth metroplex, is the second largest campus in the UT system and has 25,000 students. It has strong research programs in engineering and science. The Mathematics Department houses 23 tenured and tenure-track faculty, and has research strengths in both pure and applied fields. The department offers undergraduate, master's and doctoral degrees. As part of the university's College of Science, the department actively participates in interdisciplinary research efforts at the interface between mathematics/statistics, science, engineering and local industries.

Applications will be reviewed immediately upon receipt. The search will remain open until the position is filled. Applications should include a letter of interest, a current vita and the names of at least three references. Electronic applications are encouraged, and may be submitted to email: mathsearch@uta.edu. Hard-copy application materials should be sent to: Chairman, Math Chair search committee, Department of Mathematics, University of Texas at Arlington, Box 19408, Arlington, Texas 76019-0408.

More information may be obtained from the department's web page at http://www.uta.edu/math.

The University of Texas-Arlington is an Equal Opportunity and Affirmative Action Employer.

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## BRAZIL

### INSTITUTE FOR PURE AND APPLIED MATHEMATICS
### Impa, Brazil
### Chairs at Impa

The Institute for Pure and Applied Mathematics (IMPA) invites applications for two endowed chairs carrying an appointment for up to four years. The successful applicant is expected to be a qualified mathematician within 2 to 12 years of his or her doctorate and to display a research oriented curriculum. For further information please refer to http://www.impa.br/Concursos/chairs.html.

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# Add this Cover Sheet to all of your Academic Job Applications

**How to use this form**

1. Using the facing page or a photocopy, (or visit the AMS web site for a choice of electronic versions at `www.ams.org/coversheet/`), fill in the answers which apply to *all* of your academic applications. Make photocopies.

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

The purpose of the cover form is to aid department staff in tracking and responding to each application for employment. Mathematics departments in Bachelor's-, Master's-, and Doctorate-granting institutions are expecting to receive the form from each applicant, along with the other application materials they require.

The AMS suggests that applicants and employers visit the Job Application Database for Mathematicians (`www.mathjobs.org`), a new electronic resource being offered by the AMS (in partnership with Duke University) for the second year in 2002-03. The system provides a way for applicants to produce printed coversheet forms, apply for jobs, or publicize themselves in the "Job Wanted" list. Employers can post a job listing, and once applications are made, search and sort among their applicants. Note-taking, rating, e-mail, data downloading and customizable EOE functions are available to employers. Also, reference writers can submit their letters online. A paperless application process is possible with this system, however; employers can choose to use any portion of the service. There will be annual employer fees beginning this year. This system was developed at the Duke University Department of Mathematics.

Please direct all questions and comments to: `emp-info@ams.org`.

*Academic Employment in Mathematics*

# AMS STANDARD COVER SHEET

**Last Name** _____

**First Name** _____

**Middle Names** _____

**Address** *through next June* _____ **Home Phone**

_____ _____

_____ **e-mail Address**

_____ _____

**Current Institutional Affiliation** **Work Phone**

_____ _____

**Highest Degree Held or Expected** _____

**Granting Institution** _____ **Date (optional)** _____

**Ph.D. Advisor** _____

**Ph.D. Thesis Title (optional)** _____

***Indicate*** *the mathematical subject area(s) in which you have done research using the Mathematics Subject Classification printed on the back of this form or on the AMS website. Use the two-digit classification which best fits your interests in the Primary Interest line and additional two-digit numbers in the Secondary Interest line.*

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 applying for a position which requires U.S. citizenship or U.S. permanent residency, indicate your eligibility** ☐ Yes ☐ No

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

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

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

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

☐ _____

☐ _____

☐ _____

☐ _____

*This form is provided courtesy of the American Mathematical Society.*

*This cover sheet is provided as an aid to departments in processing job applications. It should be included with your application material.*

*Please print or type. Do not send this form to the AMS.*

AMERICAN MATHEMATICAL SOCIETY · FOUNDED 1888 · ΤΡΗΤΟΣ ΜΗ ΑΤΕΘΜΕ ΕΙΠΠΟ

# 2000 Mathematics Subject Classification

**00** General
**01** History and biography
**03** Mathematical logic and foundations
**05** Combinatorics
**06** Order, lattices, ordered algebraic structures
**08** General algebraic systems
**11** Number theory
**12** Field theory and polynomials
**13** Commutative rings and algebras
**14** Algebraic geometry
**15** Linear and multilinear algebra, matrix theory
**16** Associative rings and algebras
**17** Nonassociative rings and algebras
**18** Category theory, homological algebra
**19** *K*-theory
**20** Group theory and generalizations
**22** Topological groups, Lie groups
**26** Real functions
**28** Measure and integration
**30** Functions of a complex variable
**31** Potential theory
**32** Several complex variables and analytic spaces
**33** Special functions
**34** Ordinary differential equations
**35** Partial differential equations
**37** Dynamical systems and ergodic theory
**39** Difference and functional equations
**40** Sequences, series, summability
**41** Approximations and expansions
**42** Fourier analysis
**43** Abstract harmonic analysis
**44** Integral transforms, operational calculus
**45** Integral equations
**46** Functional analysis
**47** Operator theory
**49** Calculus of variations and optimal control, optimization
**51** Geometry
**52** Convex and discrete geometry
**53** Differential geometry
**54** General topology
**55** Algebraic topology
**57** Manifolds and cell complexes
**58** Global analysis, analysis on manifolds
**60** Probability theory and stochastic processes
**62** Statistics
**65** Numerical analysis
**68** Computer science
**70** Mechanics of particles and systems
**74** Mechanics of deformable solids
**76** Fluid mechanics
**78** Optics, electromagnetic theory
**80** Classical thermodynamics, heat transfer
**81** Quantum theory
**82** Statistical mechanics, structure of matter
**83** Relativity and gravitational theory
**85** Astronomy and astrophysics
**86** Geophysics
**90** Operations research, mathematical programming
**91** Game theory, economics, social and behavioral sciences
**92** Biology and other natural sciences
**93** Systems theory, control
**94** Information and communication, circuits
**97** Mathematics education

# Mathematical Sciences Employment Center

*Atlanta Marriott Marquis, Atlanta, Georgia*
*January 5, 6, 7, and 8, 2005*

### 2005 Employment Center Schedule

**October 25, 2004** Registration deadline for inclusion in Winter List books.

**December 10, 2004** Advance registration deadline. After this date, all registration activities will happen on-site in Atlanta.

**Wednesday, January 5**

**7:30 a.m.–4:00 p.m.** Registration and materials pick-up.

**9:00 a.m.–9:30 a.m.** Short (optional) orientation session.
**9:30 a.m.–4:00 p.m.** Submission of Scheduled Employment Register interview request forms for both Thursday and Friday interviews. No request forms can be accepted after 4:00 p.m. Wednesday.

**9:30 a.m.–6:00 p.m.** Interview Center open.

No Scheduled Employment Register interviews are held on Wednesday.

**Thursday, January 6**

**7:00 a.m.–8:15 a.m.** Distribution of interview schedules for both Thursday and Friday for those participating in the Scheduled Employment Register.

**8:15 a.m.–4:40 p.m.** Scheduled Employment Register interviews in 4 sessions: *Session 1:* 8:15 a.m.–9:50 a.m., *Session 2:* 10:00 a.m.–11:35 a.m., *Session 3:* 1:00 p.m.–2:35 p.m., *Session 4:* 3:00 p.m.–4:35 p.m.

**8:00 a.m.–7:30 p.m.** Interview Center open (doors open at 7:30 a.m.; do not schedule before 8:00 a.m.).

**Friday, January 7**

**8:15 a.m.–4:40 p.m.** Scheduled Employment Register interviews in 4 sessions: *Session 5:* 8:15 a.m.–9:50 a.m., *Session 6:* 10:00 a.m.–11:35 a.m., *Session 7:* 1:00 p.m.–2:35 p.m., *Session 8:* 3:00 p.m.–4:35 p.m.

**8:00 a.m.–7:30 p.m.** Interview Center open (doors open at 7:30 a.m.; do not schedule before 8:00 a.m.).

**Saturday, January 8**

**9:00 a.m.–12 noon** Interview Center open.

**Note:** Any participant who plans to use the Scheduled Employment Register must appear at the Employment Center on Wednesday by 4:00 p.m. to turn in the Interview Request/Availability Form. If unexpected delays occur while travelling, contact the AMS at 800-321-4267, ext. 4107.

### Overview of the Employment Center

The Employment Center (formerly the Employment Register) serves as a meeting place and information center for employers and Ph.D.-level job seekers attending the Joint Mathematics Meetings. Most applicants and employers began the search process in the fall and are looking for an opportunity to meet in person with those with whom they've already had communication. Some, however, use the Employment Center as a way to make some initial contacts, gather information, and distribute their own information. This is a less effective, but common, use of the program. The Employment Center allows everyone to choose a comfortable level of participation by seeking interviews for any of the open hours or by limiting schedules to certain days or hours.

The Employment Center is a three-day program which takes place on the Wednesday, Thursday, Friday, and Saturday (morning only) of the Joint Meetings. Most participants register in advance (by the October 25 deadline), and their brief résumé or job description is printed in a booklet which is mailed to participants in advance.

The Employment Center houses two services: the computer-scheduled interview tables (the Scheduled Employment Register) and the employer-scheduled interview tables (the Interview Center). Following three or four years of a job market favorable to candidates, the Employment Center applicant/employer ratio took a sharp turn in 2004. At the 2004 Employment Center, 504 candidates and 120 employers participated, giving an overall applicant-to-employer ratio of 4.2:1 (compared with 424 applicants and 129 employers in 2003, a ratio of 3.2:1). Those with the most interviews are those requested most by employers, usually as a result of a careful application process during the months before the Employment Center takes place. The total number of interviews arranged is dependent on the number of participating employers. Fewer employers will mean fewer interviews overall.

At the January 2005 Employment Center, job candidates will be able to choose how to participate. Two forms of participation will be available:

> All Employment Center services (computer-scheduling system, form posted in *Winter List*

*of Applicants, Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center).

Message Center and *Winter Lists* only (form posted in *Winter List of Applicants, Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center, BUT NOT use of the computer-scheduling system).

No matter which option is chosen, advance registration works best so that the Applicant Form (received by October 25, 2004) can be printed in the *Winter List* distributed to employers.

Employer forms submitted by registered employers have no connection with the AMS online job ads (EIMS). Submitted forms are not available for browsing on the Web. They are reproduced in the *Winter List* booklet for use by Employment Center participants.

The Mathematical Sciences Employment Center is sponsored by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics; it is managed by members of the AMS staff, with the general guidance of the AMS-MAA-SIAM Committee on Employment Opportunities.

**Employers: Choose one or both of these tables:**

Computer-scheduled Employment Register table

Employer-scheduled Interview Center table

## The Employment Register Computer-Scheduling System

Employers register in advance by the October 25 deadline, and their job listings ("Employer Forms") are printed and distributed in mid-December to applicants. Employers receive the book of brief, numbered applicant résumés in mid-December. Participants decide on Wednesday, January 5, which of the eight sessions (of five interviews each) they will participate in and submit their Availability/Interview Request Forms by 4:00 p.m. Wednesday. Employers can reserve time for other Joint Meetings events by marking "unavailable" for one or more of the eight sessions. Employers can request ten specific applicants per day, assuming they are available for all four sessions that day. Usually those requests will be filled by the scheduling algorithm, provided the applicants are present, except in the case of the few most-requested applicants. The rest of their interviews will be with applicants who ask to see them. Employers should be specific about their requirements on the Employer Form to avoid interviews with inappropriate candidates.

Schedules are distributed for all Thursday and Friday interviews on Thursday morning. The schedule allows 15-minute interviews, with 5 minutes between for note taking. One or more interviewers for the same position(s) may interview at the table separately, together, or in shifts (however, **no more than two** may sit at the table at one time). For follow-up interviews, the scheduled tables will also be available for use until 7:30 p.m. on Thursday and Friday and on Saturday morning from 9:00 a.m. to noon.

Participation in the scheduling program has become optional for applicants, so employers will notice some applicant résumés in the *Winter List of Applicants* with no applicant number. An employer can arrange to interview such an applicant outside of the scheduled interview sessions—for instance, between 4:40 p.m. and 7:30 p.m. Thursday or Friday, or on Saturday morning—or during sessions which they left unscheduled.

Employers who are interviewing for two distinct positions may wish to pay for two tables. See the instructions under "How to Register". Employers should bring school catalogs, corporate reports, or more lengthy job descriptions to the Employment Center early on Wednesday for perusal by applicants prior to interviews.

## The Employer-Scheduled Interview Center

The Interview Center allows any employer to reserve a table in an area adjacent to the Employment Center. Employers will arrange their own schedule of interviews, either in advance or on site, by using the Employment Message Center. Employers who have never used the Employment Center before might want to try conducting interviews at this convenient location. Since they will be setting their own schedules, employers will have complete control over whom they'll see, for how long, and when they'll be interviewing. This allows employers to pursue other activities at the Joint Meetings.

The center will be open only during the following hours:

Wednesday, January 5, 2005, 9:30 a.m.–6:00 p.m.
Thursday, January 6, 2005, 8:00 a.m.–7:30 p.m.
Friday, January 7, 2005, 8:00 a.m.–7:30 p.m.
Saturday, January 8, 2005, 9:00 a.m.–noon

The fee for use of this area is the same as the normal employer fee, $225. It is requested that all employers fill out an Employer Form for inclusion in the *Winter List*. This should clarify to Employment Center applicants what type of position is being filled. If an employer is unable to accept new applicants because the deadline has passed, that should be stated on the form.

The *Winter List of Applicants*, containing information about the candidates present at the Employment Center, will be mailed to all employers in advance of the meeting.

Employers scheduling interviews in advance should tell applicants to find the table with the institution's name in the Interview Center (not the numbered-table area). Employers can schedule any time during the open hours listed above. To schedule interviews after arriving in Atlanta, leave messages for Employment Center applicants in the Employment Message Center. Paper forms will be provided to help speed the invitation process. Each employer will be provided with a box in the Message Center where applicants can leave items.

Employers should have at most two interviewers per table at any time due to space limitations. There will be no outlets or electricity available at the interviewing tables. Only banners which can be draped over the four-foot table can be accommodated.

### About the *Winter List of Applicants*

This booklet contains hundreds of résumés of applicants registered by October 25 for the Employment Center. It will be mailed to all employers who register by October 25 who indicate on their Joint Meetings registration form that they would like their materials mailed. Employers should be aware that there will be hundreds of brief résumés to look through and should be sure to obtain the *Winter List of Applicants* as early as possible.

### Employers Not Planning to Interview

Employers who do not plan to participate in the Employment Center at all may place a job description in the book of employers. This description must be submitted on the Employer Form, which appears in the back of this issue, with the appropriate box checked, indicating that no interviews will take place. A fee of $50 is charged for this service (paid through the Joint Meetings registration form). The form must be received in the Providence office (with payment or purchase order) by the October 25 deadline to appear in the *Winter List of Employers.* Forms received in the Providence office after that deadline will be displayed at the meeting. Those wishing to bring a one-page job description to the Employment Center desk for display during the meetings may do so at no charge.

### Employers: How to Register

The interviewer should register and pay for the Joint Mathematics Meetings. They should register for the Employment Center by completing the following steps:

> Indicate on the Joint Meetings registration form (available either electronically in early September 2004, at `www.ams.org/amsmtgs/2091_intro.html` or in the back of the October issue of the *Notices*) that you are also paying the Employment Center employer fee. Indicate your choice of tables. Mark all that apply.
>
> Submit an Employer (job listing) Form electronically at www.ams.org/emp-reg, or use the print version in the back of this issue. Be sure the form indicates which type or types of tables will be used. This form will be printed in the *Winter List of Employers.*

It is important to register by the October 25 deadline in order for your form to be included in the *Winter List of Employers.* However, registration will be accepted up to December 10 for the normal fees or on site in Atlanta at the on-site rates. Call 800-321-4267, ext. 4105, with any questions or deadline problems.

Any representatives of the institution can sit at the table, together or working in shifts (however, the limit is two at one time). If possible, their names should be listed on the Employer Form as a reference point for the applicants. Employment Center fees should be paid only for each table required, not for each person.

In a few unusual cases an institution will be conducting interviews in the Employment Center for two or more distinct positions and will not want to conduct these interviews at one table. In that case, two or more Employer Forms should be submitted, and separate tables and employer numbers will be provided. Applicants will then be able to request interviews for the appropriate job by employer number. First and second table fees should be paid.

The fee for all employers to register in advance is $225 for the first table and $75 for each additional table. On-site registration fees (any registrations after 12/10/04) are $305 for the first table and $105 for each additional table. Employers must also register for the Joint Meetings and pay the appropriate Joint Meetings fee.

### Employers: Registration on Site

Employers who do not register for the Joint Mathematics Meetings and the Employment Center by December 10 may register on site in Atlanta at the Joint Meetings registration desk. They must bring their receipt to the Employment Center desk between 7:30 a.m. and 4:00 p.m. on Wednesday, January 5, to receive their materials. A typed copy of the Employer Form (found in the back of this issue) can be brought to the Employment Center for posting on site (or the form can be handwritten on site). If registering for the employer-scheduled Interview Center only, registration on Thursday is possible.

### Applicants: Use of the computer-scheduled program is now optional

In 2005 applicants will be given flexibility in deciding how to participate in the Employment Center. There are two options:

> All Employment Center services (computer-scheduling system, form posted in *Winter List of Applicants, Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center).
>
> Message Center and *Winter Lists* only (form posted in *Winter List of Applicants, Winter List of Employers* received by mail, use of Employment Message Center, availability for employer-scheduled Interview Center, BUT NOT use of the computer-scheduling system). This option is available at a slightly lower price.

Applicants who participate in the 2005 Employment Center will find themselves talking with employers in two different settings:

1. A computer-scheduling program sets 15-minute interviews at the Employment Register numbered tables.

This is the choice that has now become optional for applicants. Applicants do not have to hand in a computer-scheduling form at all.

2. There is also an Interview Center, where employers set their own schedules. These employers do not participate in the scheduling program, so applicants have no automatic access to interviews with them. They determine their own schedules and make their own appointments privately, either in advance or on site using the Employment Message Center. These interviews have always been "optional" for applicants, since they may turn down any written invitation they receive. Applicants are reminded to respond to all invitations promptly. Many applicants prefer the interviews they are invited for in this setting since it's more relaxed and interviews tend to last longer.

Overall, many applicants report being disappointed that there are not more research-oriented jobs being interviewed for at the Employment Center. Applicants should expect that many of the jobs are best suited to enthusiastic and well-qualified candidates who can contribute on many levels in an academic setting.

## The Schedule

For applicants using all services there is a certain scheduling burden placed on them to juggle these simultaneous services. However, computer-scheduled sessions are in small blocks, for a total of eight sessions over the two days of interviews (Thursday and Friday). This allows applicants, once they receive invitations to interview in the Interview Center, to accept, knowing that when they submit the computer schedule request on Wednesday they can mark that they are unavailable for one or more of these sessions without seriously jeopardizing their chances of obtaining scheduled interviews. Likewise, applicants who are scheduled to give a talk can avoid interviews for that time. Applicants are encouraged to schedule their time in advance in this manner and not wait for the computer schedule to be distributed Thursday morning.

Applicants are advised to place as many selections as possible on their scannable request sheets; however, be advised that this may result in interviews with less-preferred employers. Applicants should be aware that each year approximately 10% of applicants signing up for all services fail to submit a schedule request sheet. This is often due to having too many schedule conflicts.

## Interviews

Applicants should understand that the Employment Center provides no guarantees of interviews or jobs. It is simply a convenient meeting place for candidates and employers who are attending the Joint Meetings. Those who have not yet begun their job search efforts may go unnoticed at the Employment Center (although applicants will likely receive between one and three interviews in the scheduled program). Attention generally goes to candidates who already have applied for open positions or to those who are well suited for teaching positions at liberal arts colleges.

Data from recent Employment Centers show that women represent about half of the most sought-after applicants, although they make up less than half of the total Employment Center applicant pool. Those without permanent authorization to work in the United States will find themselves far less requested than U.S. citizens or permanent residents. Newer Ph.D.'s tend to be invited for more interviews than those who have been working longer. Most jobs listed require a doctorate. Approximately 35% of applicants responding to a recent survey report having between zero and two interviews in the Interview Center. The rest reported higher numbers. More than half of the applicants reported that at least some of the Interview Center appointments had been arranged in advance of the Meetings.

## Preparations

Candidates just beginning a job search should realize that employers have no method to judge their credentials other than the brief résumé form, and they should make an effort to make it distinct and interesting.

Applicants who register in advance will receive the *Winter List of Employers* in mid-December. If time permits, they should apply for suitable open positions they notice in the *Winter List of Employers* after they receive it. Applicants are advised to bring a number of copies of their brief vita or résumé so that they may leave them with prospective employers. It is a good idea in the fall for applicants to alert any employer to whom applications are made that they plan to be present at the Joint Meetings. Also, they should bring enough materials with them to accompany requests for interviews they may want to leave in the Message Center boxes of the Interview Center employers.

Applicants are also encouraged to leave some extra copies of their résumés in their own message folders so that interested employers may find them there. Photocopying costs at a convention are high, so applicants should come prepared with a reasonably large number of copies. A brightly colored form in each folder gives applicants an opportunity to present for public perusal some information about their availability during the meetings.

The *Winter List of Applicants* is mailed to all employers in advance, so it is vital that the Joint Meetings registration form, applicant résumé form, and payments be received by the October 25 deadline so the Applicant Form can be printed in the book. This greatly increases an applicant's chances of being invited to the Interview Center.

Applicants should keep in mind that interviews arranged by the Employment Center represent only an initial contact with the employers and that hiring decisions are not ordinarily made during or immediately following such interviews.

## Results

In a recent survey, 66% of applicants responding reported being invited for at least one on-campus visit to an employer they had interviewed with during the Employment Center. 48% reported receiving at least one job offer in the months following the interview.

## Applicants: Register Early

Applicants need to complete the following steps by the advance deadline of October 25, 2004.

### 1. Pay fees

Register for the Joint Mathematics Meetings (see form in the back of the October issue of the *Notices* or the electronic information available in early September 2004, at www.ams.org/amsmtgs/2091_intro.html). You cannot participate in the Employment Center unless you are a meetings participant. Mark one of the two "Employment Center Applicant Fee" boxes on the Joint Meetings registration form and make payments. The fee in advance for applicants is $42; "Message Center and *Winter List* ONLY" registration is $21.

### 2. Send form

Submit the Applicant Form (a brief résumé form) electronically at `www.ams.org/emp-reg/`, or use the print version in the back of this issue.

### After Registration

Submission of the Applicant Form electronically will result in an email acknowledgement almost immediately. For registration and payments, the Meetings Service Bureau acknowledges all payments. When payments AND the Applicant Form have been received, another acknowledgement will go out by email, if possible, or by mail. Please allow a week or so for processing, but after that contact staff (AMS 800-321-4267, ext. 4105) if you do not receive acknowledgement from the Employment Center.

Around December 15 the *Winter List of Employers* will be mailed to all registered applicants unless they request otherwise.

### Registering after the Deadline

After October 25 applicants can still register for the Employment Center at the same prices until the final deadline of December 10. However, the Applicant Form will NOT be included in the *Winter List of Applicants* but will be posted on site at the Employment Center (a serious disadvantage). Those who do not register by December 10 must register on site at the Joint Meetings registration desk and pay higher fees ($80 Employment Center fee; however, the "Message Center and *Winter List* ONLY" fee is always just $21).

It is worthwhile to submit the applicant form even if you miss the October 25 deadline. An unexpected delay in publishing may allow your late form to get into the book. At the very least, your printed-out form will be brought to the meetings by staff and displayed there (after all the fees have been paid).

### When to Arrive

All participants in the scheduled section of the Employment Center must submit their Interview Request/Availability forms in person between 9:30 a.m. and 4:00 p.m. on Wednesday, January 5, 2005, or they will not be included when the interview-scheduling program runs Wednesday night. Should unexpected delays occur while travelling, contact the AMS at 800-321-4267, ext. 4107. Be sure to keep Employment Center materials with you, because in an emergency you can report your interview requests over the phone.

## Applicants: Registering on Site

Feel free to enter the Employment Center area first to consult staff about the decision to register on site and to check on which employers are participating. Full registration on site early Wednesday is allowed for a higher fee but is severely discouraged. Most employers will not notice an Applicant Form which arrives on Wednesday. Therefore, these individuals will receive only a couple of computer-scheduled interviews. Registration on site is advisable only for those who know they will be interviewed in the Interview Center and would like a Message Center folder for employers to leave messages in. Registering on site for a mailbox only is possible, at the $21 rate, on Wednesday and Thursday. Pay the fees at the Joint Meetings registration area and then bring your receipt to the Employment Center desk to register yourself.

# Instructions for Applicant and Employer Forms

Applicant forms submitted for the Employment Center by the October 25 deadline will be reproduced in a booklet titled *Winter List of Applicants.* Employer forms submitted by the October 25 deadline will be reproduced for the *Winter List of Employers.*

Please use the electronic versions of Applicant and Employer forms (`http://www.ams.org/emp-reg/`). Paper forms should be submitted only by those who do not have access to the AMS website.

If submitting a paper form, please type carefully. **Do not type outside the box or beyond the lines indicated. Extra type will be omitted.**

All forms must be received by the Society by **October 25, 2004**, in order to appear in the *Winter List.* However, meeting registration (and payment of fees) is required before the forms can be processed.

**00** General
**01** History and biography
**03** Mathematical logic and foundations
**05** Combinatorics
**06** Order, lattices, ordered algebraic structures
**08** General algebraic systems
**11** Number theory
**12** Field theory and polynomials
**13** Commutative rings and algebras
**14** Algebraic geometry
**15** Linear and multilinear algebra, matrix theory
**16** Associative rings and algebras
**17** Nonassociative rings and algebras
**18** Category theory, homological algebra
**19** K-theory
**20** Group theory and generalizations
**22** Topological groups, Lie groups
**26** Real functions
**28** Measure and integration
**30** Functions of a complex variable
**31** Potential theory
**32** Several complex variables and analytic spaces
**33** Special functions
**34** Ordinary differential equations
**35** Partial differential equations
**37** Dynamical systems and ergodic theory
**39** Difference and functional equations
**40** Sequences, series, summability
**41** Approximations and expansions
**42** Fourier analysis
**43** Abstract harmonic analysis
**44** Integral transforms, operational calculus
**45** Integral equations
**46** Functional analysis
**47** Operator theory
**49** Calculus of variations and optimal control; optimization
**51** Geometry
**52** Convex and discrete geometry
**53** Differential geometry
**54** General topology
**55** Algebraic topology
**57** Manifolds and cell complexes
**58** Global analysis, analysis on manifolds
**60** Probability theory and stochastic processes
**62** Statistics
**65** Numerical analysis
**68** Computer science
**70** Mechanics of particles and systems
**74** Mechanics of deformable solids
**76** Fluid mechanics
**78** Optics, electromagnetic theory
**80** Classical thermodynamics, heat transfer
**81** Quantum theory
**82** Statistical mechanics, structure of matter
**83** Relativity and gravitational theory
**85** Astronomy and astrophysics
**86** Geophysics
**90** Operations research, mathematical programming
**91** Game theory, economics, social and behavioral sciences
**92** Biology and other natural sciences
**93** Systems theory; control
**94** Information and communication, circuits
**97** Mathematics education

**EMPLOYER FORM**
MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 5–8, 2005
ATLANTA, GEORGIA

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Register information and forms is `http://www.ams.org/emp-reg/`.
2. Paper or electronic forms are due, along with payment and your Advance Registration/ Housing Form, by October 25 (to AMS, P. O. Box 6887, Providence, RI 02940) in order to be included in the *Winter List of Employers*.
3. Please list all potential interviewers, for reference by applicants, but pay fees only for each separate table.
4. Forms will not be processed until registration and payment of fees have been received.

**EMPLOYER CODE:**

Institution _____

Department _____

Mailing address _____

_____

E-mail address (one only) _____

URL (or other contact info) _____

Name(s) of Interviewer(s) 1. _____

2. _____

3. _____

4. _____

Specialties sought _____

_____

Title(s) of position(s) _____

Number of positions _____

Starting date _____ / _____ (Month / Year)  Term of appointment _____ (Years)

Renewal  Tenure-track position

☐ Possible ☐ Impossible  ☐ Yes ☐ No  Teaching hours per week _____

Degree preferred _____  Degree accepted _____

Duties _____

_____

_____

Experience preferred _____

_____

_____

Significant other requirements, needs, or restrictions which will influence hiring decisions _____

_____

_____

This position will be subject to a security clearance which will require U.S. citizenship: ☐ Yes ☐ No

**THE EMPLOYER PLANS TO USE THE FOLLOWING SERVICES** (check all that apply):

☐ One or more computer-scheduled Interview Tables

☐ One or more self-scheduled Interview Tables

☐ Placing this form for information only (not using a table)

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# APPLICANT RÉSUMÉ FORM

MATHEMATICAL SCIENCES EMPLOYMENT REGISTER
JANUARY 5–8, 2005
ATLANTA, GEORGIA

1. Forms should be accessed and submitted electronically if possible. The URL for accessing Employment Register information and forms is `http://www.ams.org/emp-reg/`.
2. Paper or electronic forms are due, along with payment and your Advance Registration/ Housing Form, by October 25 (to AMS, P. O. Box 6887, Providence, RI 02940) in order to be included in the *Winter List of Applicants*.
3. Forms will not be processed until registration and payment of fees have been received.

**APPLICANT CODE:**

Last name _____ First name _____

Mailing address (include zip code) _____

_____

E-mail address (one only) _____

URL (or other contact info) _____

Specialties _____

_____

(use MR classification codes plus text if possible; applicants will be indexed by first number only)

**DESIRED POSITION:**

Academic: ☐ Research ☐ University Teaching College Teaching: ☐ 4-year ☐ 2-year

Would you be interested in nonacademic employment? ☐ Yes ☐ No Available mo. _____ /yr. _____

Computer skills _____

Significant requirements (or restrictions) which would limit your availability for employment _____

_____

**PROFESSIONAL ACCOMPLISHMENTS:**

Significant achievements, research or teaching interests _____

_____

_____

_____

_____

Paper to be presented at this meeting or recent publication _____

_____

| Degree | Year (expected) | Institution |
|---|---|---|
| | | |
| | | |
| | | |

Number of refereed papers accepted/published _____

**PROFESSIONAL EMPLOYMENT HISTORY:**

| | Employer | Position | Years |
|---|---|---|---|
| 1. | | | to |
| 2. | | | to |
| 3. | | | to |

References (Name and Institution only)

_____

_____

_____

_____

Work authorization status: (check one) ☐ U.S. Citizen ☐ Non-U.S. Citizen, authorized to work permanently in U.S. ☐ Other

This applicant will be using: ☐ ALL Employment Center services ☐ Message Center and Winter List ONLY

# AMS SHORT COURSE

## The Radon Transform and Applications to Inverse Problems

*Atlanta, Georgia, January 3-4, 2005*

**Organizers:**

- Gestur Olafsson, *Louisiana State University*
- Todd Quinto, *Tufts University*

**Speakers:**

- Liliana Borcea, *Rice University*
- Adel Faridani, *Oregon State University*
- Peter Kuchment, *Texas A&M University*
- Alfred Louis, *Universitaet des Saarlandes*
- Peter Massopust, *Tuboscope Pipeline Services*
- Todd Quinto, *Tufts University*

Tomography is important in pure and applied mathematics, as well as in several branches of applied sciences, in particular diagnostic radiology, nondestructive evaluation, and other forms of image reconstruction. The Short Course will cover the basic mathematics behind tomography and will describe important applications. The talks will be aimed at a general audience, beginning with elementary facts about the Radon transform and then introducing important current research areas, including impedance imaging, local tomography, wavelet methods, regularization and approximate inverse, and emission tomography. Several special sessions at the AMS Joint Meetings will continue the themes introduced in the Short Course.

**Registration** for this course will be available starting in September. Fees are: member of the AMS–$85, nonmember–$108, student, unemployed, emeritus–$37. Registration instructions will be posted on
http://www.ams.org/meetings/shcourse/html

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# Meetings & Conferences of the AMS

**IMPORTANT INFORMATION REGARDING MEETINGS PROGRAMS:** AMS Sectional Meeting programs do not appear in the print version of the *Notices*. However, comprehensive and continually updated meeting and program information with links to the abstract for each talk can be found on the AMS website. See `http://www.ams.org/meetings/`. Programs and abstracts will continue to be displayed on the AMS website in the Meetings and Conferences section until about six weeks after the meeting is over. Final programs for Sectional Meetings will be archived on the AMS website in an electronic issue of the *Notices* as noted below for each meeting.

## Nashville, Tennessee

*Vanderbilt University*

### October 16–17, 2004

*Saturday – Sunday*

### Meeting #999

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: August 2004
Program first available on AMS website: September 2, 2004
Program issue of electronic *Notices*: October 2004
Issue of *Abstracts*: Volume 25, Issue 4

### Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 24, 2004

### Invited Addresses

**Ruth M. Charney**, Brandeis University, *Title to be announced.*

**Peter S. Ozsvath**, Columbia University, *Title to be announced.*

**Sorin T. Popa**, University of California Los Angeles, *Deformation, rigidity, and the classification of $II_1$ factors.*

**Rudi Weikard**, University of Alabama at Birmingham, *Inverse problems for Sturm-Liouville equations.*

### Special Sessions

*Algebraic Geometry and Commutative Algebra* (Code: SS 8A), **Juan C. Migliore**, University of Notre Dame, and **Uwe Nagel**, University of Kentucky.

*Biomathematics* (Code: SS 12A), **Laurent Pujo-Menjouet** and **Glenn F. Webb**, Vanderbilt University.

*Geometry of Hyperbolic Manifolds* (Code: SS 10A), **John G. Ratcliffe** and **Steven T. Tschantz**, Vanderbilt University.

*Graph Theory and Matroid Theory* (Code: SS 14A), **Mark N. Ellingham** and **Michael D. Plummer**, Vanderbilt University.

*Index Theory and the Topology of Manifolds* (Code: SS 3A), **Bruce Hughes** and **Guoliang Yu**, Vanderbilt University.

*Inverse Problems* (Code: SS 9A), **Maeve L. McCarthy**, Murray State University, and **Rudi Weikard**, University of Alabama at Birmingham.

*Local and Homological Algebra* (Code: SS 6A), **Florian Enescu**, University of Utah, and **Adela N. Vraciu**, University of South Carolina.

*Nonlinear Partial Differential Equations and Applications* (Code: SS 11A), **Gieri Simonett**, Vanderbilt University.

*Operator Theory on Function Spaces* (Code: SS 7A), **Dechao Zheng**, Vanderbilt University.

*Semigroup Theory* (Code: SS 13A), **Matthew I. Gould**, Vanderbilt University, and **Karen Ann Linton**, California State Polytechnic University, Pomona.

*Topological Aspects of Group Theory* (Code: SS 5A), **Michael L. Mihalik** and **Mark V. Sapir**, Vanderbilt University.

*Universal Algebra and Lattice Theory* (Code: SS 4A), **Ralph N. McKenzie**, Vanderbilt University, and **George F. McNulty**, University of South Carolina.

*Von Neumann Algebras and Noncommutative Ergodic Theory* (Code: SS 1A), **Dietmar Bisch**, Vanderbilt University, and **Sorin T. Popa**, University of California Los Angeles.

*Wavelets, Frames, and Sampling* (Code: SS 2A), **Akram Aldroubi** and **Douglas P. Hardin**, Vanderbilt University, and **Qiyu Sun**, University of Central Florida.

### Special Presentation

**Peter J. Hilton**, SUNY at Binghamton, will give a talk at 6:30 p.m. on Friday, October 15, on *Codebreaking in WW2 with Alan Turing*, describing his personal experiences during the Second World War. This public lecture is open to all meeting participants. The location will be announced at a later date; please watch the meeting website at `http://www.ams.org/amsmtgs/2108_other.html` for further information.

### Car Rental

Avis is the official car rental company for the sectional meeting in Nashville, Tennessee. All rates include unlimited free mileage. Special rates for this meeting are effective October 9–24, 2004, and begin at $25/day for a subcompact car at the weekend rate (available from noon Thursday through Monday at 11:59 p.m.). Should a lower qualifying rate become available at the time of booking, Avis is pleased to offer a 5% discount off the lower qualifying rate or the meeting rate, whichever is lowest. Rates do not include any state or local surcharges, tax, optional coverages, or gas refueling charges. Renters must meet Avis's age, driver, and credit requirements. Reservations can be made by calling 800-331-1600 or online at `www.avis.com`. **Meeting Avis Discount Number B159266.**

### Weather

Weather conditions in Nashville during October are usually sunny and very pleasant, with lows of about 50 degrees F. and highs around 70 degrees F.

# Albuquerque, New Mexico

*University of New Mexico*

### October 16–17, 2004

*Saturday – Sunday*

### Meeting #1000

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: August 2004
Program first available on AMS website: September 3, 2004
Program issue of electronic *Notices*: October 2004
Issue of *Abstracts*: Volume 25, Issue 4

### Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 24, 2004

### Invited Addresses

**Sara C. Billey**, University of Washington, Seattle, *A combinatorial approach to solving Schubert problems on the flag manifold.*

**Peter Ebenfelt**, University of California San Diego, *Analytic and geometric properties of CR manifolds and their mappings.*

**Theodore Stanford**, New Mexico State University, *Knots modulo braids.*

**Craig A. Tracy**, University of California Davis, *The universality of the distribution functions of random matrix theory.*

### Special Sessions

*Algebraic Geometry* (Code: SS 3A), **Hirotachi Abo** and **Chris Peterson**, Colorado State University.

*Analysis and Geometry in Carnot-Caratheodory Spaces* (Code: SS 13A), **Luca Capogna**, University of Arkansas, and **Robert Smits**, New Mexico State University.

*Arithmetic Geometry* (Code: SS 6A), **Alexandru Buium** and **Michael J. Nakamaye**, University of New Mexico.

*Braids and Knots* (Code: SS 14A), **Theodore Stanford**, New Mexico State University.

*Categories and Operads in Topology, Geometry, Physics and Other Applications* (Code: SS 5A), **Hanna Ewa Makaruk** and **Robert Michal Owczarek**, Los Alamos National Laboratory, and **Zbigniew Oziewicz**, Universidad Nacional Autónoma de México.

*Financial Mathematics: The Mathematics of Derivative Securities* (Code: SS 4A), **Maria Cristina Mariani**, New Mexico State University, and **Osvaldo Mendez**, University of Texas at El Paso.

*Interactions in Riemannian Geometry* (Code: SS 8A), **Charles P. Boyer** and **Krzysztof Galicki**, University of New Mexico.

*Mathematical Methods in Turbulence* (Code: SS 9A), **Monika Nitsche** and **Vachtang Poutkaradze**, University of New Mexico.

*Mathematics for Secondary Teachers: Curriculum and Assessment* (Code: SS 16A), **Adriana Aceves** and **Kristin Umland**, University of New Mexico.

*Multiscale Methods and Sampling in Time-Frequency Analysis* (Code: SS 10A), **Jeffrey Andrew Hogan**, University of Arkansas, and **Joseph D. Lakey**, New Mexico State University.

*Nonlinear Partial Differential Equations Applied to Materials Science* (Code: SS 11A), **Patricia Bauman**, Purdue University, and **Tiziana Giorgi**, New Mexico State University.

*Probabilistic and Geometric Methods in Learning Theory* (Code: SS 15A), **Vladimir Koltchinskii**, University of New Mexico.

*Random Matrix Theory and Growth Processes* (Code: SS 1A), **Craig A. Tracy**, University of California Davis.

*Regularity in PDEs and Harmonic Analysis* (Code: SS 12A), **Marianne Korten** and **Charles Nelson Moore**, Kansas State University, and **Maria C. Pereyra**, University of New Mexico.

*Several Complex Variables and CR Geometry* (Code: SS 2A), **Peter Ebenfelt**, University of California San Diego, and **Marshall A. Whittlesey**, California State University, San Marcos.

*Spectral Geometry* (Code: SS 7A), **Ivan G. Avramidi**, New Mexico Institute of Mining and Technology, and **Thomas Patrick Branson**, University of Iowa.

# Evanston, Illinois

*Northwestern University*

### October 23–24, 2004

*Saturday – Sunday*

### Meeting #1001

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: August 2004
Program first available on AMS website: September 9, 2004
Program issue of electronic *Notices*: October 2004
Issue of *Abstracts*: Volume 25, Issue 4

### Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: August 31, 2004

### Invited Addresses

**Ian Agol**, University of Illinois at Chicago, *Title to be announced.*

**Robert W. Ghrist**, University of Illinois, *Title to be announced.*

**Yuri Manin**, Northwestern University, *Title to be announced.*

**Paul Seidel**, Imperial College-London and University of Chicago, *Title to be announced.*

### Special Sessions

*Algebraic Representations and Deformations* (Code: SS 19A), **Stephen R. Doty** and **Anthony Giaquinto**, Loyola University of Chicago.

*Algebraic Topology: Interactions with Representation Theory and Algebraic Geometry* (Code: SS 13A), **Paul G. Goerss**, Northwestern University, **Jesper Kragh Grodal**, University of Chicago, and **Brooke E. Shipley**, University of Illinois at Chicago.

*Applications of Motives* (Code: SS 18A), **Eric M. Friedlander**, Northwestern University, **Alexander Goncharov**, Brown University, **Mikhail Kapranov**, Yale University, and **Yuri Manin**, Max Planck Institute for Mathematics.

*Codes and Applications* (Code: SS 5A), **William C. Huffman**, Loyola University of Chicago, and **Vera S. Pless**, University of Illinois at Chicago.

*Computability Theory and Applications* (Code: SS 8A), **Robert I. Soare** and **Denis R. Hirschfeldt**, University of Chicago.

*Differential Geometry* (Code: SS 10A), **Anders Ingemar Linner** and **Hongyou Wu**, Northern Illinois University.

*Extremal Combinatorics* (Code: SS 2A), **Dhruv Mubayi** and **Yi Zhao**, University of Illinois at Chicago.

*Fluid Dynamics, Diffusion and Reaction* (Code: SS 4A), **Peter S. Constantin** and **Leonid V. Ryzhik**, University of Chicago.

*Geometric Aspects of the Langlands Program* (Code: SS 17A), **Edward Frenkel**, University of California Berkeley, **Dennis Gaitsgory**, University of Chicago, **Mark Goresky**, Institute for Advanced Study, and **Kari Vilonen**, Northwestern University.

*Geometric Partial Differential Equations* (Code: SS 7A), **Gui-Qiang Chen** and **Jared Wunsch**, Northwestern University.

*Hopf Algebras at the Crossroads of Algebra, Category Theory, and Topology* (Code: SS 24A), **Louis H. Kauffman** and **David E. Radford**, University of Illinois at Chicago, and **Fernando J. O. Souza**, University of Iowa.

*Index Theory, Morse Theory, and the Witten Deformation Method* (Code: SS 3A), **Igor Prokhorenkov** and **Ken Richardson**, Texas Christian University.

*Iterated Function Systems and Analysis on Fractals* (Code: SS 12A), **Ka-Sing Lau**, Chinese University of Hong Kong, and **Stephen S.-T. Yau**, University of Illinois at Chicago.

*Low-Dimensional Topology and Kleinian Groups* (Code: SS 21A), **Ian Agol**, **John Holt**, and **Saul Schleimer**, University of Illinois at Chicago.

*Mathematical Problems in Robotics* (Code: SS 15A), **Robert W. Ghrist**, University of Illinois at Urbana-Champaign.

*Mathematical Techniques in Musical Analysis* (Code: SS 23A), **Judith Baxter**, University of Illinois at Chicago, **Richard Cohn**, University of Chicago, and **Robert Peck**, Louisiana State University.

*Modern Schubert Calculus* (Code: SS 1A), **Ezra Miller**, University of Minnesota, and **Frank Sottile**, University of Massachusetts.

*Nonlinear Partial Differential Equations and Applications* (Code: SS 6A), **Gui-Qiang Chen**, Northwestern University, and **Mikhail Feldman**, University of Wisconsin at Madison.

*Nonlinear Waves* (Code: SS 14A), **Jerry L. Bona**, University of Illinois at Chicago, **Shuming Sun**, Virginia Polytechnic Institute and State University, and **Bingyu Zhang**, University of Cincinnati.

*Representation Theory of Reductive Groups* (Code: SS 20A), **Jeffrey D. Adler**, University of Akron, and **Ju-Lee Kim**, University of Illinois at Chicago.

*Solving Polynomial Systems* (Code: SS 9A), **Anton Leykin** and **Jan Verschelde**, University of Illinois at Chicago.

*Special Functions, Orthogonal Polynomials, and Their Applications* (Code: SS 22A), **George Gasper**, Northwestern University, and **Ahmed I. Zayed**, DePaul University.

*Spectral Problems of Differential Operators* (Code: SS 16A), **Qingkai Kong**, **Hongyou Wu**, and **Anton Zettl**, Northern Illinois University.

*Stability Issues in Fluid Dynamics* (Code: SS 11A), **Susan J. Friedlander** and **Roman Shvydkoy**, University of Illinois at Chicago.

# Pittsburgh, Pennsylvania

*University of Pittsburgh*

### November 6–7, 2004

*Saturday – Sunday*

### Meeting #1002

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: September 2004
Program first available on AMS website: September 23, 2004
Program issue of electronic *Notices*: November 2004
Issue of *Abstracts*: Volume 25, Issue 4

### Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: September 14, 2004

### Invited Addresses

**Jeffrey F. Brock**, Brown University, *Title to be announced.*

**Der-Chen Chang**, Georgetown University, *Title to be announced.*

**Robert Schapire**, Princeton University, *Title to be announced.*

**Ofer Zeitouni**, University of Minnesota, Minneapolis, *Title to be announced.*

### Special Sessions

*Convexity and Combinatorics* (Code: SS 2A), **James F. Lawrence** and **Valeriu Soltan**, George Mason University.

*Geometric Analysis and Partial Differential Equations in Subelliptic Structures* (Code: SS 12A), **Cristian E. Gutierrez**, Temple University, **Guozhen Lu**, Wayne State University, and **Juan J. Manfredi**, University of Pittsburgh.

*Graph Polynomials* (Code: SS 8A), **E. Glen Whitehead Jr.**, University of Pittsburgh.

*The History of Mathematics* (Code: SS 3A), **Robert E. Bradley**, Adelphi University, and **Lawrence A. D'Antonio**, Ramapo College of New Jersey.

*Invariants of Knots and 3-Manifolds* (Code: SS 1A), **Marta M. Asaeda**, University of Maryland, **Jozef H. Przytycki**, George Washington University, and **Adam S. Sikora**, SUNY at Buffalo.

*Knots and Macromolecules* (Code: SS 7A), **Kenneth C. Millett**, University of California Santa Barbara, and **Eric J. Rawdon**, Duquesne University.

*Mathematical Biology* (Code: SS 13A), **Jonathan E. Rubin** and **Bard Ermentrout**, University of Pittsburgh.

*Mathematical Finance* (Code: SS 11A), **David Saunders** and **John Chadam**, University of Pittsburgh.

*Mathematical Modeling of Nonlinear Phenomena in Biology and Mechanics* (Code: SS 6A), **Anna Vainchtein** and **William C. Troy**, University of Pittsburgh.

*Modularity of Galois Representations and Serre's Conjecture* (Code: SS 14A), **Mark E. T. Dickinson**, University of Pittsburgh.

*Multiscale Algorithms in Computational Fluid Dynamics* (Code: SS 5A), **William J. Layton**, University of Pittsburgh, and **Anastasios Liakos**, U.S. Naval Academy.

*Multivariate Hypergeometric Functions: Combinatorial and Algebro-Geometric Aspects* (Code: SS 9A), **Eduardo Cattani**, University of Massachusetts, Amherst, **Alicia M. Dickenstein**, Universidad de Buenos Aires, and **Laura Felicia Matusevich**, Harvard University.

*Partial Differential Equations and Applications* (Code: SS 4A), **Xinfu Chen** and **Dehua Wang**, University of Pittsburgh.

*PDE-Based Methods in Imaging and Vision* (Code: SS 15A), **Stacey E. Levine**, Duquesne University, and **Yunmei Chen**, University of Florida.

*Trends in Operator Theory and Banach Spaces* (Code: SS 10A), **Christopher J. Lennard** and **Thomas A. Metzger**, University of Pittsburgh.

### Accommodations

Participants should make their own arrangements directly with a hotel of their choice as early as possible. Special rates have been negotiated with the hotels listed below. Rates quoted do not include sales tax of 14%. The AMS is not responsible for rate changes or for the quality of the accommodations. When making a reservation, participants should state that they are with the American Mathematical Society (AMS)/University of Pittsburgh group. Cancellation and early checkout policies vary; be sure to check when you make your reservation.

**Hampton Inn University Center**, 3315 Hamlet Pl., Pittsburgh, PA 15213; 412-681-1000 (phone), 412-681-3022 (fax), $89/single or double, complimentary continental breakfast buffet daily; about 1/2 mile to the meeting site. **Deadline for reservations is October 6, 2004.** Be sure to check cancellation and early checkout policies.

**Wyndham Garden Hotel**, University Place, 3454 Forbes Avenue, Pittsburgh, PA 15213; 412-683-2040 (phone), 412-688-1986 (fax); $109/single or double, full-service hotel with restaurant/room service, exercise room on premises; parking is $10/day; about four blocks to the meeting site. **Deadline for reservations is October 8, 2004.** Be sure to check cancellation and early checkout policies.

## Food Service

A list of local restaurants will be available at registration.

## Local Information and Maps

The math department's webpage is located at `http://www.math.pitt.edu/`; the university's homepage is `http://www.umc.pitt.edu/`. Location information can be found at `http://www.umc.pitt.edu/tour/tour-217.html`; campus maps are at `http://www.umc.pitt.edu/tour/tour-firstmap.html` (click at the bottom of this page for a large-sized map).

## Other Activities

**Book Sales:** Examine the newest titles from the AMS! Many of the AMS books will be available at a special discount available only at the meeting. Complimentary coffee will be served courtesy of AMS Membership Services.

**AMS Editorial Activity:** An acquisitions editor from the AMS book program will be present to speak with prospective authors. If you have a book project that you would like to discuss with the AMS, please stop by the book exhibit.

**TA Development Using Case Studies:** A Workshop for Faculty: **Solomon Friedberg**, Boston University, will guide workshop participants in the effective use of the case studies method as a tool in preparing Teaching Assistants for their important roles as classroom instructors. The faculty edition of the publication *Teaching Mathematics in Colleges and Universities: Case Studies for Today's Classroom* will be provided to workshop participants at no charge, compliments of the AMS. For a recent review of the book, visit `http://www.maa.org/reviews/casestudies.html`. The workshop will be held on Sunday, from 9:30 a.m. to 10:50 a.m. and from 2:30 p.m. to 4:00 p.m. Advance registration is encouraged; contact Karen Butler at the AMS, `klb@ams.org`.

## Parking

The nearest parking is the garage of the Soldiers & Sailors (SO) Memorial, located at Fifth Ave. and Bigelow Blvd. The night and weekend rate is $4 for 24 hours. See `http://www.pts.pitt.edu/parking/maps.html` and click on "Visitor Parking" for the map, other parking lots, and rates.

## Registration and Meeting Information

The meeting is on the main campus of the University of Pittsburgh in the Oakland suburb of the city of Pittsburgh, Pennsylvania. Sessions and Invited Addresses will take place in Benedum Hall.

The registration desk will be in Room 1175, Benedum Hall, and will be open Saturday, November 6, 7:30 a.m. to 4:00 p.m. and Sunday, November 7, 8:00 a.m. to noon. Fees are $40 for AMS or CMS members, $60 for nonmembers, and $5 for students/unemployed/emeritus, payable on site by cash, check, or credit card.

## Social Event

The Department of Mathematics of the University of Pittsburgh will host a reception in the Assembly Room of the William Pitt Union (`http://www.umc.pitt.edu/tour/tour-005.html`) on Saturday, November 6, at 6:30 p.m. All participants are welcome. The AMS thanks the department and the university for their hospitality.

## Travel

**By Air:** The nearest major airport is Pittsburgh International Airport, about 15 miles away. Cabs and shuttle services are located in the ground transportation area of the airport, adjacent to baggage claim. For more information about Pittsburgh International Airport, call 412-472-3525. Delta Air Lines has been selected as the official airline for this meeting. The following specially negotiated rates are available for this meeting and exclusively for mathematicians and their families for the period November 3, 2004, through November 10, 2004. Other restrictions/discounts may apply, and seats are limited.

Delta Air Lines is offering:

- A 5% discount off Delta's published round-trip fares within the continental United States, excluding A, D, I, U, and T classes of service.
- A 10% discount off Delta's domestic published unrestricted round-trip coach fares (Y06/YR06) rates. No advance reservations or ticketing is required.
- An additional 5% bonus discount if you purchase your ticket 60 days or more prior to your departure through Meeting Network Reservations or your travel agent; online not applicable.

To take advantage of these discounts and make immediate reservations, call Delta Meeting Network at 800-241-6760, between 8:00 a.m. and 11:00 p.m. Eastern Standard Time, Monday through Sunday, referencing **File Number 205778A**.

**Ground transportation from the airport:** A taxi ride to downtown Pittsburgh will take between 30 and 45 minutes and cost about $30. Express Shuttle vans make the trip downtown for $17/one way or $32/round trip. Call Express Shuttle USA at 412-472-3180 or see `http://www.taxicabusa.com/Pittsburgh/airportshuttle.html`.

You can also take public transportation: The PAT (Port Authority Transit) 28X Airport Flyer runs downtown on a 16-mile express route every 30 minutes; the trip takes about 50 minutes. Fare is $1.95. Call 412-442-2000 for more information

**From the south, including Pittsburgh International Airport:** Follow I-79 North to the I-279 North exit. Take 279 through the Fort Pitt Tunnels and across the bridge to the I-376 Monroeville exit (first exit on the right). Follow 376 to the Forbes Avenue/Oakland exit. Forbes Avenue leads into the Pitt campus.

**From the north:** Take I-79 South to I-279 South (you exit to the left off I-79). Follow 279 into the city, to the I-376 Monroeville exit. Follow 376 to the Forbes Avenue/Oakland exit. Forbes Avenue then leads right into the Pitt campus.

**From the east via the PA Turnpike (I-76):** Take Exit 6 to I-376 West. From 376 take Exit 7A, Oakland, onto Bates Street. Stay on Bates until it ends at Bouquet Street. Turn left onto Bouquet, then right at the first light onto Forbes Avenue.

**From the west via the PA Turnpike (I-76):** Take Exit 3 and follow I-79 South to I-279 South. (You exit to the left off I-79). Follow 279 into the city, to the I-376 Monroeville exit. Follow 376 to the Forbes Avenue/Oakland exit. Forbes Avenue then leads right into the Pitt campus.

### Car Rental

Avis is the official car rental company for the sectional meeting in Pittsburgh, Pennsylvania. All rates include unlimited free mileage. Special rates for this meeting are effective October 30–November 14, 2004, and begin at $25/day for a subcompact car at the weekend rate (available from noon Thursday through Monday at 11:59 p.m.). Should a lower qualifying rate become available at the time of booking, Avis is pleased to offer a 5% discount off the lower qualifying rate or the meeting rate, whichever is lowest. Rates do not include any state or local surcharges, tax, optional coverages, or gas refueling charges. Renters must meet Avis's age, driver, and credit requirements. Reservations can be made by calling 800-331-1600 or online at `www.avis.com`. **Meeting Avis Discount Number B159266.**

### Weather

Weather conditions in Pittsburgh in early November are generally cool, with highs in the 50s F. and lows in the 30s F. For a forecast, see `http://www.srh.noaa.gov/data/forecasts/PAZ021.php?warncounty=PAC003&city=Pittsburgh`.

# Atlanta, Georgia

*Atlanta Marriott Marquis and Hyatt Regency Atlanta*

### January 5–8, 2005

*Wednesday – Saturday*

### Meeting #1003

*Joint Mathematics Meetings, including the 111th Annual Meeting of the AMS, 88th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association of Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association of Symbolic Logic (ASL).*
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: October 2004
Program first available on AMS website: November 1, 2004
Program issue of electronic *Notices*: January 2005
Issue of *Abstracts*: Volume 26, Issue 1

### Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: October 5, 2004
For summaries of papers to MAA organizers: September 14, 2004

### Joint Invited Addresses

**Andrea L. Bertozzi**, University of California Los Angeles, *Title to be announced* (AMS-MAA Invited Address).

**Bernd Sturmfels**, University of California Berkeley, *Title to be announced* (AMS-MAA Invited Address).

### AMS Invited Addresses

**Ingrid Daubechies**, Princeton University, *Title to be announced* (Josiah Willard Gibbs Lecture).

**Eleny Ionel**, University of Wisconsin, *Title to be announced.*

**Bruce A. Kleiner**, University of Michigan, Ann Arbor, *Title to be announced.*

**Robert K. Lazarsfeld**, University of Michigan, *Title to be announced* (Colloquium Lectures

**Gunther Uhlmann**, University of Washington, *Title to be announced.*

**Avi Wigderson**, Institute for Advanced Study, *Title to be announced.*

**Steven M. Zelditch**, Johns Hopkins University, *Title to be announced.*

### MAA Invited Addresses

**Georgia Benkart**, University of Wisconsin, Madison, *Title to be announced.*

**Erik D. Demaine**, Massachusetts Institute of Technology, *Title to be announced.*

**Fernando Q. Gouvêa**, Colby College, *Title to be announced.*

**Steven G. Krantz**, Washington University, *Title to be announced.*

**Ravi D. Vakil**, Stanford University, *Title to be announced.*

**Robin J. Wilson**, The Open University, *Title to be announced.*

### Invited Addresses of Other Organizations

**Pavel Pevzner,** University of California San Diego, *Title to be announced* (SIAM).

### AMS Special Sessions

Some sessions are cosponsored with other organizations. These are noted within the parentheses at the end of each listing, where applicable.

*Algebraic Geometry Codes and Quantum Codes* (Code: SS 13A), **Shuhong Gao** and **Gretchen L. Matthews**, Clemson University.

*Algorithmic Algebraic and Analytic Geometry* (Code: SS 34A), **Saugata Basu**, Georgia Institute of Technology,

**Victoria A. Powers**, Emory University, **Mika K. Sepälä**, Florida State University, **Tanush T. Shaska**, University of Idaho, and **Emil J. Volcheck**, National Security Agency.

*Analysis and Applications in Nonlinear Partial Differential Equations* (Code: SS 27A), **Michael T. Lacey, Jason L. Metcalfe, Gerd Mockenhaupt, Ronghua Pan,** and **Andrzej J. Swiech**, Georgia Institute of Technology. (AMS-SIAM)

*Analysis Problems in Modern Physics* (Code: SS 30A), **Steven M. Zelditch**, Johns Hopkins University.

*Arithmetic Algebraic Geometry* (Code: SS 32A), **Matthew H. Baker** and **Dino J. Lorenzini**, University of Georgia.

*Commutative Algebra* (Code: SS 20A), **Srikanth B. Iyengar**, University of Missouri, **Sean M. Sather-Wagstaff**, University of Illinois at Urbana-Champaign, **Anurag K. Singh**, Georgia Institute of Technology, and **Carolyn A. Yackel**, Mercer University.

*Complex and Functional Analysis* (Code: SS 25A), **Mihaly Bakonyi**, Georgia State University, and **Imre Patyi**, University of California San Diego.

*Current Events* (Code: SS 1A), **David Eisenbud**, Mathematical Sciences Research Institute and University of California Berkeley.

*Design Theory and Graph Theory* (Code: SS 24A), **Mike Daven**, Mount Saint Mary College, and **Atif A. Abueida**, University of Dayton.

*D-Modules* (Code: SS 14A), **Steven Sperber**, University of Minnesota, Minneapolis, and **Uli Walther**, Purdue University.

*Dynamic Equations on Time Scales: Integer Sequences and Rational Maps* (Code: SS 26A), **Martin J. Bohner**, University of Missouri-Rolla, **Marc A. Chamberland**, Grinnell College, **Billur Kaymakcalan**, Georgia Southern University, **Ilan C. Peterson**, University of Nebraska-Lincoln, and **Diana M. Thomas**, Montclair State University.

*Dynamics of Mapping Class Groups on Moduli Spaces* (Code: SS 10A), **Richard J. Brown**, American University.

*History of Mathematics* (Code: SS 3A), **Joseph W. Dauben**, Lehman College (CUNY), **Patti Hunter**, Westmont College, and **KarenH. Parshall**, University of Virginia. (AMS-MAA)

*Integrable Systems and Special Functions* (Code: SS 31A), **Andras Balogh**, University of Texas-Pan American, **Mourad E. H. Ismail**, University of Central Florida, **Wen-Xiu Ma**, University of South Florida, and **Zhijun Qiao**, Los Alamos National Laboratory. (AMS-SIAM)

*Inverse Spectral Geometry* (Code: SS 16A), **Carolyn S. Gordon**, Dartmouth University, and **Ruth Gornet** and **Peter A. Perry**, University of Kentucky.

*In the Wake of Jacobi and Hamilton 200 Years Later* (Code: SS 37A), **Maria-Clara Nucci**, University of Perugia, and **Pavel Winternitz**, Centre de Recherches Mathématiques, Université de Montréal.

*Mathematical Image Processing* (Code: SS 36A), **Jianhong Shen**, University of Minnesota, Minneapolis, and **Tony F. Chan**, University of California Los Angeles. (AMS-SIAM)

*Mathematical Sciences Contributions to the Biomedical Sciences* (Code: SS 29A), **Peter D. March**, Ohio State University, **De Witt L. Sumners**, Florida State University, and **John Whitmarsh**, The National Institutes of Health. (AMS-MAA)

*Mathematical Sciences Research for the Department of Energy's Computational Biology Needs* (Code: SS 7A), **Jennifer R. Slimowitz**, Board on Mathematical Sciences and Their Applications.

*Mathematicians' Work on Mathematics Education* (Code: SS 19A), **William G. McCallum**, University of Arizona. (AMS-MAA)

*Mathematics and Education Reform* (Code: SS 2A), **William H. Barker**, Bowdoin College, **Jerry L. Bona** and **Naomi Fisher**, University of Illinois at Chicago, **Kenneth C. Millett**, University of California Santa Barbara, and **Bonnie Saunders**, University of Illinois at Chicago. (AMS-MAA-MER)

*Mathematics and Mathematics Education in Fiber Arts* (Code: SS 21A), **Sarah-Marie Belcastro**, Xavier University, and **Carolyn A. Yackel**, Mercer University.

*Modular Representation Theory of Finite and Algebraic Groups* (Code: SS 8A), **David J. Hemmer**, University of Toledo, and **Cornelius Pillen**, University of South Alabama.

*Nonsmooth Analysis in Variational and Imaging Problems* (Code: SS 17A), **M. Zuhair Nashed**, University of Central Florida, and **Otmar Scherzer**, University of Innsbruck. (AMS-SIAM)

*Orthogonal Polynomials—Random Matrices—Integrable Systems: Interdisciplinary Aspects* (Code: SS 38A), **Jinho Baik**, University of Michigan, Ann Arbor, **Steven B. Damelin**, Georgia Southern University, and **Peter D. Miller**, University of Michigan, Ann Arbor. (AMS-SIAM)

*Quantum Topology* (Code: SS 15A), **Stavros Garoufalidis** and **T. T. Q. Le**, Georgia Institute of Technology.

*Radon Transform and Inverse Problems* (Code: SS 5A), **Adel Faridani**, Oregon State University, **Gestur Olafsson**, Louisiana State University, and **Todd Quinto**, Tufts University.

*Reaction Diffusion Equations and Applications* (Code: SS 28A), **Xu-Yan Chen**, Georgia Institute of Technology, **Yuanwei Qi**, University of Central Florida, **Junping Shi**, The College of William and Mary, and **Ratnasingham Shivaji**, Mississippi State University. (AMS-SIAM)

*Recent Advances in Mathematical Ecology* (Code: SS 18A), **Semen Koksal**, Florida Institute of Technology, **Sebastian Schreiber**, The College of William and Mary, and **Robert van Woesik**, Florida Institute of Technology. (AMS-SIAM)

*Representations of Lie Algebras* (Code: SS 23A), **Brian D. Boe**, University of Georgia, **Ben L. Cox**, College of Charleston, **Vyacheslav M. Futorny**, Universidade de Sao Paulo, **William A. Graham**, University of Georgia, **Duncan J. Melville**, St. Lawrence University, and **Daniel K. Nakano**, University of Georgia.

*Research in Mathematics by Undergraduates* (Code: SS 9A), **Darren A. Narayan** and **Tamara A. Burton**, Rochester

Institute of Technology, **Michael J. Fisher**, California State University, Fresno, and **Carl V. Lutzer**, Rochester Institute of Technology. (AMS-MAA-SIAM)

*Reverse Mathematics* (Code: SS 6A), **Jeff L. Hirst**, Appalachian State University, and **Reed Solomon**, University of Connecticut. (AMS-ASL)

*Riemannian Geometry* (Code: SS 11A), **Igor Belegradek**, Georgia Institute of Technology, and **Mohammad Ghomi**, Georgia Institute of Technology and Pennsylvania State University.

*Spaces of Vector-Valued Functions* (Code: SS 22A), **Terje Hõim**, Florida Atlantic University, and **David A. Robbins**, Trinity College.

*Stochastic, Large-Scale, and Hybrid Systems* (Code: SS 12A), **A. S. Vatsala**, University of Louisiana at Lafayette, and **G. S. Ladde**, University of Texas at Arlington. (AMS-SIAM)

*Theoretical and Computational Aspects of Inverse Problems* (Code: SS 4A), **Gunther Uhlmann**, University of Washington, and **David L. Colton**, University of Delaware. (AMS-SIAM)

*Topics in Geometric Function Theory* (Code: SS 33A), **Abdelkrim Farouk Brania**, Morehouse College, **David A. Herron**, University of Cincinnati, and **Shanshuang Yang**, Emory University.

*Tropical Geometry* (Code: SS 35A), **Michael Develin** and **Bernd Sturmfels**, University of California Berkeley. (AMS-MAA)

# Bowling Green, Kentucky

*Western Kentucky University*

### March 18–19, 2005

*Friday – Saturday*

### Meeting #1004

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 2

### Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

# Newark, Delaware

*University of Delaware*

### April 2–3, 2005

*Saturday – Sunday*

### Meeting #1005

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 2

### Deadlines

For organizers: September 2, 2004
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

### Invited Addresses

**Xiu Xiong Chen**, University of Wisconsin, *Title to be announced.*

**Anna Gilbert**, AT&T Labs-Research, *Title to be announced.*

**Alex Lubotzky**, Hebrew University of Jerusalem, *Title to be announced.*

**Lorenz Schwachhoefer**, University of Dortmund, *Title to be announced.*

### Special Sessions

*Asymptotic Behavior of Evolution Equations* (Code: SS 4A), **Gaston M. N'Guerekaya**, Morgan State University, and **Nguyen Van Minh**, James Madison University.

*Designs, Codes, and Geometries* (Code: SS 5A), **James A. Davis**, University of Richmond, **Keith E. Mellinger**, Mary Washington College, and **Qing Xiang**, University of Delaware.

*Homotopy Theory (in Honor of Donald M. Davis's and Martin Bendersky's 60th Birthdays)* (Code: SS 1A), **Kenneth G. Monks**, University of Scranton, and **W. Stephen Wilson**, Johns Hopkins University.

*Mathematical Methods in Electromagnetic Wave Propagation* (Code: SS 3A), **Fioralba Cakoni** and **Peter B. Monk**, University of Delaware.

*Singular Analysis and Spectral Theory of Partial Differential Equations* (Code: SS 2A), **Juan B. Gil**, Pennsylvania State University, Altoona, and **Gerardo A. Mendoza**, Temple University.

# Lubbock, Texas

*Texas Tech University*

### April 8–10, 2005

*Friday – Sunday*

### Meeting #1006

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 3

### Deadlines

For organizers: September 9, 2004
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

### Invited Addresses

**Nikolai Ivanov**, Michigan State University, *Title to be announced.*

**Mattias Jonsson**, University of Michigan, *Title to be announced.*

**Nicolas Monod**, University of Chicago, *Title to be announced.*

**Hee Oh**, California Institute of Tech, *Title to be announced.*

### Special Sessions

*Classical and Differential Galois Theory* (Code: SS 3A), **Lourdes Juan** and **Arne Ledet**, Texas Tech University, and **Andy R. Magid**, University of Oklahoma.

*Differential Geometry and Its Applications* (Code: SS 2A), **Josef F. Dorfmeister**, Munich University of Technology, **Magdalena D. Toda**, Texas Tech University, and **Hongyou Wu**, Northern Illinois University.

*Homological Algebra and Its Applications* (Code: SS 4A), **Alex Martsinkovsky**, Northeastern University, and **Mara D. Neusel**, Texas Tech University.

*Real Algebraic Topology* (Code: SS 6A), **Anatoly Korchagin** and **David Weinberg**, Texas Tech University.

*Recent Advances in Complex Function Theory* (Code: SS 5A), **Brock Williams**, **Roger W. Barnard**, and **Kent Pearce**, Texas Tech University.

*Topology of Continua* (Code: SS 1A), **Wayne Lewis**, Texas Tech University.

# Santa Barbara, California

*University of California Santa Barbara*

### April 16–17, 2005

*Saturday – Sunday*

### Meeting #1007

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 3

### Deadlines

For organizers: September 16, 2004
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

### Invited Addresses

**Mei-Chu Chang**, University of California Riverside, *To be announced.*

**Mischa Kapovich**, University of California Davis, *To be announced.*

**Mihai Putinar**, University of California Santa Barbara, *To be announced.*

**James Sethian**, University of California Berkeley, *To be announced.*

### Special Sessions

*Automorphisms of Surfaces* (Code: SS 4A), **Anthony Weaver**, Brooklyn Community College of the City University of New York.

*Dynamical Systems in Neuroscience* (Code: SS 1A), **Eugene M. Izhikevich**, The Neurosciences Institute.

*History of Mathematics* (Code: SS 2A), **Shawnee L. McMurran**, California State University, San Bernardino, and **James J. Tattersall**, Providence College.

*Recent Advances in Combinatorial Number Theory* (Code: SS 3A), **Mei-Chu Chang**, University of California Riverside, and **Van Ha Vu**, University of California San Diego.

# Mainz, Germany

### June 16–19, 2005

*Thursday – Sunday*

### Meeting #1008

*Joint International Meeting with the Deutsche Mathematiker-Vereinigung (DMV) and the Oesterreichische Mathematische Gesellschaft (OMG)*

Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

### Deadlines

For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

### Invited Addresses

**Helene Esnault**, University of Essen, *Title to be announced.*

**Richard Hamilton**, Columbia University, *Title to be announced.*

**Michael J. Hopkins**, Massachusetts Institute of Technology, *Title to be announced.*

**Christian Krattenthaler**, University of Lyon-I, *Title to be announced.*

**Frank Natterer**, University of Muenster, *Title to be announced.*

**Horng-Tzer Yau**, New York University and Stanford University, *Title to be announced.*

### Special Sessions

*Algebraic Combinatorics*, **Patricia Hersh**, University of Michigan, **Christian Krattenthaler**, University of Lyon-I, and **Volkmar Welker**, Philipps University Marburg.

*Algebraic Geometry*, **Yuri Tschinkel**, Georg-August-Universität Göttingen, and **Brendan E. Hassett**, Rice University.

*Discrete Geometry*, **Jacob Eli Goodman**, The City College of New York (CUNY), **Emo Welzl**, Eidgen Technische Hochschule, and **Gunter M. Ziegler**, Technical University of Berlin.

*Functional Analytic and Complex Analytic Methods in Linear Partial Differential Equations*, **R. Meise**, University of Dusseldorf, **B. A. Taylor**, University of Michigan, and **Dietmar Vogt**, University of Wuppertal.

*History of Mathematics: Mathematics and War*, **Thomas W. Archibald**, Acadia University, **John H. McCleary**, Vassar College, **Moritz Epple**, University of Stuttgart, and **Norbert Schappacher**, Technische Universität Darmstadt.

*Homotopy Theory*, **Paul G. Goerss**, Northwestern University, **Hans-Werner Henn**, Institut de Recherche Mathématique Avancée, Strasbourg, and **Stefan Schwede**, Universität Bonn.

*Hopf Algebras and Quantum Groups*, **Susan Montgomery**, University of Southern California, and **Hans-Jurgen Schneider**, University of Munich.

*Mathematics Education*, **Gunter Torner**, Universität Duisburg-Essen, and **Alan Schoenfeld**, School of Education, Berkeley.

*Nonlinear Waves*, **Herbert Koch**, University of Dortmund, and **Daniel I. Tataru**, University of California Berkeley.

*Stochastic Analysis on Metric Spaces*, **Laurent Saloff-Coste**, Cornell University, **Karl-Theodor Sturm**, University of Bonn, and **Wolfgang Woess**, Graz Technical University.

*Topology of Manifolds*, **Matthias Kreck**, University of Heidelberg, and **Andrew Ranicki**, University of Edinburgh.

# Annandale-on-Hudson, New York

*Bard College*

### October 8–9, 2005

*Saturday – Sunday*

### Meeting #1009

Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 4

### Deadlines

For organizers: March 8, 2005
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

### Invited Addresses

**Persi Diaconis**, Stanford University, *Title to be announced* (Erdős Memorial Lecture).

# Johnson City, Tennessee

*East Tennessee State University*

### October 15–16, 2005

*Saturday – Sunday*

### Meeting #1010

Southeastern Section
Associate secretary: John L. Bryant
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 4

### Deadlines

For organizers: March 15, 2005
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

# Lincoln, Nebraska

*University of Nebraska in Lincoln*

### October 21–22, 2005

*Friday – Saturday*

### Meeting #1011

Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: August 2005
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 4

### Deadlines

For organizers: March 22, 2005
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

### Invited Addresses

**Howard Masur**, Universiy of Illinois at Chicago, *Title to be announced.*

**Alejandro Uribe**, University of Michigan, *Title to be announced.*

**Judy Walker**, University of Nebraska, *Title to be announced.*

**Jack Xin**, University of Texas, *Title to be announced.*

### Special Sessions

*Algebraic Geometry* (Code: SS 1A), **Brian Harbourne**, University of Nebraska-Lincoln, and **Bangere P. Purnaprajna**, University of Kansas.

# Eugene, Oregon

*University of Oregon*

### November 12–13, 2005

*Saturday – Sunday*

### Meeting #1012

Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: Volume 26, Issue 4

### Deadlines

For organizers: April 12, 2005
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

# Taiwan

### December 14–18, 2005

*Wednesday – Sunday*

### Meeting #1013

*First Joint International Meeting between the AMS and the Taiwanese Mathematical Society.*
Associate secretary: John L. Bryant
Announcement issue of *Notices*: To be announced
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

### Deadlines

For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

# San Antonio, Texas

*Henry B. Gonzalez Convention Center*

### January 12–15, 2006

*Thursday – Sunday*
*Joint Mathematics Meetings, including the 112th Annual Meeting of the AMS, 89th Annual Meeting of the Mathematical Association of America, annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).*
Associate secretary: John L. Bryant
Announcement issue of *Notices*: October 2005
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: January 2006
Issue of *Abstracts*: To be announced

### Deadlines

For organizers: April 12, 2005
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

# San Francisco, California

*San Francisco State University*

### April 29–30, 2006

*Saturday – Sunday*
Western Section
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: To be announced

Program first available on AMS website: To be announced
Program issue of electronic *Notices*: To be announced
Issue of *Abstracts*: To be announced

### Deadlines

For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

# New Orleans, Louisiana

*New Orleans Marriott and Sheraton New Orleans Hotel*

### January 4–7, 2007

*Thursday – Sunday*
*Joint Mathematics Meetings, including the 113th Annual Meeting of the AMS, 90th Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).*
Associate secretary: Susan J. Friedlander
Announcement issue of *Notices*: October 2006
Program first available on AMS website: To be announced
Program issue of electronic *Notices*: January 2007
Issue of *Abstracts*: To be announced

### Deadlines

For organizers: April 4, 2006
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

# San Diego, California

*San Diego Convention Center*

### January 6–9, 2008

*Sunday – Wednesday*
*Joint Mathematics Meetings, including the 114th Annual Meeting of the AMS, 91st Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).*
Associate secretary: Michel L. Lapidus
Announcement issue of *Notices*: October 2007
Program first available on AMS website: November 1, 2007
Program issue of electronic *Notices*: January 2008
Issue of *Abstracts*: Volume 29, Issue 1

### Deadlines

For organizers: April 6, 2007
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

# Washington, District of Columbia

*Marriott Wardman Park Hotel and Omni Shoreham Hotel*

### January 7–10, 2009

*Wednesday – Saturday*
*Joint Mathematics Meetings, including the 115th Annual Meeting of the AMS, 92nd Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).*
Associate secretary: Lesley M. Sibner
Announcement issue of *Notices*: October 2008
Program first available on AMS website: November 1, 2008
Program issue of electronic *Notices*: January 2009
Issue of *Abstracts*: Volume 30, Issue 1

### Deadlines

For organizers: April 7, 2008
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

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Please send your written application accompanied by a curriculum vitae, list of publications and three references to:
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Personnel & Organisation Department
P.O. Box 72, 9700 AB Groningen
The Netherlands.
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Additional information about vacancies at the RUG is available on the university web site:

**(www.rug.nl)**

The RUG has a special careers advisory service for the partners of new staff who move to the area.

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Department of Mathematics and Computing Science
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These sections are not separate administrative units but are rather clusters of basic units formed around chairs and research programmes: 6 mathematics research programmes and 5 computer science programmes. The new professor will be head of the basic unit Analysis which has no other personnel at this moment. There is a vacant position for a tenure track assistant professor in this unit and several vacancies for PhD students.

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http://www.rug.nl/fwn/vacatures/vacaturesFWN

Rijks*universiteit* Groningen

# Meetings and Conferences of the AMS


**Associate Secretaries of the AMS**

**Western Section: Michel L. Lapidus,** Department of Mathematics, University of California, Sproul Hall, Riverside, CA 92521-0135; e-mail: lapidus@math.ucr.edu; telephone: 909-787-3113.

**Central Section: Susan J. Friedlander**, Department of Mathematics, University of Illinois at Chicago, 851 S. Morgan (M/C 249), Chicago, IL 60607-7045; e-mail: susan@math.nwu.edu; telephone: 312-996-3041.

**Eastern Section: Lesley M. Sibner**, Department of Mathematics, Polytechnic University, Brooklyn, NY 11201-2990; e-mail: lsibner@duke.poly.edu; telephone: 718-260-3505.

**Southeastern Section: John L. Bryant**, Department of Mathematics, Florida State University, Tallahassee, FL 32306-4510; e-mail: bryant@math.fsu.edu; telephone: 850-644-5805.


The Meetings and Conferences section of the *Notices* gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. **Information in this issue may be dated. Up-to-date meeting and conference information can be found at** www.ams.org/meetings/.

## Meetings:



### Important Information regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 84 in the January 2004 issue of the *Notices* for general information regarding participation in AMS meetings and conferences.

### Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of LaTeX is necessary to submit an electronic form, although those who use LaTeX may submit abstracts with such coding, and all math displays and similarily coded material (such as accent marks in text) must be typeset in LaTeX. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html, or send mail to abs-submit@ams.org, typing help as the subject line; descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed email 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. There is a $20 processing fee for each paper abstract. There is no charge for electronic abstracts. Note that all abstract deadlines are strictly enforced.

Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

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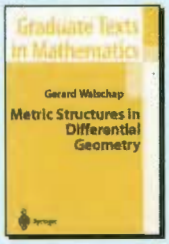
## Index of Advertisers

# SPRINGER FOR MATHEMATICS

## METRIC STRUCTURES IN DIFFERENTIAL GEOMETRY

**GERARD WALSCHAP,** University of Oklahoma, Norman, OK




This text is an introduction to the theory of differentiable manifolds and fiber bundles. The only requisites are a solid background in calculus and linear algebra, together with some basic point-set topology. The first chapter provides a comprehensive overview of differentiable manifolds. The following two chapters are devoted to fiber bundles and homotopy theory of fibrations. Vector bundles have been emphasized, although principal bundles are also discussed in detail. The last three chapters study bundles from the point of view of metric differential geometry: Euclidean bundles, Riemannian connections, curvature, and Chern-Weil theory are discussed, including the Pontrjagin, Euler, and Chern characteristic classes of a vector bundle. These concepts are illustrated in detail for bundles over spheres. Chapter 5, with its focus on the tangent bundle, also serves as a basic introduction to Riemannian geometry in the large. This book can be used for a one-semester course on manifolds or bundles, or a two-semester course in differential geometry.

2004/232 PP., 15 ILLUS./HARDCOVER/$69.95
ISBN 0-387-20430-X
GRADUATE TEXTS IN MATHEMATICS, VOL. 224

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**I.I. GIKHMAN** and **A.V. SKOROKHOD,** Michigan State University, East Lansing, MI

*"To call this work encyclopedic would not give an accurate picture of its content and style. Some parts read like a textbook, but others are more technical and contain relatively new results ... The exposition is robust and explicit, as one has come to expect of the Russian tradition of mathematical writing. The set when completed will be an invaluable source of information and reference in this ever-expanding field"*

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## THE THEORY OF STOCHASTIC PROCESSES II

**I.I. GIKHMAN** and **A.V. SKOROKHOD,** Michigan State University, East Lansing, MI

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SECOND EDITION

**HERBERT OERTEL,** University of Karlsruhe, Germany (Ed.)
With contributions from: **M. BÖHLE, D. ETLING, U. MÜLLER, K.R. SREENIVISAN, U. RIEDEL, J. WARNATZ**

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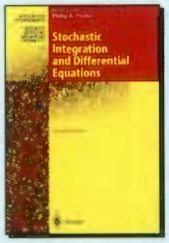


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